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COVER PICTURE

The cover picture shows a battery of hammers in action at the forge shop of the Dominion Bridge Company's Lachine plant near Montreal. (*Reproduced from an original painting by J. S. Walsh, M.E.I.C.*)

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PERMANENTLY FROZEN GROUND AND FOUNDATION DESIGN

Paper presented before the Edmonton Branch of The Engineering Institute of Canada on March 13th, 1945

SUMMARY—Part I of this paper deals with the theory of frost action in soils and presents results of tests recently run on samples of permanently frozen ground from Alaska and the Yukon area of Northern Canada. Part II deals with problems encountered with the foundations of structures and aircraft runways in the area of permanently frozen ground in these northern regions.

Part I

R. M. HARDY, M.E.I.C.

Associate Professor of Civil Engineering, University of Alberta, Edmonton

Permanently frozen ground is ground that is not thawed out by seasonal changes in temperature. The word "permafrost" is coming into general usage in the literature to mean permanently frozen ground, and so will be used for the remainder of this paper. A layer of ground near the surface may be subject to thawing and refreezing due to seasonal changes in temperature. This is called the "active layer".

Permafrost occurs quite generally on this continent where the mean annual temperature is less than about 30°F. Figure 1 (an adaptation from a map prepared by the U.S. Geological Survey) shows the areas in North America where permafrost may occur. It has been estimated that about one-fifth of the land surface of the world is underlaid by permafrost. Its thickness varies from a few feet to as much as 1,200 ft. It may also occur in bands, that is, there may be alternating layers of frozen and unfrozen ground. Occasionally it is also found in a columnar structure.

The great mass of the permafrost is a relic of the last ice age, that is, of the Pleistocene age, which started perhaps a million years ago. However permafrost can be readily caused to form locally in areas where it does not ordinarily occur. For example, there is a record of a depth of 28 ft. of earth above bed rock becoming permanently frozen in an area where the mean annual temperature was above freezing. This occurred under a pile of boulders accumulated during mining operations. Another case is known of a depth of 25 ft. of permafrost forming under a building approximately in the latitude of Edmonton. This occurred under a cold storage room in the basement of the structure.

Theory of Frost Action

For soil to freeze implies that there be water in the voids between the soil particles. In freezing this water turns to ice. In sandy soils with little or no content of silt or clay material, the water in the voids simply turns to ice on freezing. The only change in volume of such a soil mass on freezing or thawing is that resulting from the change in state of the water in the voids. It will, of course, expand on freezing and contract on thawing. The volume change accompanying this change of state for water is 9 per cent. For a saturated sand it will amount to about 5 per cent of the volume of frozen soil. However, for soils with a silt or clay content, a different phenomenon takes place during freezing. Ice lenses may grow in the material. These consist of horizontal layers of solid ice varying in thickness from hair lines to a foot or more, and in length from about an inch to many feet. They are usually interspersed at quite regular intervals throughout the mass of the frozen soil. Under favourable conditions of freezing, the growth of ice lenses may produce an increase in volume of as much as 200 per cent in the frozen soil. This increase will produce a corresponding "heave" of any structure, highway or runway resting on the material. Moreover, such frozen soil on thawing has a moisture content greater than it had before freezing by the amount of water in the ice lenses. Consequently, while the material may have been reasonably stable before freezing, after thawing, it may be just so much soft muck, quite incapable of supporting any type of building foundation, or any kind of highway or runway pavement, including concrete.

Frost action in soils was made the subject of extensive researches in Sweden from 1925-1935. On this continent Dr. Stephen Taber①, a geologist at the University of North Carolina, conducted the pioneer research on the mechanics of frost action in an "open" system. Benklemen and Olmstead②, of the Michigan State Highway Department, have presented an alternative hypothesis applying to conditions with a fluctuating frost line where the surface is prevented by adjacent frozen ground from settling as the ground thaws from below. It may apply to comparatively small pockets of material very susceptible to frost heave, surrounded by highly impervious soil. However, Taber's is the accepted theory in Europe

Fig. 1—Permafrost regions of the North American Continent.

Fig. 2—Ice lens produced in the laboratory.

as well as on this continent and there is no question but that his hypothesis explains the formation of the vast areas of permafrost.

According to Taber, ice crystals begin to form in the centre of the voids of a saturated soil. These crystals grow principally in the direction of heat transfer and eventually press against the thin absorbed water films surrounding the soil particles. The absorbed water has a lower freezing point than that in the main body of the voids. There follows, however, a transfer of molecules from the films to the growing crystals. To maintain pressure equilibrium, water is pulled to the films from the unfrozen soil below. If the growing crystals are within the range of capillary rise in the soil from a source of water, such as the ground water table, the system is an "open" system. The ice layer continues to grow or segregate as long as the frost line stays at that level and at a rate determined by the permeability of the soil.

Dr. A. Casagrande③ has also made a contribution to the subject of frost action in soils that is of considerable interest in the interpretation of some of the test results presented here. He has stated that, "Under natural freezing conditions and with sufficient water supply, one should expect considerable ice segregation in non-uniform soils containing more than 3 per cent of grains smaller than 0.02 mm., and in very uniform soils containing more than 10 per cent smaller than 0.02 mm. No ice segregation was observed in soils containing less than 1 per cent of grains smaller than 0.02 mm. even if the ground water level was as high as the frost line."

There are thus several conditions that must exist simultaneously for ice segregation to take place in a freezing soil. First, there must be a source of water. If the ground water table is above the frost line it naturally can supply the necessary water. But what is equally important is the fact that if the ground water table is lower than the height of capillary saturation below the frost line, it may serve as the source of the water necessary for ice segregation. A second requirement is that there must be the minimum percentage of soil particles less than 0.02 mm. as stated by Casagrande. A third condition is that the permeability of the soil must be such as to permit relatively rapid flow of water through the soil to the frost line. Finally a fourth requirement is that the rate of penetration of the frost into the ground must be relatively slow. These last two conditions are interrelated, since the range of permeabilities for which serious ice segregation will take place depends upon that rate of penetration.

In general, clays are so impervious that they are seldom susceptible to serious frost action. At the other extreme clean gravels and sands are not susceptible to frost action because of their lack of fine particles. The soils which give the most trouble are the silts and sandy silts with their relatively fine texture and high permeability permitting ice segregation to proceed at a relatively rapid rate.

Figure 2 shows ice segregation secured in the laboratory in a silt soil. It requires careful temperature control and a stationary frost line for several hours to secure ice lenses of any appreciable thickness. Figure 3 shows an ice lens about two feet thick formed under natural conditions.

Results of Classification Tests

Samples of permafrost from two sites where the underground was being thawed out by heat from buildings were submitted to the Department of Civil Engineering of the University of Alberta in the spring of 1944 for routine tests. Cylindrical samples were cut from the frozen underground. Those from site "A" were 3 in. dia. and up to 10 in. long. Those from site "B" were 6 in. dia. and 12 in. long. They were delivered to the laboratory packed in ice and sawdust.

Fig. 3—Ice lens about 2 ft. thick, formed under natural conditions.

Table I
Classification tests of Permafrost samples.

Sample No.	Location	Specific Gravity	Moisture Cont. Wt. of Sample	Moisture Cont. ω%	Limits Liquid Limit	Limits Plastic Limit	Limits Plasticity Index	Remarks
1	Site B	2.76	192 gm. 1853 "	42.2% 49.1	22.5	27.5	0	Silt - Many thin Ice Lenses
2	"	2.74	1289 "	27.1	—	—	—	Sand - No Ice Lenses
3	"	2.73	2283 "	23.7	—	—	—	" " " "
4	"	—	1745 " 116 "	26.3 31.5	—	—	—	" " " "
5	"	—	2182 "	30.8	—	—	—	" " " "
6	"	—	3320 "	28.7	—	—	—	" " " "
7	"	2.71	3696 "	27.2	—	—	—	" " " "
8	"	—	2659 "	31.1	—	—	—	" " " "
9	Site A	—	1316 gm.	54	17	16	1	A Gravel with much silt. Icelenses up to 3/8"
10	"	2.42	96 "	66.7	40	33	7	Silt - Many ice lenses from hair lines to 1/16"
11	"	2.46	71 " 75 " 138 "	267 209 209	76	71	5	Silt - Many ice lenses from hair lines to 1/8"

All Moisture Contents are Based on Dry Weight of Soil

Table I shows the results of tests for specific gravity of the soil particles, moisture contents and limit tests. It is of interest to note the extremely high moisture contents of the silt materials as compared with the sands. A moisture content of 200 per cent in these silts represents an increase in volume of the material from its loosest state of 175 per cent. It will also be noted that no ice lenses were observed in the materials having the comparatively low moisture contents.

Figure 4 shows the results of the grain size determinations for the samples. It is of interest to note that the curves for samples 2 to 8, in which no ice lenses were observed, have practically no particles as fine as 0.02 mm., while the curves for samples 1, 9, 10 and 11, in which ice lenses were observed, have a percentage of particles finer than 0.02 mm. considerably in excess of the 3 to 10 per cent mentioned by Casagrande. The curve for sample 9 is of particular interest. It is from a gravel bed upon which a concrete floor slab was placed. It had ice lenses in it up to 3/8 in. thick. Considerable cracking and settlement of this slab occurred as the bed was thawed out from the heat of the building. Many people refuse to accept Taber's hypothesis and Casagrande's observations because they claim that they have seen many ice lenses in gravels. It will be noted, however, that this sample had 10 per cent particles finer than 0.02 mm. To an inexperienced observer, this gravel would appear simply as a " dirty " material. It would not readily be appreciated that the percentage of fine particles is so large. If one wishes to avoid heaving in a backfill of gravel, he should beware of a " dirty " gravel.

Results of Consolidation Tests

In addition to the tests, the results of which are shown in Table I and Fig. 4, consolidation ④ tests were run on some of the samples. These were run on 2⅝ in. dia. test pieces either ¾ or 1¼ in. thick. The samples were cut to fit the consolidation rings at temperatures below freezing, using a hacksaw and " shaving " the sample to size. Quite satisfactory samples were secured by this process.

Several loading cycles up to a maximum of 10 tons per sq. ft. were run on each sample at a temperature below freezing. The tests indicated that even at temperatures of only —0.5 deg. C. no thawing or appreciable deformation resulted from these loads. This result could have been deduced beforehand from the physical properties of ice, but we were specifically asked to run the test in this way.

The consolidation tests, after being set up in freezing temperatures, were moved into ordinary room temperatures and thawing was allowed to take place in such a manner that no soil particles could be lost from the samples but that the excess water could flow off. The thawing took place with a small load on the sample. After complete thawing the usual type of consolidation test was run on the sample. Figure 5 shows the " pressure-void ratio " curves from the consolidation tests.

Curves for Samples 1, 2 and 4 are from the sand material, and for Samples 10 and 11 are from the silt material. The sand samples, while they were in a comparatively loose state for a sand, did not loose excessive volume on thawing, and were comparatively incompressible and stable if confined after being thawed out. The silt samples, on the other hand, lost considerable volume in thawing, and were highly compressible after thawing. Curve for Sample A is added as a comparison. It is from a test on a material in which 2½ ft. of settlement has been recorded in a 50-ft. depth of compressible soil carrying a load of approximately 3,000 lb. per sq. ft. over an area 75 by 150 ft.

Conclusions From Results of Tests

In terms of behaviour of foundations the tests indicate that a foundation on the frozen sand would not be appreciably affected if the sand thaws. However, in the case of the silts, the settlement of a foundation, for all practical purposes, would be equal

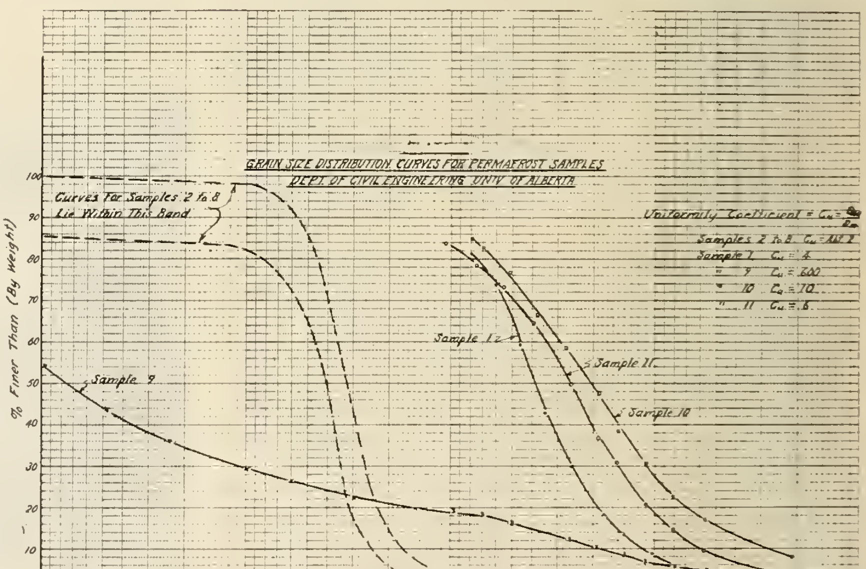

Fig. 4—Grain size distribution curves for permafrost samples.

to the thickness of the underground thawed out, if conditions were such that the soil could flow from under the load. This would be the case under posts or spread footings. Under a large loaded area, such as under a hangar or runway, the minimum settlement to be expected would be as indicated by the reduction of volume in thawing in the consolidation tests. Further settlement could then be expected consistent with the high compressibility of the soil as indicated by the results from the standard part of the consolidation tests.

It is of considerable practical interest to note that a soil survey at sites subject to frost action and a few simple soil tests will enable dangerous soil types to be identified, will permit an intelligent analysis of the action of a foundation at the site, and will facilitate the selection of the proper type of foundation.

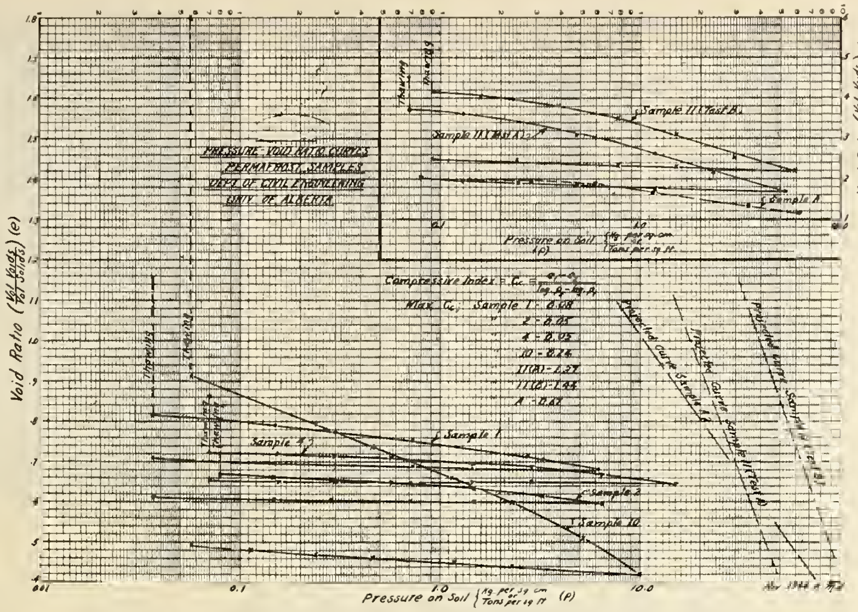

Fig. 5—Pressure-void ratio curves for permafrost samples.

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Part II

E. D'APPOLONIA, Jr.E.I.C.

Department of Civil and Municipal Engineering, University of Alberta, Edmonton

Introduction

Within recent years the barren cold north, as it is known to most of us, has taken on great developments in the field of mining and in the growth of communities, roads and airfields. To-day in the north can be found some of the largest airfields on the North American Continent—airfields which can accommodate the largest bombers. These airfields have been further linked together by a highway which serves as an artery over which supplies for maintenance and repairs are carried. Nature's crude oil flows through the famous Canol line to Whitehorse to be refined as fuel for airplanes and other services.

These developments of the north are the outcome of the ingenuity and perseverance of those men who built in the north. Mother Nature placed every conceivable obstacle in their path—cold weather, floods, frozen ground, insects and many others. The most serious of these to the engineer was the frozen ground.

It has been pointed out in Part I that the greater portion of the northern region is underlaid by this permanently frozen ground. The potentialities of this ground as a destructive agent to structures depends mainly on the number of ice lenses present. When thawed, certain soils cannot sustain a load; if the soil refreezes after being thawed, heaving results.

Roads, railroads, bridges, buildings and airports have all suffered due to the behaviour and destructive characteristics of this frozen ground. The severity of the damage to structures already built has been mainly due to lack of adequate preliminary investigation, study and research in this particular field of foundation design.

Structure in permafrost regions simply cannot be built on the same basis as those in temperate climates with the expectation that they will not suffer damage due to the freezing and melting of the ground.

The state of affairs to date has been that most engineers from Canada and the United States have disregarded the characteristics of the frozen ground and built according to practice in regions of temperate climate. The outcome of such construction is evident all along the Alaska Highway and at various airports built in the Northwest Territories, the Yukon and Alaska.

The purpose of this paper is to present some of the failures which have occurred, some revised foundation designs for structures, roads and runways, and the results of a load settlement test carried out in a permafrost region.

Failures

Failures which occur in frozen ground are mainly due to two fundamental causes.

1. The thawing of the frozen ground which supports the structure.

2. Heaving, which results from the growth of ice lenses in the soil.

Examples of each types of failure are numerous, and consideration will be given to a few of the more interesting cases.

Repeater Station

The first building failure which was encountered was at a repeater station located near the intersection of the Alaska Highway and the Alaskan border. At this site the permafrost extended from 2 to 42 ft. below the surface, as indicated by the log of a well boring. The building was located on a glacial deposit and, as indicated in Part I (Table I, Sample No. 9), the texture of the soil varied from clay to coarse gravel and contained a high moisture content, as a result of the growth of ice lenses.

The foundation for the furnace consisted of a 24-in. gravel backfill placed on the permafrost, after the 18 in. of active layer had been removed. A 4-in. plain concrete slab formed the base for the furnace. After four to five months of operation the heat had penetrated to a depth of 51 in. under the centre of the furnace resulting in a settlement of 7 in.

In the original design it appears that no particular consideration had been given to the texture of the frozen ground, nor to the study of its properties. The failure was a direct result of the thawing of the permafrost. In the new foundation design, this problem of the thawing of the frozen ground was considered. As a result the floor was elevated to give a free air space under the building. The purpose of this was to cause a minimum of disturbance to the natural thermal regime of the frozen ground.

Raising the building necessitated the use of posts, and this led to the possible danger of the posts being heaved due to the growth of ice lenses in the active layer. To offset this hazard the posts were securely anchored into the permafrost at a depth below which the permafrost horizon would not recede. Further, the posts had sufficient penetration to develop tangential adfreezing forces along its surface capable of withstanding the upheaval forces in the active layer. To help minimize these upheaval forces the surface of the post in the active layer was made smooth and then covered with a collar made up of grease and tar-paper. This collar allowed the ground heaved by the growth of ice lenses to slide along the surface of the post. If no collar had been used the freezing ground would have adhered to the post near the ground surface. Then, with increased penetration of the frost line and the formation of more ice lenses, the post would have been heaved along with the expanding soil.

To offer the greatest possible resistance to the heat transfer by conduction from the slab to the ground, insulation was placed between the joists. To reduce radiation, a fibre board having a surface with a low emissivity was used as sheeting on the underside of the joists. The free circulation of air under the floor helped to carry away transmitted heat by natural convection. Such precautions are essential to the preservation of the permafrost horizon and the stability of the structure.

Boiler House

In the Norman Wells area, the depth of permafrost varies from 60 to 130 ft. and is overlaid by an active layer which averages 18 in. in thickness. The frozen ground at a particular site where a boiler house was erected was a fine silty soil with a high moisture content.

The active layer was not removed during construction of the foundations, but was added to by a mat of brush and moss followed by 3 ft. of poor gravel fill. This supported a 10-in. concrete slab which formed the base for the boilers. After six months of operation a maximum settlement of 2.69 ft. was recorded.

The settlement resulted from the thawing of the permafrost by the heat transmitted from the firebox. The plasticity of the soil when thawed was so high that it flowed when subjected to load.

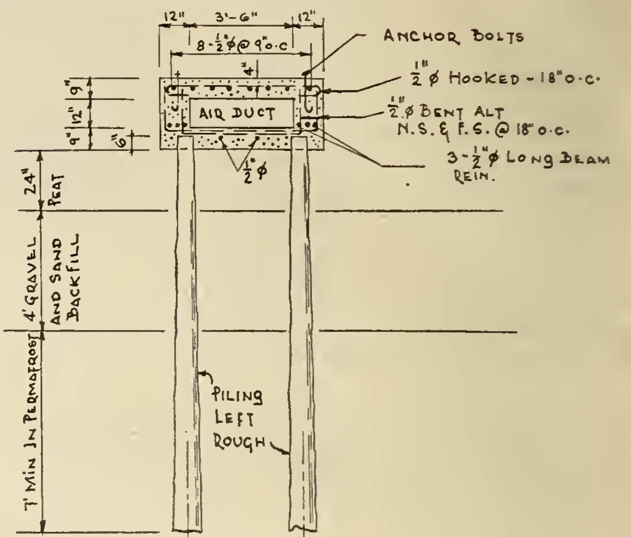

Fig. 6—Proposed foundation details for boiler units.

Figure 6 shows the new foundation design. The purpose of the duct is to have forced convection and thereby the removal of the greatest portion of the heat transmitted from the firebox. To further resist the heat transfer, the floor of the duct is given a shiny surface to reduce radiation. Heat transfer due to conduction is resisted by the concrete slabs, 24 in. of peat and 4 ft. of gravel backfill.

The depth to which the piles are sunk into the frozen ground depends on the desired life span of the structure and the rate of heat transfer. It should be understood that, once the permafrost horizon recedes to the base of the piles, settlement will result, if the soil is unable to sustain the load.

Warehouse

Figure 7 shows the 4 in. of shimming required to make the floor of a warehouse level. The supporting posts are resting on woodpads bearing directly on the permafrost. During construction the active layer was removed and not replaced, leaving the permafrost horizon exposed. The coming of warm spring weather caused a melting of the permafrost and subsequent settlement.

Utility Line

An example of a failure mainly due to heaving is shown in Fig. 8. The utility line in this particular case carried the steam, water and sewer lines for the community. The supporting posts of the box rested on the permafrost or, at the most, penetrated it only a few inches. During the winter the posts were heaved with the expanding active layer. In the spring settling

Fig. 7—Shimming under warehouse floor.

occurred, leaving the utility line with the twisted alignment shown in the photograph.

This heaving of posts is also common with telephone, power lines, and buildings supported on piles. In these cases the piles or poles are not anchored to a sufficient depth in the permafrost, nor have they protection against upheaval forces in the active layer.

General Schemes for Building Foundations

For frozen ground, four general schemes of construction are possible, and the choice of any one or any combination thereof will depend on the nature, use and life span of the building along with a study of the soil properties at the chosen site.

Experience shows that buildings or other structures resting on a clean gravel or sandy stratum of 20 ft. or more in thickness are not damaged by settling or heaving action of the soil. The reason for this is that the growth of ice lenses is not possible in such stratum. It also appears that such a thickness of stratum offers sufficient resistance to heat transfer under small buildings and assures the stability of the foundation for the normal life span (20 years) of the structure.

The problem of by-passing a silty stratum to a thick layer of sand or gravel requires no more precaution than the existence of proper protection of the piles in the active layer.

The main foundation problems arise where there is the existence of (1) alternate layers of sand and silt, (2) a thick stratum of fine grained soil.

Practically without exception, wherever there is a fine textured soil, the moisture content is high, due to the ice lenses which have formed. These soils when thawed are very plastic and possess little to no load bearing capacity.

These brief statements should emphasize the fact that foundation design should be preceded by (1) a determination of the soil profile to a depth equal to the width of the building, but at least to 20 ft. (2) a study of the soil properties at all changes in stratum. (3) study of the rate of heat transfer under a heated slab.

In order to determine the type of foundation to be used it is essential that the data obtained from the first two be considered. Very little attention has been given to the last item, rate of heat transfer, which is the controlling factor in determining the life span of the structure built on silty frozen ground.

The problem, though complex in character, is to determine the transient state of heat flow beneath the slab, maintained at a constant or variable temperature. The designer must be able to state within reasonable limits at what depth below the surface the permafrost horizon will be at any given time. The time element is necessary to establish the probable settlement, length of pile, or life span of the structure.

Returning to a consideration of the four main schemes of building foundations,—

Scheme 1 is a suitable solution for small buildings with an average life span of 20 years. These buildings remain stable as long as the permafrost horizon does not recede below the base of the piles. Figure 9 shows a typical section of such a foundation. Insulation is normally placed between the joists to reduce the heat transfer. The space beneath the buildings has no fluctuation of air temperature, but is fairly constant. Gradually the heat will penetrate further into the

Fig. 8—Alignment of utility line after one cycle of freezing and thawing.

frozen ground, melting it, and over a period of years the permafrost horizon will recede to the level of the base of the piles. The length of time required for this to occur is not certain. Experience indicates however that for small dwellings, piles set at least 10 ft. into the permafrost assure stability for the desired life span of the building.

Scheme 2. This design, illustrated in Fig. 10, is

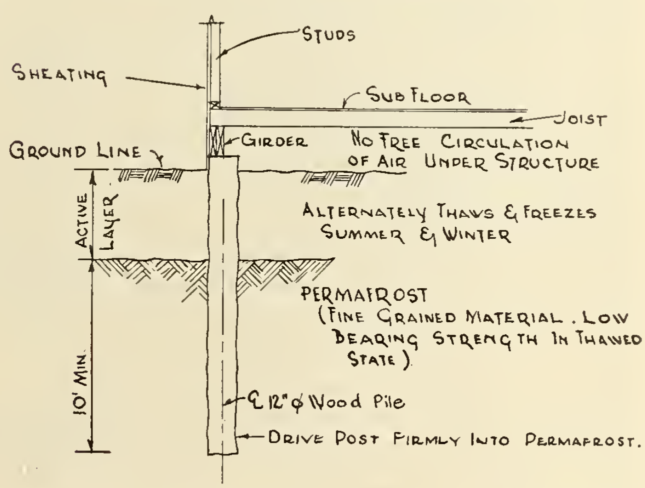

Fig. 9—Wood pile construction Type A. No free circulation of air under structure.

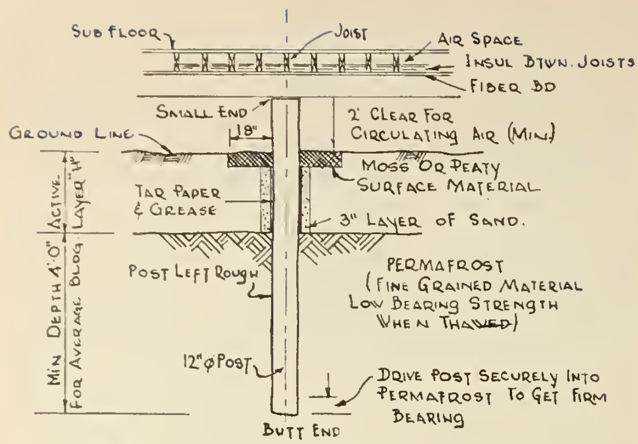

Fig. 10—Wood pile construction Type B. Free circulation of air permitted under building.

satisfactory for foundations of warehouses, boiler and power houses, barracks and such medium sized structures. The air space under the floor allows a free circulation of air and thereby tends to maintain the permafrost horizon near its natural level. In this design, as in Scheme 1, the heat transfer is resisted by insulation placed between the joists, and by having the underside of the floor sheeted with a fibre board which has a shiny surface.

Piles are set approximately twice the depth of the active layer into the permafrost. This develops sufficient bond to resist the upheaval forces which occur during freezing. In the active layer the piles are further protected from heaving by the use of a collar.

Steam Thawing

It can be readily recognized that it is impossible to drive piles into the frozen ground. This difficulty is overcome by steam thawing the ground to roughly the desired hole diameter for the driving of the pile. The process of thawing the ground is much the same as that used in the cold-water thawing of placer mining operations. The thawing is done with a ½ or ¾ in. dia. steam-point having steam pressure at 30 lb. per sq. in. This steam-point is then gradually driven to the desired depth. The length of time the steam-point is left in the ground depends on the texture of the soil. For sandy or silty soils, the time should be ½ to 1½ hours and increased to 3 hours for clay soils. The difference is mainly due to the fact that in sandy soils the heat is dissipated by the circulating and filtering action of the water in the void spaces. In the more impermeable soils, like the clays, the heat transfer and thawing is mainly a function of conduction, which is a much slower process. The piles are then driven butt down to refusal. These piles are checked for additional driving two or three days after initial placing.

Temperature measurements taken in the field show that the ground begins to refreeze very quickly. Figure 11 shows Fahrenheit isopleths of the thawed ground 3½ days after completion of steam-thawing. Records indicate that within ten days of the start of operations the temperatures along the face of the piles have dropped below freezing. For this reason it is recommended that no load be placed on the piles for a period of two weeks to a month. This gives the necessary time for the piles to become securely bonded with the permafrost. The Russians recommend that this operation of pile driving be carried out in the fall and that the piles be allowed to stand all winter before construction of the structure is started.

The load which each pile can carry depends on the adfreezing strength of the frozen ground to the wood pile, that is, the resistance which can be developed between the frozen ground and the pile. A value of 5 tons per sq. ft. of surface area is average for clay soils, 7 tons per sq. ft. for silts and sands, 3 for gravel and 5 for ice.

Scheme 3 can be well adapted to the design of foundations for water tanks and similar structures. As shown by Fig. 12, a backfill of clean sand is built up to a height of 3 to 4 ft. above the surrounding terrain. This fill is placed on the frozen ground during the early spring at a time when the seasonal frost has penetrated to its greatest depth. The thought in this design is to maintain the frozen ground by having the permafrost rise as high as possible into the sandy backfill. To reduce the transmission of heat, the necessary insulation and air space under the floor is provided.

Scheme 4 requires the thawing of the permafrost and the maintaining of it in a thawed state. This type of construction is suitable in cases where the frozen ground possesses reasonable bearing properties, and where there is a soil which will not undergo too great a consolidation due to the dead load and overburden when thawed.

An impervious wall is built around the building and anchored into the permafrost. The function of this wall is to prevent the movement of ground water into the thawed area under the dwelling. The ground water is subjected to a hydrostatic pressure when the active layer begins to freeze, and should this water find an avenue of escape through the thawed area under the building, it will move up through the soil and flood

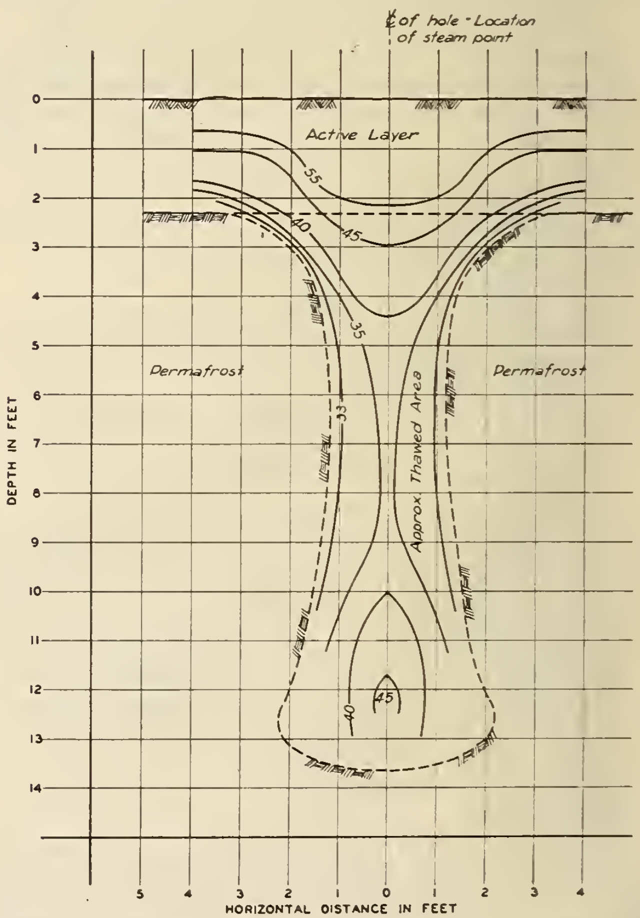

Fig. 11—Fahrenheit isopleths of thawed ground 3½ days after completion of steam jetting.

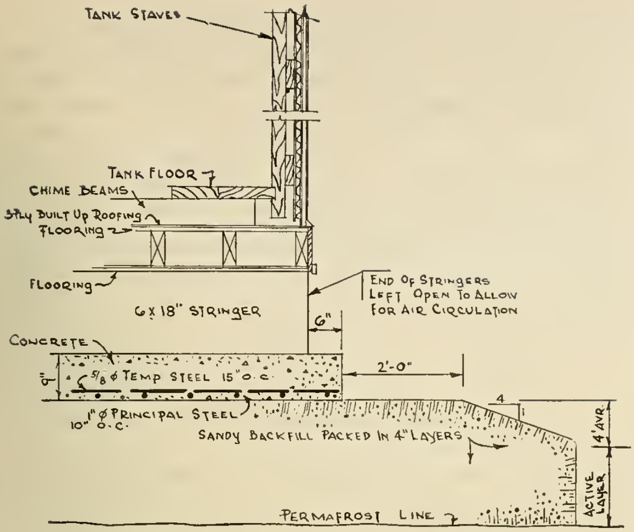

Fig. 12—Earth foundation for water tank.

the structure. Manifestations of this phenomenon have been recorded in Siberia.

Hangar and Load-Settlement Test

It can be readily understood from the preceding discussion that great importance should be attached to the study of the soil profile, its properties and the rate of heat transfer before a foundation is designed for any structure. This statement forcefully expressed itself in the case of a particular hangar built in Alaska.

The hangar was constructed on the site of an old borrow pit which was filled with sand and gravel to an average depth of 5 ft. No borings were made of this site and it must have been expected that the sandy backfill would properly distribute the footing load and be of sufficient depth to offer adequate resistance to the transfer of heat.

To determine the behaviour of the permafrost horizon, records of a dozen probing holes were kept. That is, the depth of the permafrost horizon below the finish floor was determined by driving a ¾-in. diameter rod to refusal. A record of nine months readings clearly indicated that the permafrost was receding at a rapid rate. To further investigate the problem, a boring was sunk to a depth of 40 ft. to determine the soil profile. The results of the boring showed that a clean layer of sand was underlaid by layers of silt and peat. These strata are typical of river deposits and their moisture contents indicate the existence of ice lenses. Figure 13 shows the soil profile along with moisture contents varying from 21.7 to 129.4 per cent based on dry weight of sample.

To obtain a measure of the settlement that might occur if the permafrost thawed, a pit 8 by 8 ft. was dug to permafrost, and a platform having an 18 by 18 in. bearing pad was erected on the permafrost horizon.

A 2500-lb. sq. ft. footing pressure was obtained by stacking lead weights on the platform. After this preliminary set-up, the ground was thawed to a depth of 40 ft. by four steam-points and a record of the settlement kept by taking level readings with reference to a fixed datum. The test was carried on for a period of 40 days, and in that short length of time a total settlement of 3 ft. was recorded.

To date, the hangar floor has undergone no settlement due to the thawing of the frozen sand. Figure 13 also shows the present level of the permafrost horizon and the amount of thawing which has occurred from the day the building was occupied. The conclusions which can be drawn from this figure are as follows: If the soil strata are continuous throughout the hangar area and should the permafrost horizon continue to recede at its present rate, the remaining life of the hangar is only another one to one and a half years. There remain approximately 5 ft. of good frozen sandy material before the silt is encountered. That settlement is inevitable is quite obvious when one considers only the high moisture content of the silt, 85.7 to 103.4 per cent, and the behaviour of the loaded platform.

Highways and Runways

Construction

The construction of highways and runways in permafrost regions along lines similar to those used in temperate climate regions, has resulted in failure of part or all of a runway or roadway resting on frozen ground.

As in standard practice, the surface insulation of moss and peat is removed along with the active layer. The result of such construction is the melting of the permafrost and the subsequent formation of a quagmire in fine grained soils. The backfill is then placed in lifts of approximately two feet to make the road passable. The placing of the backfill in such high lifts produces isolated pockets of a very plastic soil. These pockets in turn are conductive to the growth of frost mounds during the winter.

To cause a minimum disturbance to the natural thermal regime of the permafrost, careful consideration should be given to the soil profile before any insulating surface is removed. Should stripping be necessary, it should precede the backfilling only by a few hundred feet.

It is advantageous to build the roadway or runway in the early spring, that is, at the time when the permafrost horizon and frost line coincide. In the case

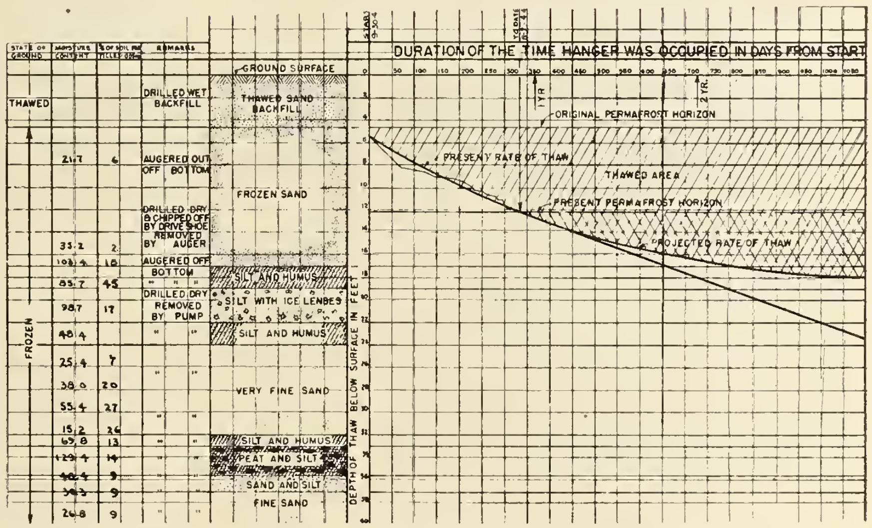

Fig. 13—Variation of permafrost under hangar floor.

of a roadway no insulation is removed, but a mat of brush and moss 50 to 75 ft. in width is added to the road. On this mat a clean gravel fill is then placed. The principle of such construction is to preserve a high level of the permafrost horizon and, if possible, have it rise up into a fill not susceptible to frost action. This type of construction has been tried and has proved successful in certain areas of the north. In other cases it may require several years to stabilize a road. This is done by periodically adding fill until it is found that the depth of summer thaw does not extend below the base of the brush insulation.

SHOULDERS

Other sources of trouble in roadways are the damming of water above the high rise of the frozen ground under the centre of the roadway, and the deep thawing of the permafrost on southern slopes. Such action, in either case, tends to increase the moisture content of the shoulders with subsequent slides resulting.

This difficulty can be avoided by the construction of a wide berm or mat along each side of the roadway. This causes the permafrost horizon to vary uniformly in depth under the full width of the roadway, and thereby insures the stability of the shoulders. A deep trench is cut well up on the high side of the road where the ground water can come to the surface and be removed by a system of drainage ditches and culverts.

CULVERTS

Roads suffer the greatest damage in the winter time due to the failure of the culverts to remain open. Once the culverts become blocked, the water, in due time, builds up as ice and " glaciates " the surface of the road making it impassable. At times the difficulty can be avoided by providing an adequate number of large culverts with good slope for drainage.

Another scheme is to provide winter maintenance as, for example, steam-thawing. Another method widely used is to build a small shed at each end of the culvert and place an oil-burner in each shed. In this manner the ice is melted and the temperature of the water is raised sufficiently to allow it to flow through the culvert. On the low side the water is again heated so that it flows well away from the opening before freezing again.

Each site has its own peculiarities and the scheme selected will require trial and readjustment before a satisfactory solution is obtained.

DEPTH OF BACKFILL

The statements made regarding the construction of highways apply equally well to runways, with the exception that the brush insulation is omitted.

The main problem in highway and particularly runway design is to determine the depth of backfill necessary to produce a stable section. Though the procedure has been to use the California Bearing Ratio Method, the results in permafrost regions have not been satisfactory. It is the author's opinion that the air temperature variation and depth of summer thaw are the predominant factors in establishing this required depth of backfill at any given site.

The depth of summer thaw and its duration can be computed from the following mathematical expression:—

$$T = T_m + \frac{a}{2}\, e - x\sqrt{\frac{\pi}{kp}}\, \cos\left[\frac{2\pi t}{p} - x\sqrt{\frac{\pi}{kp}}\right]$$

a = yearly range in temperature at the ground surface in °C.
k = the thermal diffusivity per square meter per day.
x = depth below the earth's surface in meters.
T = temperature in °C.
T_m = mean yearly soil temperature °C.
e = base of natural system of logs.
t = time in days.
p = period of temperature variation in days.

This equation states that the ground temperature at different depths can be computed on the assumption that the temperature fluctuation in the earth's surface is a harmonic function of time.

It is not certain to what degree of accuracy this method of design applies to runways and roadways in arctic and sub-arctic regions. This, however, could be determined if experiments were conducted on constructed runways in permafrost regions. This approach to runway design is based solely on the physical properties of the soil and the air temperature. Further, the solution depicts the conditions as they exist in the field.

Conclusion

Further development of the north will require a better working knowledge of frozen ground. This can only be accomplished through research and study, coupled with experimental work in the field. Russia has made great progress in the study and development of the permafrost regions both from an agricultural and an engineering point of view. To-day, the United States is taking measures to become acquainted with and to study her problems in Alaska. This should serve as a note of warning to Canada. If the Canadian north is to play the part hoped for it in our post-war world of air commerce and travel, the problems of frozen ground within the boundaries of Canada are of vital importance to us all.

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A NEW HIGH-EFFICIENCY LINEAR AMPLIFIER

SIDNEY T. FISHER, M.E.I.C.
F. T. Fisher's Sons Ltd., Consulting Engineers, Montreal

SUMMARY—This paper describes a new high-efficiency amplifier circuit with a quantitative analysis of its operation. This circuit operates by dividing the wave in several sections, amplifying each section separately and recombining the sections in the output to produce a larger wave of the original form. The circuit has special application to controlled-carrier system and relatively high efficiencies are obtained, the comparison with conventional arrangements being most favourable at low modulation levels.

Introduction

The problem of a high-efficiency linear amplifier is one with which radio engineers have been concerned for 25 years. Power amplifiers for either unmodulated or frequency-modulated carrier waves operate with such high efficiency, of the order of 75 per cent, that no considerable improvement is necessary. A power amplifier for a carrier wave modulated in amplitude by a speech wave still presents an outstanding problem and it is the purpose of this paper to develop a general line of attack on the problem.

Several solutions have previously been offered. The most wide-spread arrangement in use today is the class C radio amplifier modulated at high level by a class B audio amplifier. Other more complex arrangements in less common use are the Chireix "outphasing" modulation method, and the Doherty high-efficiency circuit.

The Linear-Amplifier Problem

When a wave containing amplitude modulation is to be amplified, the amplification must be closely linear. A conventional class B amplifier is linear, and when operated continuously at its maximum capacity, such an amplifier will have an efficiency of the order of 66 per cent. An amplitude-modulated wave has a value on peaks of modulation of twice the carrier value, so that a class B linear amplifier transmitting such a wave must have a maximum capacity twice that of the carrier wave unmodulated. Since over any considerable period of time a voice-modulated wave has a very low average value, we are not far wrong in considering the efficiency of the circuit for the carrier wave alone as its actual performance The efficiency of the class B amplifier is about proportional to the root-mean-square value of the wave being transmitted by it, so that we have in conventional linear amplifiers intended for transmitting a carrier wave amplitude-modulated by a speech wave, and where the modulation may reach 100 per cent, an average efficiency of only about 33 per cent. This means that, for every watt delivered to the antenna, about two watts of power is dissipated as heat at the anodes of the output tubes.

Two disadvantages are immediately apparent: first, the cost and difficulty of providing this relatively large amount of direct-current power at high voltage are considerable; and second, unduly large power-amplifier tubes must be employed in order safely to dispose of this amount of heat.

Aside from the question of efficiency of the power amplifier for the conventional transmission method, another factor should be considered. In an amplitude-modulated system, three major components are contained in the output wave; the carrier wave and two wideband waves. The two sidebands are equal in power, and together contain one half of the power contained in the carrier wave, for continuous maximum modulation. In other words, a radio transmitter with an unmodulated carrier of 100 watts, at maximum modulation transmits 150 watts, of which 25 watts is contained in the lower sideband, and 25 watts in the upper sideband. Telephonic speech may be assumed to have an average value of about 20 per cent of the maximum value over any considerable period of time. The total power in the two sidebands is therefore, for average telephonic speech, not one half the power in the unmodulated carrier, but is given by the following expression:

$$\frac{\text{Sideband power for telephonic speech}}{\text{Unmodulated carrier power}}=\frac{1}{2}\times\frac{1}{5^2}=\frac{1}{50}.$$

This means then that, for the 100-watt unmodulated carrier, the average sideband power over some period would be about 2 watts.

Since the intelligence is wholly contained in the sidebands and not in the carrier, the real efficiency of such a system is seen to be surprisingly low. Suppressed-carrier and controlled-carrier systems have been suggested and put to use in a wide variety of applications but have heretofore suffered from a rather fundamental disadvantage. If, for example, the amplitude of the carrier wave in a radio transmitter is adjusted by a circuit operating from the envelope of the audio modulating wave, so that for all values of the modulating wave the percentage modulation is kept close to 100 per cent, then in the conventional class B linear amplifier, which is required to raise this wave to a high power level, the efficiency will not be 33 per cent. Actually, it will be very much less, because the average value of such a wave will be much less over a period of time than the average value of the wave in a conventional system, which is very close to the unmodulated carrier wave. If we again assume the average value of the telephonic speech wave is about 20 per cent of the peak value, then in such a system we will have a carrier wave which has an average value of 20 per cent of the maximum carrier which the system will transmit, and this wave will therefore have 1/25 of the power of the maximum carrier rating.

Taking the case of the transmitter with 100-watt unmodulated carrier, the control of the carrier wave to maintain substantially complete modulation for all values of the audio modulating wave will not affect the peak rating which the power-amplifier stage must have, and we incur the serious disadvantage that this output stage will operate at an average power level of about 1/25 of its peak power rating. The over-all efficiency will therefore be very low (of the order of a few per cent) and the apparent advantage obtained by a controlled-carrier system has largely been offset by the low efficiency of the linear power amplifier which must be employed.

In the high-efficiency circuit of Doherty, linear amplification is obtained at an efficiency of around 60 per

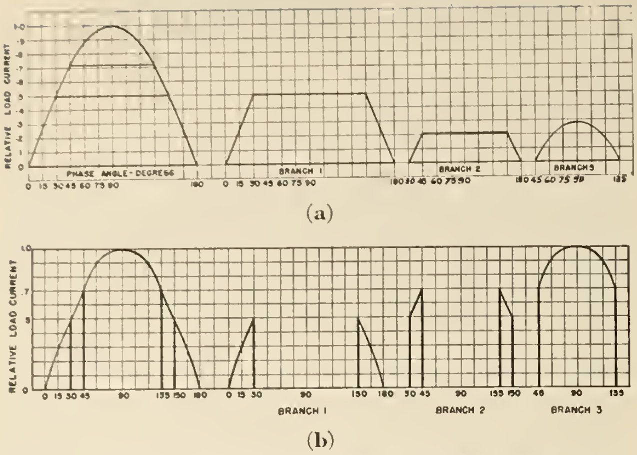

Fig. 1—Division of sinusoidal wave into sections, each of which can be amplified with higher efficiency than the original wave.

cent, which is very nearly twice the efficiency of the conventional class B modulated-wave amplifier. This efficiency of 60 per cent is the same order of efficiency as is achieved by a class C carrier amplifier modulated at high level by a class B audio amplifier, and the choice between the two systems lies in the practical details of components, ease of adjustment, and first cost, which for any individual application may be quite different for the two approaches to the problem. We have previously noted that, based on average speech, the sideband power is only about 2 per cent of the unmodulated carrier power, so that if we take the ratio of sideband power to direct-current input to the power-amplifier stage (which is actually a true statement of the utility of the conversion which we obtain in the power-amplifier stage of a radio transmitter) then it is seen that the true efficiency lies between 1 and 2 per cent, and we are back to the same order of efficiency as is obtained in a controlled-carrier system using a conventional class B linear amplifier. A controlled-carrier system using a Doherty or Chireix amplifier will have better efficiency than this, although the efficiency will still be in the region below 10 per cent, and for many applications where tuning over a frequency band is required, the complexity of these circuits is prohibitive.

Proposed Circuit

On consideration of these facts, it is realized that this problem, one of the most important in all radio engineering because of the large use of radio transmitters for aircraft and other mobile uses where weight, size, tube cost, and power requirements are serious considerations, requires a completely new attack. It is believed that the proposal which follows is a basically correct approach to the problem.

The anode dissipation in a vacuum tube goes to a low value when either the anode current is reduced to a low value without exceeding the allowable anode voltage, or the anode voltage is reduced to a low value without exceeding the maximum anode current. It will be obvious that the wave form which fulfills both these conditions will be transmitted with maximum efficiency, and that this wave form is a square-topped wave. In such a wave, the energy is completely contained in rectangular pulses which rise instantaneously from zero to the maximum value, and drop to zero from this maximum value instantaneously. The energy is therefore transmitted wholly during the time at which the maximum allowable anode current is being transmitted, and under this condition the ratio of voltage drop across the load to voltage drop across the tube is a maximum. If signalling systems were called upon to transmit only such wave forms, of constant amplitude, we would then have linear power amplifiers which would operate with an efficiency of the order of 90 per cent, using conventional tubes. It appears that a successful approach to the actual problem can be developed from this simple statement.

The solution to the problem resolves itself into changing the actual signal wave to the form in which it can be transmitted with the highest efficiency; that is, having it approach square-topped wave as nearly as possible. Figure 1 shows two ways in which this can be done. The wave can be divided into a number of sections, horizontally (Fig. 1 (a)) or vertically (Fig. 1 (b)), that is on either an amplitude basis or a time basis. The method to be proposed therefore consists of the following steps: (1) Subdivision of the wave into components that approximate the optimum, rectangular wave form; (2) Amplification of these components separately in vacuum-tube amplifiers; (3) Recombination of the separate components in the output circuit of the amplifiers so as to reproduce the original wave at a higher power. That is to say, high-efficiency amplification is achieved by dividing the wave on an amplitude basis into several sections, in practical cases, about three; transmitting each of the sections through a power amplifier whose peak allowable current is that of the section being transmitted, and then combining the three sections at the output by connecting the three amplifier branches to a common load circuit so that the original wave form is again obtained. This arrangement results in some circuit complexity, but increases by a large factor the plate-circuit efficiency of the amplifier. It also reduces the required tube complement, with a corresponding reduction in weight and size of the associated apparatus, since the increase in efficiency chiefly manifests itself in a reduction of the amount of power dissipated on the anodes of the power amplifiers.

Circuit Operation

An approximate way of regarding the system proposed is to think of it as a series of class C amplifiers,

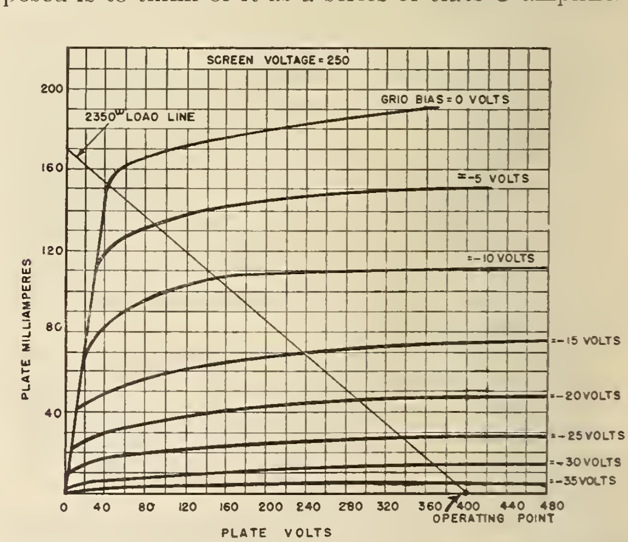

Fig. 2 — Plate-current — plate-voltage characteristic of typical small beam tetrode, showing low-voltage drop across tube at high values of plate current.

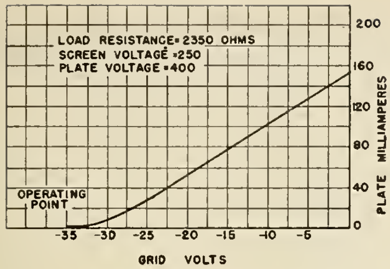

Fig. 3—Grid-voltage—plate-current characteristic of the tube of Fig. 2

whose inputs are driven by different sections of the wave, the sections being selected by a combination of grid bias and grid drive in an arrangement which can be termed an "amplitude filter." Each branch then amplifies the section of the wave which it receives with higher efficiency and higher output than with which it could handle the whole wave, and the sections of the group are combined in the output circuit so that a linear relation is obtained between input and output.

A reference to Fig. 2 demonstrates in a qualitative way the major point involved. This illustration shows the plate characteristic, and Fig. 3 shows the grid-voltage—plate-current characteristic of a typical small transmitting tube. When the tube is operated as a class B amplifier into the rated load impedance, the plate current rises along the load line to a maximum value which is determined by the allowable anode heating and the allowable cathode current. It will be noted for the tube whose characteristics are given, that when the grid is driven to zero voltage, the maximum operating point for this tube, 10 per cent of the plate voltage appears across the tube, and 90 per cent across the load. That is to say, at this point the tube is transmitting power at an instantaneous efficiency of 90 per cent. However, when the tube transmits a sine wave or a modulated signal wave, only a small part of the energy is transmitted at, or near, this high-efficiency point, and most of the energy content of the wave is transmitted at much lower efficiencies; a sine wave being transmitted with about 60 per cent, and modulated wave with about 35 per cent over-all efficiency. It will be apparent that this tube would transmit a square-topped wave with an efficiency of 90 per cent, so that for a given plate dissipation the tube would have a power output for the square-topped wave about four times greater than for the sine wave, and about six and one-half times greater than for the carrier wave 100 per cent modulated by a signal.

This leads to the present proposal of dividing the sine wave or modulated wave into a series of pulses, each of which has a form more nearly approaching the required rectangular form, amplifying these pulses through separate power amplifiers whose peak allowable currents are the same as the maximum value of

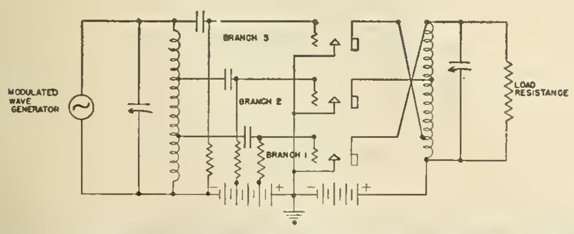

Fig. 4 — Schematic circuit of a three-branch linear amplifier, with the grid drive and grid bias individually adjusted for each branch.

the pulses in a common load circuit to form the original wave form.

In practice this rather roundabout method has been found to work out with surprising ease. Figure 4 shows an outline circuit of a three-branch modulated-wave linear amplifier. Each of the three branches has its grid drive and grid bias individually adjusted so that the branches transmit current in sequence and not simultaneously. Branch 1 is biased at cutoff, so that it operates as a conventional class B amplifier. It receives the lowest grid drive. Branch 2 is biased beyond cutoff, and it has a greater grid drive. Branch 3 is biased to about twice cutoff, and it has the highest grid drive. These three branches are connected to the load through a common plate coil, and their load im-

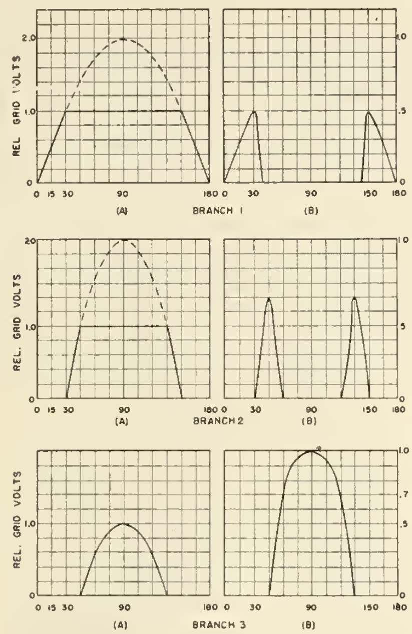

Fig. 5—Division of input wave through a three-branch amplifier.

pedances are adjusted about in inverse proportion to the grid drive. Branch 1 has the highest load impedance, branch 2 an intermediate load impedance, and branch 3 a load impedance about one half that of branch 1.

The operation of this circuit can now be described with reference to Figs. 5 and 6. As the wave commences, branch 1 immediately starts to draw plate current, since it is biased to class B operation. As the wave advances it reaches a point, shown as a relative grid voltage of 1.0 and a relative load current of 0.5, where the peak allowable current of branch 1 tube is reached. At this point, the grid commences to draw current and biases itself back due to the direct voltage set up across the grid leak. At the same time the plate current of branch 1 decreases abruptly because at this point in the wave branch 2 has started to draw plate current and is delivering power to the load from a higher voltage source than does branch 1. Similarly as the wave advances, branch 3 draws plate current and branch 2 at this point has its plate current abruptly reduced. The same process takes place in a reverse order when the wave has passed its maximum value and decreases again to zero. It will be seen that each tube operates linearly over a range of amplitude for which it delivers power, and nonlinearly outside this range. The three groups of pulses are delivered in sequence to the load resistance, and the way in which they combine is shown in Fig. 6. It might be mentioned that the illustrations shown are copies of oscillograms obtained in an experimental amplifier.

It will be noticed that the recombined wave has, for a three-branch arrangement, an appreciable content of the ninth harmonic. Other distortion products are almost entirely lacking. In any radio-frequency application it is, of course, rather easy to reduce the ninth harmonic by any factor desired; and where this circuit is used for audio frequencies, the harmonic content can be reduced about as desired by the application of negative feedback.

Efficiencies Obtained in New Circuit

It will be apparent that the efficiency of this circuit is high, even for low values of the wave being transmitted, since the instantaneous efficiency rises to about 90 per cent as the maximum current in each branch is reached. This is shown in Fig 7 which is a plot of per-cent instantaneous efficiency against per-cent peak load current for the transmission of a sine wave. For the conventional class B amplifier the efficiency is assumed to be proportional to the peak load current,

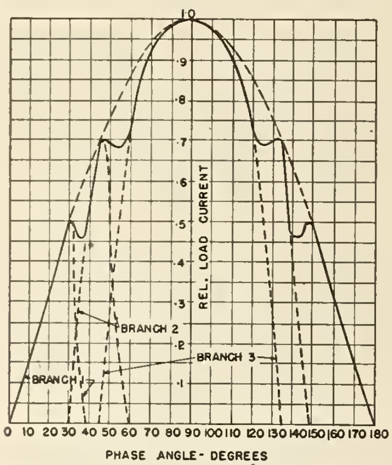

Fig. 6—Recombination of the wave sections of Fig. 5 in the output circuit of a three-branch amplifier.

rising to a value of about 90 per cent at 100 per cent of the allowable current. The plot shows how this efficiency curve varies as circuits of varying numbers of branches are used. In each case for which the data is given on this figure, the power ratio in successive branches is 2 to 1; that is, a 3-decibel separation. For a three-branch circuit, for example, the case illustrated by the previous wave-form curves, the instantaneous efficiency rises to 90 per cent at 50 per cent of the maximum load current, and the efficiency does not depart far from this value right up to the maximum power from the over-all circuit. For waves of low amplitude, the efficiency of this circuit is therefore quite good, and in fact is the same for waves of half the maximum amplitude as the efficiency of a conventional class B amplifier for waves of maximum amplitude. If as many as ten branches are used, then the efficiency of the circuit for waves of 4.4 per cent of the maximum amplitude is the same as the efficiency of the conventional circuit for waves of the maximum amplitude, and for waves of amplitude higher than 4.4 per cent, the efficiency steadily improves to a value in excess of 80 per cent for waves of the maximum amplitude.

Figure 7, which was obtained experimentally, is further explained by Fig. 8, which shows the efficiency obtained in amplifiers of different numbers of branches in which 3-decibel separation exists between the

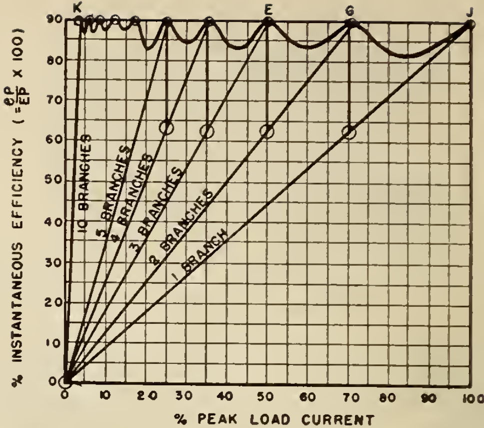

Fig. 7—Per-cent instantaneous efficiency plotted against per-cent peak load current, for the transmission of a sine wave through amplifiers of different numbers of branches.

branches. The efficiencies are shown both for a sine wave of constant amplitude, and for a signal-modulated carrier wave with 100 per cent modulation, and were derived experimentally using the tube whose characteristics are shown in Figs. 2 and 3. Based on this data, it appears that, for normal applications involving speech modulation, an arrangement of about three or four branches gives the practical compromise between efficiency and circuit complexity in the case of either type of wave. It is likely that for amplification of audio frequencies the greater complexity of the circuit, because of the impossibility of tuning the load, would dictate a smaller number of branches, either two or three. In the audio-frequency case, the " amplitude-filter " arrangement is not so readily obtained by the adjustment of grid drive and grid bias of the power amplifiers, and for such applications it will occasionally be necessary to have separate signal-shaping driver stages, each power-amplifier stage operating as a conventional class B amplifier. Such a circuit for a push-pull three branch audio-frequency amplifier is shown in Fig. 9. In this case the division of the signal into sections is accomplished by small driver tubes which accomplish their function by individual adjustments of the grid drive, grid bias, and plate load.

Application to Controlled-Carrier Systems

It is apparent that the linear-amplifier system described, whose efficiency remains relatively high for low amplitudes of the transmitted wave, has special advantages to offer as a power amplifier for a signal-modulated wave in which the carrier is either controlled so as to keep the per cent modulation substan-

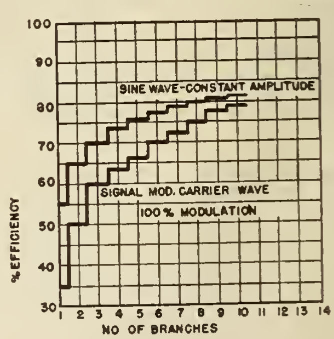

Fig. 8—Per-cent efficiency of transmission of a sine wave and of a carrier wave 100 per cent modulated by a sine wave, through amplifiers of different numbers of branches. In each case, succeeding branches have a 3-decibel difference in output power.

tially constant and high, or in which the carrier is suppressed. Since suppressed-carrier systems are of rather a special nature and require special receivers, consideration of a controlled-carrier system is of more interest in the present application. In a controlled-carrier system, in general it is not necessary to use special receiver, and the transmission is essentially no different from constant-carrier systems.

The usual way in which a controlled-carrier system operates is to derive from the audio-frequency modulating wave a unidirectional pulse which has the form of the envelope of the audio-frequency wave. Thus in Fig. 10, the input wave A is rectified and filtered to provide the unidirectional pulse B. This pulse is then added to the original wave to form the unidirectional wave C. It is this wave which is introduced into the system ahead of the modulated-wave amplifier. This wave is applied to the modulated amplifier in such a way, that when no speech current exists, carrier is transmitted at only a very low level, say 5 per cent of the maximum capacity of the system. When speech current is applied, the carrier is increased proportionately to this current so that the output wave consists of a voice-modulated carrier wave whose modulation is substantially complete for all amplitudes of the voice wave. Such a wave is shown as D in Fig. 10. Since average voice modulation is only about 20 per cent, it is seen that the range of amplitudes of the output wave will vary, not in a ratio of 2 to 1 as in the conventional transmitter, but in a ratio of, say, 30 to 1, with the average amplitude about one fifth of the peak amplitude instead of about one half the peak amplitude as is the case in a conventional system. It will be recognized that these factors are responsible for the low efficiency of conventional linear amplifiers in controlled-carrier systems, and that the ability of the circuit outlined in the previous paragraphs to sustain its efficiency at low amplitude will be of great value for this type of transmission For example, to consider again a transmitter with an unmodulated output of 100 watts, if this carrier is so controlled that it drops to, say, 5 watts in the absence of modulation, it will rise to a total value of 150 watts, averaged over an audio-frequency cycle, for 100 per cent modulation. Considering average modulation as 20 per cent, the average power content of the carrier plus the sidebands will be somewhat more than 6 watts. This value would be 6 watts if the carrier were completely suppressed during silent periods, but the constant carrier output of 5 watts combined with the modulation gives an average carrier plus sideband output of about 10 watts. This output power will be generated in a three-branch amplifier with an efficiency of around 30 per cent. This can be determined by applying the data of Fig. 7 to the wave form D of Fig. 10. That is to say, the direct-current input to this output stage will be about 33 watts for telephonic speech. This compares with the case of the conventional class B amplifier operating on a controlled-carrier system where under similar conditions, the direct-current input is of the order of 200-watts, or of the class C carrier-amplifier modulated by the class B audio amplifier using a constant carrier where the direct-current input is about 300 watts.

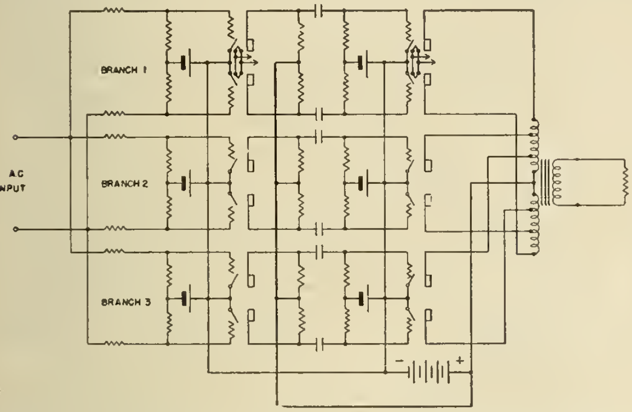

Fig. 9 — Schematic circuit of a three-branch audio-frequency amplifier, with separate "signal-shaping" stages.

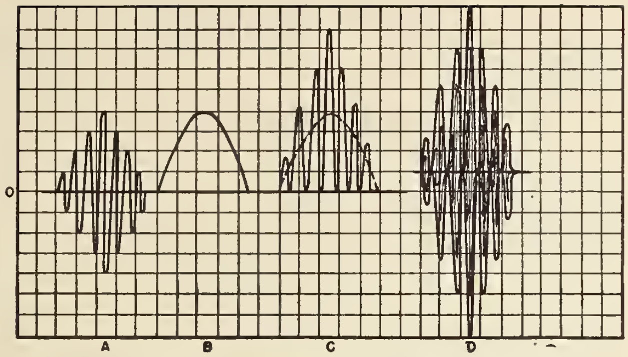

Fig. 10—Wave forms obtained in the operation of a controlled-carrier modulator.

Conclusions

On a basis of direct-current power input, this arrangement therefore appears to have an advantage of at least 5 to 1 over circuits now in use, and in some cases this improvement might be 10 to 1. It is possible that these advantages will not in all cases be obtained in practical apparatus due to the greater circuit complexity, but substantially the improvement to be expected should be obtained. A further point is that with this circuit the total power dissipation of the output stage is now considerably reduced. For instance, in the example cited above, the power to be dissipated by the anodes of the power-amplifier tubes for average telephonic speech is about 23 watts. The power to be dissipated by the anodes of the power amplifier in a controlled-carrier system, using a conventional class B power stage is about 190 watts, and in an output stage in which a class C amplifier is plate modulated by a class B audio amplifier, it is about the same. The anode dissipation in the system described is therefore only about 15 per cent of that obtained in conventional systems, and the tube complement employed is of correspondingly smaller capacity.

Practical Variations of Basic Circuit

A large number of variations of this basic idea is obviously possible. Only the " vertical " division of the wave has been considered. " Horizontal " division is also possible, in which all branches may transmit current simultaneously; this would involve a bridge or hybrid-coil arrangement in the output, so that the branches could supply current simultaneously to the load, without mutual coupling. Both series and shunt plate-supply arrangements should be considered. In place of the " signal-shaping " arrangement employing adjustments of grid drive and grid bias to set up the sections of the wave, the plate current of one

TABLE I—TRIANGULAR WAVE

	Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Total
One Branch—Efficiency 60%						
Power Input—watts	—	—	—	—	—	1670
Power Output—watts	—	—	—	—	—	1000
Plate Dissipation—watts	—	—	—	—	—	670
Two Branches—Efficiency 70.5%						
Voltage Factors	0.67	1.00	—	—	—	—
Power Input—watts	490.	930.	—	—	—	1420
Power Output—watts	300.	700.	—	—	—	1000
Plate Dissipation—watts	190.	230.	—	—	—	420
Three Branches—Efficiency 75.4%						
Voltage Factors	0.47	0.78	1.00	—	—	—
Power Input—watts	240.	440.	650.	—	—	1330
Power Output—watts	140.	340.	520.	—	—	1000
Plate Dissipation—watts	100.	100.	130.	—	—	330
Four Branches—Efficiency 78.0%						
Voltage Factors	0.44	0.66	0.84	1.00	—	—
Power Input—watts	140.	265.	375.	500.	—	1280
Power Output—watts	85.	200.	300.	415.	—	1000
Plate Dissipation—watts	55.	65.	75.	85.	—	280
Five Branches—Efficiency 80.4%						
Voltage Factors	0.38	0.57	0.73	0.87	1.00	—
Power Input—watts	90.	170.	260.	320.	410.	1250
Power Output—watts	60.	130.	205.	265.	340.	1000
Plate Dissipation—watts	30.	40.	55.	55.	70.	250

TABLE II—SINUSOIDAL WAVE

	Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Total
One Branch—Efficiency 70.6%						
Power Input—watts	—	—	—	—	—	1412
Power Output—watts	—	—	—	—	—	1000
Plate Dissipation—watts	—	—	—	—	—	412
Two Branches—Efficiency 77.4%						
Voltage Factor	0.71	1.00	—	—	—	—
Power Input—watts	293.	1000.	—	—	—	1293
Power Output—watts	182.	818.	—	—	—	1000
Plate Dissipation—watts	111.	182.	—	—	—	293
Three Branches—Efficiency 80.3%						
Voltage Factor	0.57	0.83	1.00	—	—	—
Power Input—watts	138.	319.	790.	—	—	1247
Power Output—watts	90.	240.	670.	—	—	1000
Plate Dissipation—watts	48.	79.	120.	—	—	247
Four Branches—Efficiency 82.4%						
Voltage Factor	0.485	0.71	0.88	1.00	—	—
Power Input—watts	81.	174.	289.	666.	—	1210
Power Output—watts	52.	134.	237.	577.	—	1000
Plate Dissipation—watts	29.	40.	52.	89.	—	210
Five Branches—Efficiency 83.8%						
Voltage Factor	0.43	0.63	0.857	0.91	1.00	—
Power Input—watts	57.	114.	174.	263.	586.	1194
Power Output—watts	34.	85.	144.	223.	514.	1000
Plate Dissipation—watts	23.	29.	30.	40.	72.	194

branch can be utilized to "trigger" the grid bias of the succeeding branch. By using a divided direct-current power supply, the branches can be arranged in parallel or in series to deliver power to a single load impedance, instead of the divided load described. The adaptations of this circuit to a modulated amplifier and to an oscillator are straightforward.

Special tubes, having a higher ratio of plate current to plate dissipation than those currently used, will have particular value in this circuit. New forms of tubes, employing multiple grids or multiple anodes, with heat interchange between the anodes, appear to have useful possibilities.

The foregoing material gives a qualitative description of the operation of the new circuit as a linear amplifier.

Mr. E. S. Kelsey, M.E.I.C., Electronics Research Engineer, Northern Electric Company Limited, at Montreal, has made a theoretical analysis *(Journal of the Institute of Radio Engineers*, January, 1946) of the circuit for the cases of a triangular wave and a sinusoidal wave, in each case of constant amplitude. This study in these cases supports the experimental results noted above, but the case of a voice-modulated carrier wave, either with or without the complications of carrier-control or carrier-suppression, requires more basic experimental data before it can be treated theoretically in a satisfactory manner. Mr. Kelsey intends to carry out and report on this further study.

The optimum ratios of the peak voltage output of each branch to the maximum load voltage were worked out for circuits with up to five branches, and using these optimum values ("voltage factors") the efficiency of theoretical 1000 watt-output amplifiers, for the cases of a triangular and a sine-wave, were calculated. Tables I and II show these conclusions. In arriving at these results it has been assumed that in every case the ratio of voltage across the load to supply voltage ("voltage-utilization factor") reaches a maximum of 0.9.

These theoretical results are somewhat more favourable than those reported above, from the initial experimental work. For instance, in the case of the sinusoidal wave, the efficiency of the 5-branch amplifier is 83.8 per cent as against 70.6 per cent for a conventional amplifier.

Acknowledgment

The author is indebted to Mr. C. B. Fisher, M.E.I.C., of Montreal, who worked over the proposal in its early stages and first put it into a sound theoretical and practical form. Wing Commander K. R. Patrick, O.B.E., of the R.C.A.F. was of assistance on the experimental side.

GAS TURBINE FUNDAMENTALS

DALE D. STREID
Aircraft Gas Turbine Engineering Division, General Electric Company, Lynn, Mass., U.S.A.

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The gas turbine is a prime mover embodying a compressor, a combustion chamber, and a turbine as illustrated in Fig. 1. Any combination of these elements working together is considered a gas turbine; however, the use of these components in conjunction with an Otto cycle engine, a Diesel engine, a steam power plant, or other common forms of prime movers is not considered as a gas turbine power plant. Other components besides the compressor, combustion chamber, and turbine may be added to these and the resulting power plant is still considered a gas turbine. Such components are regenerators, compressor interstage coolers, turbine interstage combustion chambers, and split compressors or split turbines. The addition of these other components merely improves the performance or mechanical operation of the gas turbine and does not change its fundamental principles.

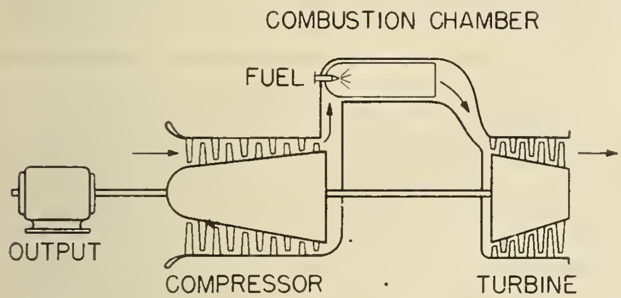

Fig. 1—Schematic diagram of simple cycle gas turbine.

The gas turbine as illustrated in Fig. 1 operates on the familiar Joule (or Brayton) cycle which consists of adiabatic compression, constant pressure burning, and adiabatic expansion. The adiabatic compression is normally accomplished in a compressor which may be either of the axial flow type or the centrifugal type or a combination of the two. The constant pressure burning is normally accomplished in a combustion chamber, although heating of the air may be done by indirect means such as a heat exchanger. The adiabatic expansion is normally accomplished by means of a turbine although other methods of removing the energy from the gas may also be used. The cycle of operation of the gas turbine is illustrated on the diagram shown in Fig. 2. The air enters the compressor at (1) and is compressed adiabatically to (2). It then enters the combustion chamber and is heated at constant pressure to (3). In this state it enters the turbine and is expanded adiabatically to (4).. Obviously, this is a simplified explanation since the compression is not 100 per cent efficient adiabatic compression, the heating does not occur without a slight pressure loss, and the expansion in the turbine is not 100 per cent efficient adiabatic expansion. However, the cycle is very well illustrated by this example of ideal conditions.

For the purpose of this paper, gas turbines are considered as being in two classes; the static gas turbine, and the dynamic gas turbine. The static gas turbine is the one used for the familiar applications such as stationary power plant, marine power plant, locomotive power plant, etc. The dynamic gas turbine is the one used for aircraft applications in which the performance is greatly affected by the forward speed of the gas turbine. The fundamentals of the static gas turbine are thoroughly discussed in the literature; some of the most recent publications are given in References 3, 4, 5, and 10. The simple theory and some performance data of the static gas turbine are being repeated in this paper merely to provide a background and foundation for the theory and performance of the dynamic gas turbine. The simplest form of the static gas turbine is the simple cycle gas turbine shown in Fig. 1.

The performance of gas turbines depends on the properties of air and gasses at pressures and temperatures which vary over a wide range. Therefore, to be strictly correct, the calculations of the performance of the gas turbines must take account of the variations of available energy, enthalpy, specific heat, and other properties with temperature and pressure, as well as with moisture content and composition. Since this is a very laborious process, and since the properties of air and hot gas have only recently been accurately established (See Ref. 6 and 7), simplifying assumptions are usually made. The simplest assumption, which may be called the first approximation, is that of an Ideal Air Cycle using normal air throughout and perfect gas laws. The second approximation, and the one used in this paper, is to assume normal air for the compressor, average properties for the air in the combustion chamber, and average properties for the hot gasses in the turbine. In addition, it is assumed that the air in the compressor, the air in the combustion chamber, and the hot gas in the turbine obey the perfect gas laws.

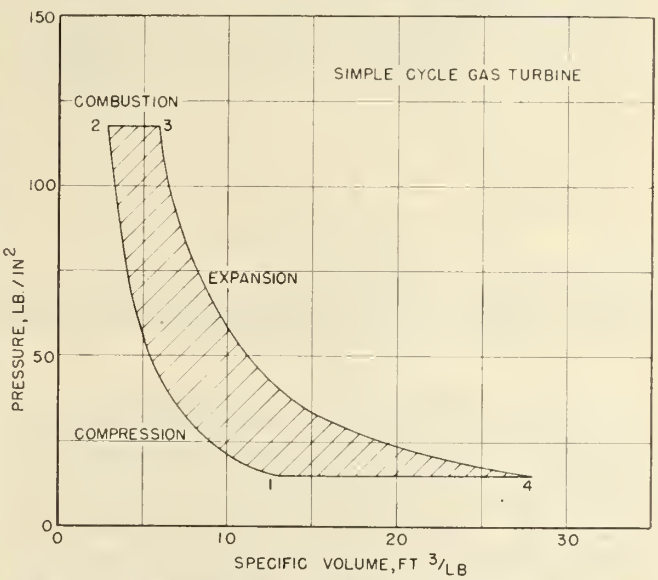

Fig. 2—Pressure-volume diagram of simple cycle gas turbine. These curves are based on assumed efficiencies.

Based on these assumptions, the compression in the compressor results in a temperature rise of

$$\triangle T_c = \frac{XT_1}{\eta_c}$$

where X is obtained from the familiar expression:

$$X = \left[\left(\frac{p_2}{p_1}\right)^{\frac{k-1}{k}} - 1\right]$$

The power required for this cycle is given by the following:

$$P_c = \frac{778}{550} C_{pc} \triangle T_c w_a$$

The temperature rise in the combustion chamber is given by:

$$\triangle T_b = \frac{w_f}{w_a} \quad \frac{Q_L \eta_b}{C_{pb}}$$

and the pressure loss through the combustion chamber is given by

$$\triangle p_b = p_2 - p_3 = C_b p_2$$

The temperature drop through the turbine is given by

$$\triangle T_u = \eta_u \varphi T_3$$

where φ is a function for expansion similar to the X function for compression

$$\varphi = \frac{\left[\left(\frac{p_3}{p_4}\right)^{\frac{k-1}{k}} - 1\right]}{\left(\frac{p_3}{p_4}\right)^{\frac{k-1}{k}}}$$

The power developed by the turbine is given by the following equation:

$$P_u = \frac{778}{550} \triangle T_u C_{pu} w_g$$

(See appendix A for nomenclature).

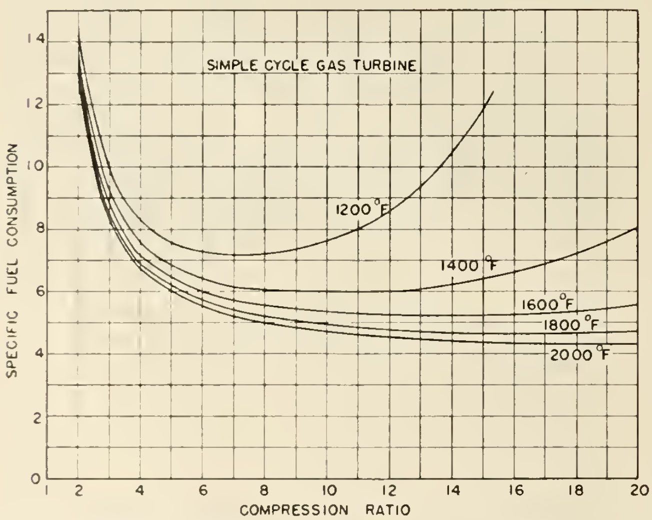

Fig. 3—Effect of compression ratio and turbine inlet temperature on specific fuel consumption of a simple cycle gas turbine. These curves are based on assumed efficiencies.

In analyzing the gas turbine throughout this paper, the weight flow of hot gas from the combustion chamber and through the turbine is assumed to be equal to the weight flow of air entering the compressor. Actually the hot gas flow from the combustion chamber and through the turbine is greater than the air flow into the compressor by the amount of fuel burned. These two flows are being made equal with the assumption that the difference represents the mechanical loss. Thus, it is not necessary to use a mechanical or coupling efficiency to take account of the heat radiation losses, the bearing losses, the windage losses, etc. of the turbine, the combustion chamber, the compressor, and the power output.

The performance of all of the gas turbine cycles throughout this entire paper is based on the standard efficiencies shown in Table I. These efficiencies are used in all curves and discussions of this paper except when it is specifically indicated that one or more of them is changed or being considered variable.

The efficiencies shown in Table I are assumed values which are not necessarily obtained at present. However, in the author's opinion, these values represent a possibility for the future, with the development of the art proceeding as it is to-day. Since these efficiencies are being used for illustration of the fundamentals of gas turbines and not for actual performance representation, the performance data presented in this paper are not for any real gas turbine, either in existence or of a proposed design.

Table I—Standard Efficiencies for Gas Turbine Calculations

Compressor Efficiency	η_c	.85
Turbine Efficiency	η_u	.83
Turbine & Jet Efficiency	η_{uj}	.90
Jet Efficiency	η_j	.98
Combustion Chamber Pressure Loss	C_b	.03
Heat Exchanger Effectiveness	η_h	.50
Combustion Efficiency	η_b	.98
Ram Efficiency	η_r	.85
Regenerator Pressure Loss	C_h	.05
Intercooler Pressure Loss	C_h	.03

It is realized that these efficiencies are both higher and lower than those used by other authors in gas turbine papers. (See Ref. 3, 4, 5, and 10). For example, Ref. 5 uses .80 for both compressor and turbine efficiencies. These values may be representative of present practice, considering the effects of dirt, carbon, deterioration of the vital parts, etc., but it is expected that improvements will be made leading to the realization of the assumed efficiencies given in Table I. The heat exchanger effectiveness and pressure loss are controversial subjects, and an effectiveness of .75 might easily be obtained with a pressure loss of .08 instead of the values given in Table I.

All of the curves and discussion of this paper are based on constant values for the properties of the air and hot gas as shown in Table II. The properties of air are for "Normal Air" described in Reference 1. The conditions of the air at altitude are taken from Reference 2. The properties of the air in the combustion chamber are average values for air at about 900 deg. F. The properties for the hot gas in the turbine are average values at about 1500 deg. F. (See Ref. 6 and 7). Experience has shown that the use of these constant values in gas turbine calculations gives performance which is very nearly the same as that obtained by the rigorous method employing actual properties, enthalpies, etc. This is true for only one set of conditions, but it is reasonably well true for other reasonably similar conditions.

The basic parameter of performance to be used in this paper as the ordinate for most of the curves is Specific Fuel Consumption. The Specific Fuel Consumption is the ratio of the fuel flow in pounds per hour to the output in horse power.

$$w_{fp} = \frac{\text{lb (fuel)}}{\text{hp. hr.}}$$

There is a definite relation between the Thermal Efficiency normally used for analysis of power plants and the Specific Fuel Consumption as follows:

$$\text{Thermal Efficiency} = \frac{3600 \times 550}{w_{fp} \times 778 \times Q_L}$$

Table II—Constant Values for Gas Turbine Calculations

Compression

$C_{pc} = .243$ Btu/lb °F.

$k = 1.3947 = C_p/C_v$

$\frac{k-1}{k} = .283$

$R_c = 53.4$

Combustion

$C_{pb} = .26$ Btu/lb °F.

$Q_L = 18{,}550$ Btu/lb

Turbine

$C_{pu} = .276$ Btu/lb °F.

$k = 1.33 = C_p/C_v$

$\frac{k-1}{k} = .248$

$R_u = 53.6$

Inlet Air

$T_{am} = 518.4$ °F.

$P_{am} = 14.7$ lb/in^2

Very elementary considerations of the simple cycle gas turbine show that a considerable amount of heat energy is being wasted in the exhaust from the turbine. If this heat energy could be used in place of fuel to help to heat the compressor discharge air, an improvement in Specific Fuel Consumption can be obtained. By means of a heat exchanger called a regenerator, some of the waste heat can be so utilized. The performance of regenerators is normally considered in terms of their effectiveness as a heat exchanger. Effectiveness is the ratio of the temperature rise (or drop) of the fluid being heated (or cooled) to the inlet temperature difference between the fluid being heated (or cooled) and the heating (or cooling) fluid.

Figure 4 is a schematic diagram of a regenerative cycle static gas turbine. The regenerative cycle is obtained by adding a regenerator to the simple cycle. This is recognized as one of the most useful gas turbine cycles and will probably have many applications. Figure 5 shows the effect of regenerator effectiveness on the Specific Fuel Consumption of a regenerative cycle gas turbine. The curve with no regeneration is for the simple cycle gas turbine. Figure 5 clearly illustrates that, for any given regenerator effectiveness, there is a certain optimum pressure ratio at which minimum Specific Fuel Consumption is obtained. This figure also shows that considerable gains in Specific Fuel Consumption can be realized by using a regenerator. Furthermore, it shows that the optimum compression ratio for a regenerative cycle is considerably lower than for a simple cycle.

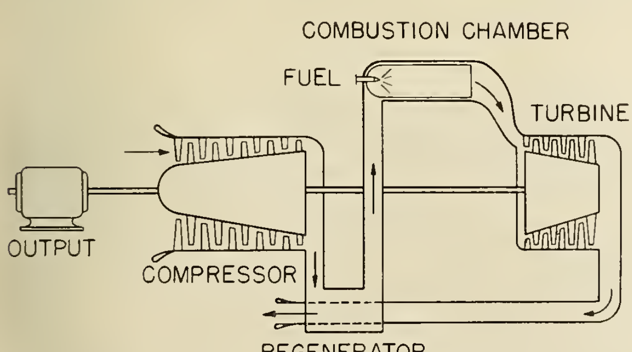

Fig. 4—Schematic diagram of a regenerative cycle gas turbine.

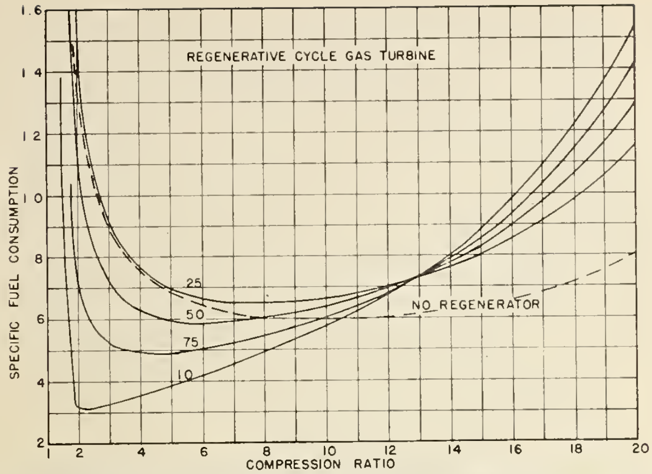

Fig. 5—Effect of regenerator effectiveness and compression ratio on the specific fuel consumption of a regenerative cycle gas turbine. These curves are based on assumed efficiencies. $T_3 = 1400$°F.

By rather elementary considerations of the gas turbine cycle, it is apparent that improved performance can be obtained by intercooling between compressor stages and by reheating between turbine stages. In the limit these additions result in a cycle with isothermal compression, constant pressure combustion, isothermal expansion, and regeneration to conserve waste heat. A cycle with intercooling between compressor stages, with reheating between turbine stages, and with a regenerator is called a complete cycle and is illustrated in Fig. 6. The Specific Fuel Consumption of a complete cycle compared to the Specific Fuel Consumption of a regenerative cycle and of a simple cycle is shown on Fig. 7 for various pressure ratios. Unfortunately, it is not possible to realize the good performance which could be obtained by isothermal compression and isothermal expansion. Furthermore, the pressure drops through intercoolers, combustion chambers, and regenerators detract considerably from the performance which could be obtained if these pressure drops were negligible. Even so, a very definite gain is shown for the complete cycle over the regenerative cycle, by

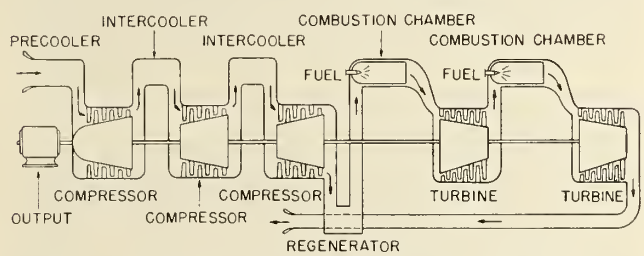

Fig. 6—Schematic diagram of a complete cycle gas turbine.

about as much as the regenerative cycle is better than the simple cycle. Thus, it appears that as the gas turbine becomes more complex, its performance is improved, although this improvement is obtained only at the expense of a greater amount of capital equipment and a considerable increase in the maintenance costs. However, in large power plants, the improvement in Specific Fuel Consumption may be sufficient to warrant the increased capital investment and increased maintenance cost.

When the gas turbine is used for propulsion of aircraft or for other purposes in which the forward velocity is high, two new effects must be considered. These are the effect of the ramming intake and the effect of the jet discharge. When these two effects become appreciable

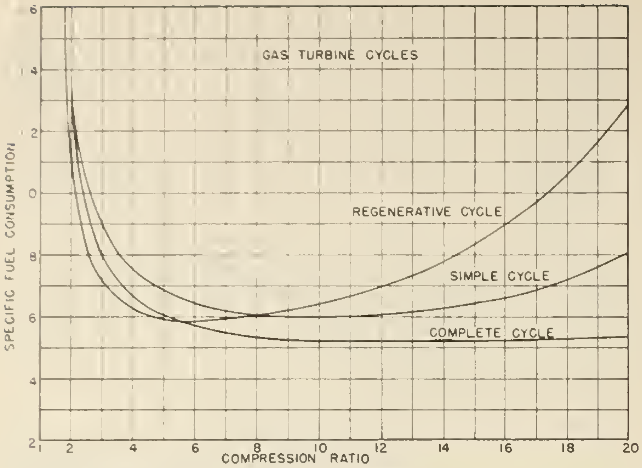

Fig. 7—Effect of compression ratio on the specific fuel consumption of a complete cycle gas turbine. These curves are based on assumed efficiencies. $T_3 = 1400°F$.

and affect performance, the gas turbine is called a dynamic gas turbine to differentiate it from the static gas turbines discussed above in which the ramming intake and the jet discharge are not important factors. For all practical purposes, the dynamic gas turbine can be considered the gas turbine for aircraft propulsion.

The ramming intake increases both the temperature and the pressure at the compressor inlet. The temperature rise is the full temperature rise equivalent to the forward speed of the gas turbine and is given by:

$$\triangle T_r = \frac{V^2}{2gJC_{pc}}$$

The pressure rise is not as efficient as the temperature rise and only a portion of the pressure rise theoretically available can be obtained. In aircraft literature, the ram efficiency is defined as follows:

$$p_1 - p_{am} = \eta_r \, q_c$$

Where the theoretical rise q_c is obtained from:

$$\left[(q_c/p_{am} + 1)^{\frac{k-1}{k}} - 1) \right] \quad T_{am} = \triangle T_r$$

The performance of the dynamic gas turbine is adversely affected by the ram temperature rise; however, the performance is improved by the ram pressure rise. Since the temperature rise is automatic, the only controllable factor is the ram efficiency which has a very important effect on the performance as will be illustrated.

The available energy at the turbine inlet can be used both for turbine power and for jet power, providing the forward speed of the gas turbine is high enough so that some power can be developed by the jet thrust. Therefore, a combined turbine and jet efficiency, η_{uj}, is used for determining the proportion of the available energy at the turbine inlet which is realized in the turbine and in the jet. Thus, the temperature drop through the turbine and jet is:

$$\triangle T_u + \triangle T_j = \eta_{uj} \, \varphi T_3$$

where

$$\varphi = \frac{\left[\left(\dfrac{p_3}{p_{am}} \right)^{\frac{k-1}{k}} - 1 \right]}{\left(\dfrac{p_3}{p_{am}} \right)^{\frac{k-1}{k}}}$$

This definition of combined turbine and jet efficiency results in an apparent turbine efficiency of η_{uj} when no energy is being used in the jet which is somewhat unrealistic. However, when reasonable jet velocities are used, as is necessary in a real gas turbine design, this combined turbine and jet efficiency is a reasonable approximation.

The power developed by the turbine is the same as given above for the static gas turbine.

The jet velocity is obtained from the relation

$$v_j = \sqrt{2gJ \, C_{pu} \, \eta_j \, \triangle T_j}$$

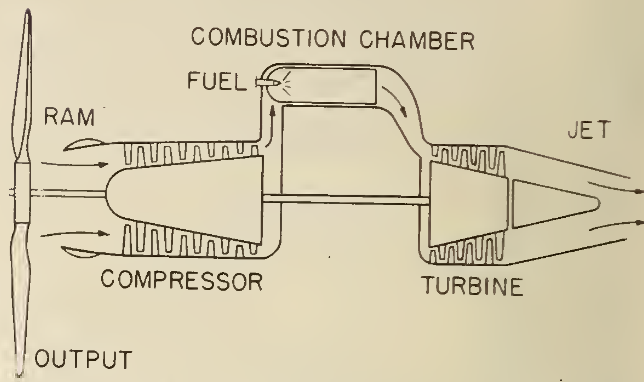

Fig. 8—Schematic diagram of a propeller drive gas turbine.

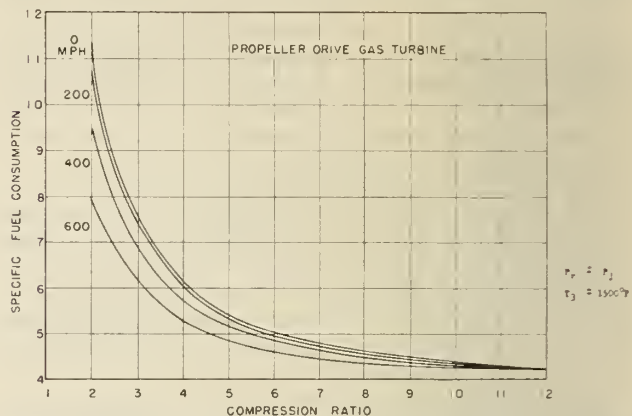

Fig. 9—Effect of forward speed and compression ratio on the specific fuel consumption of a propeller drive gas turbine. These curves are based on assumed efficiencies.

The dynamic gas turbine is moving with sufficient speed so that the power required to take the air on board and accelerate it to the speed of the gas turbine must be considered. Likewise, the power developed by the jet due to its rear-ward velocity from the gas turbine becomes appreciable. This can be considered the elementary theory of jet propulsion and is based on Newton's second law of motion which says that thrust is equal to the time rate of change of momentum. On this theory, the ram power is:

$$P_r = \frac{V^2 \, w_a}{550g}$$

Likewise, the jet power is

$$P_j = \frac{V v_j \, w_g}{550g}$$

Figure 8 is a schematic diagram of a dynamic gas turbine for propeller drive. The air enters the ramming intake and is compressed and heated by ram as described above due to the forward speed of the gas turbine. It then passes through the compressor, the combustion chamber, and the turbine. From the turbine, it is discharged through a jet nozzle to the rear. Output power developed is delivered to a propeller. Obviously, this gas turbine must be charged with the power lost due to ram and must be given credit for the power developed by the jet. Thus, the power output is the shaft power plus the propulsive jet power minus the ram power. In all considerations of the propeller drive gas turbine, the power output is based on the shaft power and does not include a propeller efficiency. In a real application, the useful output is obtained by multiplying the shaft power by the propeller efficiency, adding the jet power, and subtracting the ram power.

The performance of a propeller drive gas turbine is shown in Fig. 9. This shows the effect of forward speed and compression ratio on the Specific Fuel Consumption of a propeller drive gas turbine. This curve was made by assuming that the jet power is equal to the ram power, which, of course, is an assumption. Theoretically, the turbine energy can be divided between the propeller and the jet in any desired proportion. The effect of division of energy between the propeller and the jet on the Specific Fuel Consumption of a propeller drive gas turbine is shown in Fig. 10. This shows that the optimum performance is obtained at a certain energy distribution between the propeller and the jet depending on the forward speed. Further analysis of this has shown that this optimum point of Specific Fuel Consumption occurs where the jet power is equal to the ram power. Thus, the curves of Fig. 9 are for the optimum distribution of energy between the propeller and the jet. Since it is impractical to design a turbine without some leaving loss (or energy in the exhaust) these curves are only of theoretical interest below about 15 per cent energy in the jet.

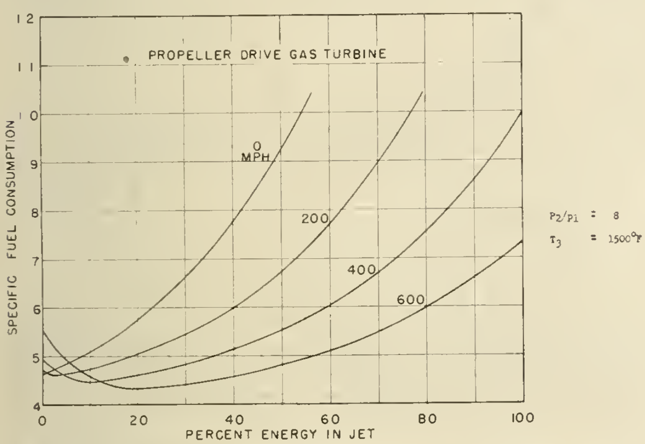

Fig. 10—Effect on the specific fuel consumption of the division of energy between the propeller and the jet of a propeller drive gas turbine. Efficiencies assumed.

Since the propeller drive gas turbine is particularly for aircraft application, it might be expected that altitude will have some effect on performance. The output of a given gas turbine is materially affected by the reduction in density at high altitudes. This, however, is a mechanical consideration and is beyond the scope of this paper. There is also a thermodynamic effect due to the reduction in temperature with increasing altitude. This effect is illustrated in Fig. 11 which shows the effect of altitude on the Specific Fuel Consumption. This entire effect is due to inlet temperature change and it is not due to pressure change. This shows that optimum performance of a propeller drive gas turbine can always be obtained at the highest altitude or at the lowest air temperature obtainable.

In the limit of zero shaft power when all of the energy is used in the jet discharge, the propeller drive gas turbine becomes a pure jet propulsion gas turbine. Figure 12 is a schematic diagram of a jet propulsion gas turbine. In this cycle the air is compressed in a ramming intake. It then passes through a compressor, a combustion chamber, and a turbine. At the exhaust from the turbine it is discharged rearward through a

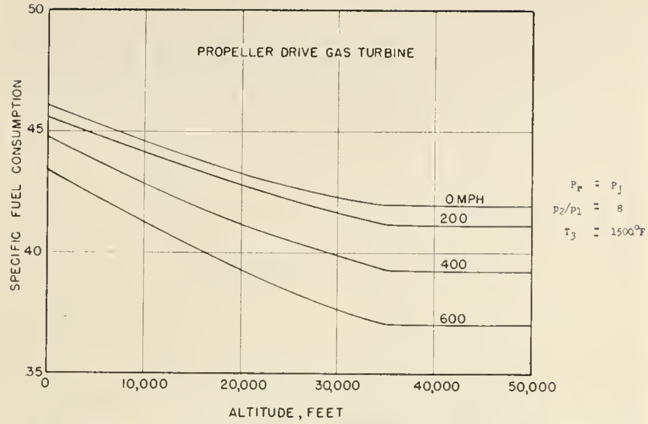

Fig. 11—Effect of altitude on the specific fuel consumption of a propeller drive gas turbine. These curves are based on assumed efficiencies.

jet nozzle. The power of the turbine is just sufficient to drive the compressor. Although this is a special case of the propeller drive gas turbine, it is a very important gas turbine cycle and so will be discussed and illustrated in some detail. Figure 13 shows the effect of compression ratio and forward speed on the Specific Fuel Consumption. Shown on the same figure is the curve for a propeller drive gas turbine at 400 mph for which the Specific Fuel Consumption has been increased by dividing by the propeller efficiency in order to put it on a comparable basis. The propeller efficiency is assumed to be .86, which is a reasonable propeller efficiency at sea level and 400 mph. (according to Reference 11). The Specific Fuel Consumption of the jet propulsion gas turbine is based on propulsive power, whereas the Specific Fuel Consumption of the propeller drive gas turbine must be divided by the propeller efficiency to be based on propulsive power which brings the actual performance of the two gas turbines much closer. At very high speeds, the propeller efficiency falls off with speed increase, and the jet propulsion gas turbine gets better with speed increase. Thus, there is some forward speed above which the Specific Fuel Consumption based on net propulsive power of the jet propulsion gas turbine is better than of the propeller drive gas turbine, or of other forms of power plants having comparable performance which may be used with a propeller.

Figure 14 shows the effect of turbine and compressor efficiency on the Specific Fuel Consumption of a jet propulsion gas turbine. Various curves are shown for various ram efficiencies. This shows very clearly the importance of obtaining the highest possible ram efficiency if good Specific Fuel Consumption is to be obtained. This curve was made up by assuming that the ratio of the compressor efficiency to the turbine and jet efficiency was constant at the standard value of .945. The same curves are approximately true for other ratios of compressor and turbine efficiency. The

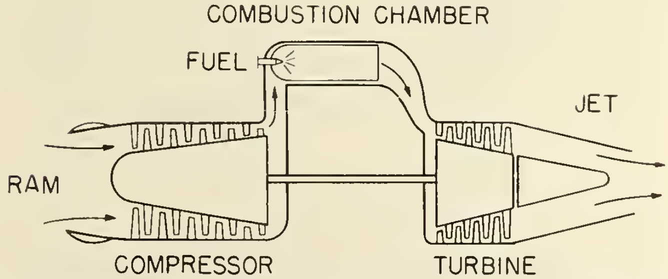

Fig. 12—Schematic diagram of a jet propulsion gas turbine.

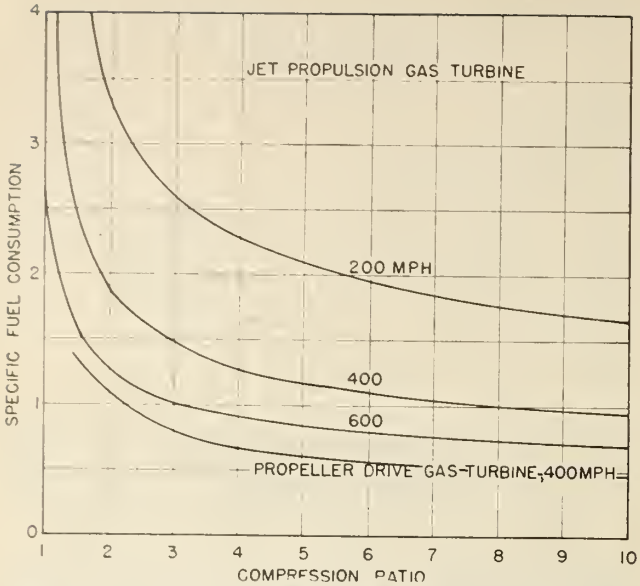

Fig. 13—Effect of compression ratio and forward speed on the specific fuel consumption of a jet propulsion gas turbine. These curves are based on assumed efficiencies. Propeller efficiency = .86 T_3 = 1500°F.

output of a jet propulsion gas turbine falls off with increasing altitude because of reduced density. However, the temperature effect is not as pronounced for the jet propulsion gas turbine as it is for the propeller drive gas turbine as was shown in Fig. 11.

In dealing with jet propulsion, it is obvious that there is no power output when the gas turbine is tested in a test cell, because the gas turbine is not in motion. Therefore, another parameter is used with jet propulsion, and is called Specific Fuel Consumption based on thrust. This is defined as the fuel flow in pounds per hour divided by the net thrust developed by the gas turbine in pounds.

$$w_{fn} = \frac{\text{lb (fuel)}}{\text{lb (net thrust) hr.}}$$

By using this Specific Fuel Consumption based on thrust, it is possible to obtain data in test cells and make extrapolations to actual operating conditions. Figure 15 illustrates the Specific Fuel Consumption based on thrust as a function of compression ratio for various forward speeds. This is the only curve for jet propulsion on which zero miles per hour forward speed is plotted. Thus, tests can be run in a cell with the gas turbine static and the curve for zero miles per hour can be obtained. Extrapolations to actual operating conditions are much easier on this basis for thrust, than are extrapolations of power.

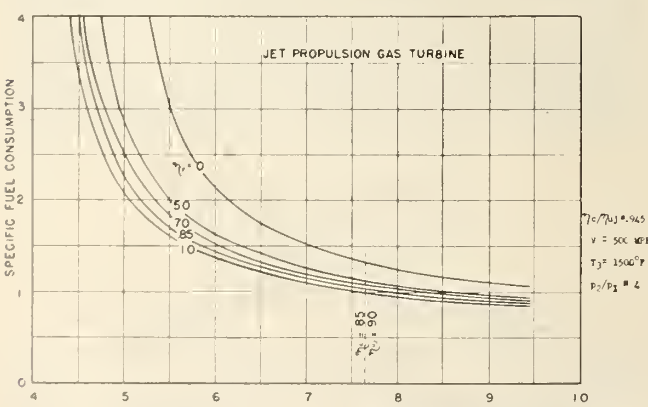

Fig. 14—Effect of compressor, turbine, and ram efficiency on the specific fuel consumption of a jet propulsion gas turbine. Based on assumed efficieneics.

As shown on Fig. 3 the performance of a static gas turbine is improved by using higher turbine inlet temperatures. The same is true also for a propeller drive gas turbine. This, however, is not true for jet propulsion gas turbines because the higher turbine inlet temperatures result in higher jet velocities and lower propulsive efficiencies. Figure 16 illustrates the effect of turbine inlet temperature on the Specific Fuel Consumption of a jet propulsion gas turbine for various forward speeds. This shows that for any given forward speed, there is an optimum turbine inlet temperature for minimum Specific Fuel Consumption. This turbine inlet temperature occurs at relatively low temperatures compared to the practical operating temperatures for gas turbines. For example, at 400 mph the minimum Specific Fuel Consumption occurs at about 1100 deg. F, and at 600 mph the minimum Specific Fuel Consumption occurs at approximately 1200 deg. F. turbine inlet temperature. Fortunately, the curves are fairly flat for

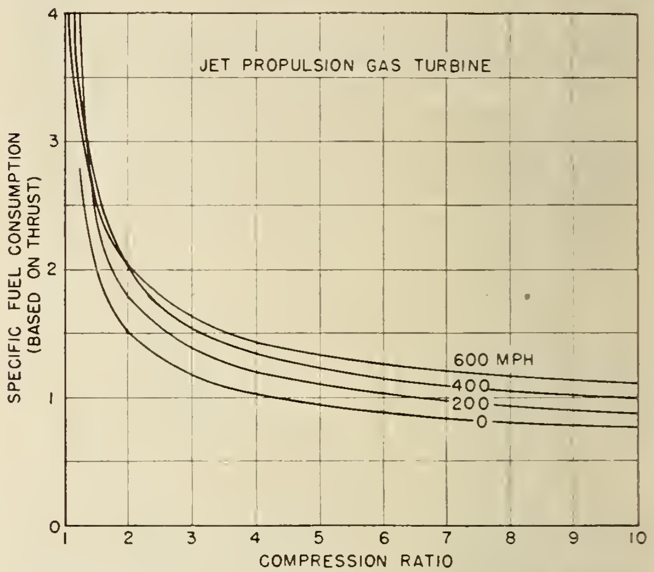

Fig. 15—Effect of compression ratio and forward speed on the specific fuel consumption based on thrust of a jet propulsion gas turbine. These curves are based on assumed efficiencies. T_3 = 1500°F.

higher temperatures, so the choice of turbine inlet temperature is not critical and depends on other factors.

In order to establish a basis for evaluation of the numerical values of Specific Fuel Consumption presented in this paper, the performance of other well known prime movers can be transformed into a comparable Specific Fuel Consumption. The Otto cycle aviation engine has a Specific Fuel Consumption ranging from .43 to .50 lb. (fuel) /hp hr. and averaging about .45. The best that has been realized to date with these engines is about .40 for ideal operating conditions of a new engine. These figures are not comparable to the performance of a jet propulsion gas turbine because they are based on test stand shaft power output. To be comparable, they must be converted to a propulsive power basis which means that the propeller efficiency and the cooling air drag power must be taken into account. This would increase these figures about 15 per cent to an average of about .52 lb. (fuel)/hp (propulsive) hr. The modern central station steam generating plant has a minimum heat rate of about 10,000 Btu (fuel)/KW hr. which corresponds to a Specific Fuel Consumption of .40 lb. (fuel)/hp hr. The combined mercury vapor and steam plant has attained as low as 9158 Btu (fuel)/KW hr. which is a Specific Fuel Consumption of .37 lb. (fuel)/hp hr. (See Reference 8). The modern

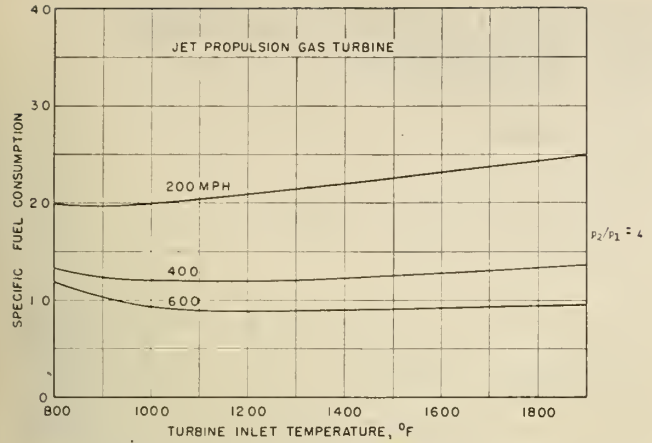

Fig. 16—Effect of turbine inlet temperature and forward speed on the specific fuel consumption of a jet propulsion gas turbine. Based on assumed efficiencies.

Diesel engine obtains as high as 35 per cent thermal efficiency which corresponds to a Specific Fuel Consumption of .39 lb (fuel)/hp hr. (See Reference 9). By comparing these figures with the curves presented in this paper, it is seen that the gas turbine is rapidly approaching the state of development where it will be competitive with these other types of prime movers. However, the gas turbine is shooting at moving targets which always seem to move ahead when the gas turbine seems to be getting close.

As shown in the early part of this paper, the addition of regenerators, intercoolers, etc., to the simple cycle improves the performance of the simple cycle gas turbine. (See Figs. 3, 5, and 7). In like manner, the performance of the propeller drive gas turbine can be improved by these additional components. Also, the jet propulsion gas turbine can be improved somewhat by these additional elements, although not as much as the propeller drive gas turbine. Thus, the dynamic gas turbine for aircraft propulsion offers interesting possibilities for the present and near future. It must be remembered that the performance data presented in this paper are based on assumed efficiencies, hence the performance data are not for any existing or proposed gas turbines.

The author wishes to acknowledge the help given him by his colleagues in the General Electric Company which has made possible the preparation of this paper. Messrs. R. A. Novak, J. E. Foisy, and C. E. Danforth are thanked especially for the preparation of the curves used in this paper.

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APPENDIX A—Nomenclature

Pressure, Total*	p	lb/in²
Temperature, Total*	T	°F.
Atmosphere, Ambient	p_{am}	T_{am}
Compressor inlet	p_1	T_1
Compressor discharge	p_2	T_2
Turbine inlet	p_3	T_3
Turbine discharge	p_4	T_4
Air Flow	w_a	(lb/sec)
Gas Flow	w_g	(lb/sec)
Fuel Flow	w_f	(lb/sec)
Compressor Temperature Rise	$\triangle T_c$	°F
Combustion Chamber Temperature Rise	$\triangle T_b$	°F
Turbine Temperature Drop	$\triangle T_u$	°F
Ram Temperature Rise	$\triangle T_r$	°F
Jet Temperature Drop	$\triangle T_j$	°F
Compressor Efficiency	η_c	
Turbine Efficiency	η_u	
Turbine and Jet Efficiency	η_{uj}	
Jet Efficiency	η_j	
Ram Efficiency	η_r	
Combustion Efficiency	η_b	
Heat Exchange Efficiency (Effectiveness)	η_h	
Combustion Pressure Loss Coefficient	C_b	
Regenerator, Intercooler, Pre-cooler and Pressure Loss Co-efficient	C_h	
Specific Heat at Constant Pressure in Turbine	c_{pu}	Btu/lb °F.
Specific Heat at Constant Pressure in Compressor	c_{pc}	Btu/lb °F.
Specific Heat at Constant Pressure Combustion Chamber	c_{pb}	Btu/lb °F.
Turbine Gas Constant	R_u	
Compressor Gas Constant	R_c	
Specific Fuel Consumption	w_{fp}	$\frac{\text{lb. (fuel)}}{\text{H.P. hr.}}$
Specific Fuel Consumption (thrust)	w_{fn}	$\frac{\text{lb. (fuel)}}{\text{lb. (net thrust)hr.}}$
Heating Value of Fuel, Lower	Q_L	$\frac{\text{Btu}}{\text{lb.}}$
Compressor Power	P_c	HP
Turbine Power	P_u	HP
Jet Power	P_j	HP
Shaft Output Power	P_s	HP
Ram Power	P_r	HP
Joule's Constant	J	778 ft. lb/Btu
Acceleration of Gravity	g	32.2 lb/sec²
Combustion Chamber Pressure Loss	$\triangle p_b$	lb/in²
Regenerator & Heat Exchanger Pressure Loss	$\triangle p_h$	lb/in²
Airplane Forward Speed	V	ft/sec.
Dynamic Pressure Rise	q_c	lb/in²
Jet Velocity	v_j	ft/sec.
Ratio of Specific Heats, c_p/c_v	k	

**Note that all pressures and temperatures throughout this paper are total, except p_4 which is a static pressure.*

THE WINTER TEMPERATURE CYCLE OF THE ST. LAWRENCE WATERS

A Plea for More Data

J. G. G. KERRY, M.E.I.C.

Paper to be presented at the Sixtieth Annual General Meeting of The Engineering Institute of Canada, at Montreal, on February 8th, 1946.

The boundaries of the Dominion of Canada are such that all its area lies within a section of the earth's surface that annually gives off more heat to outside space than it receives from the sun and from other celestial radiation. This fact means that the Canadian climate would steadily grow colder were it not for the counter balance supplied by air movements of very great magnitude from more favoured sections of the earth.

The staff of the Scripps Oceanographic Institute in their book, "The Oceans"⑬, make the following estimate of the daily gains and losses of heat energy at various latitudes, the quantities given being in B.T.U.'s per sq. ft. per day:

Latitude	Heat Gains	Heat Losses	Net Loss or Gain
30	1578	1504	+ 74
40	1419	1446	− 27
50	1233	1371	−138

In view of these geophysical facts it is natural that all questions concerning the formation of ice and snow should be of great interest to every construction engineer practicing in Canada, for he must deal with these obstructions sooner or later. It was fitting that the first paper read to the Canadian Society of Civil Engineers dealt with the formation of frasil ice.

This present paper contains a brief review of certain sections of the available data upon which the practice of what the late Dr. Barnes called "Ice Engineering" is based—the history of the engineer's struggle in Canada against these major obstructions is briefly related, present-day knowledge or rather lack of knowledge of the life history of float ice on the Great Lakes is considered, the winter temperature cycle of the waters of the Great Lakes, both surface and sub-surface, is discussed and the causes that make these waters lose or gain heat energy are analyzed. The writer's conclusions are that data on these major problems are woefully lacking, for no major scientific study appears to have been made at any time covering the formation and dissipation of sheet ice on the Great Lakes, only one scientific study of the depth temperatures of their waters has been published and on only one of the Great Lakes have the temperatures of the surface waters been systematically recorded over a period of years. Finally, no estimates have been made of the heat energy contained in the waters of the Great Lakes at various dates throughout the year nor has any study been made of the possibility of beneficially utilizing this heat energy. It is hoped that the publication of this paper will lead to greater activity on the part of proper authority in the collection and publication of the needed data.

History

Historically, the struggle against the forces of ice and snow has been active for a century past and one gain after another has been achieved by the profession. Along the St. Lawrence waterway, perhaps the first notable step was the construction of the old revetment wall in front of Montreal by the Royal Engineers in the early 1840's when, for the first time, the moving ice sheet met up with a piece of construction that it could not overthrow. The writer has seen ice piled up sixty-odd feet deep on the old low level wharves in Montreal where the spring shove had crashed against the masonry of the now buried revetment wall.

A second step was the construction of the Victoria Bridge in the late 1850's by the engineers of the Grand Trunk Railway. Even to-day it is a pleasure to watch the moving ice sheet shattering itself to pieces against the highly developed cutwaters of the old bridge.

The Montreal Flood Commission (1889) made extensive surveys of the ice conditions around Montreal but the complete success of the simple remedy that the Commission recommended for the protection of the city has caused other remedies that the Commission was considering to be overlooked.

The high level piers and the Guard Pier in Montreal were to some extent the outcome of the Flood Commission's work, as Mr. John Kennedy, M.E.I.C., the chief engineer of the Montreal Harbour Commissioners, was also a member of the Flood Commission. After the completion of the Guard Pier about 1895, vessels could, for the first time, be safely wintered in Montreal harbour.

Mr. Kennedy also introduced in the 1880's the practice of taking daily observations of the water temperatures in the harbour with an especially protected thermometer. Sailing vessels were not unusual visitors to Montreal in those days and Mr. Kennedy depended upon his records of water temperatures when he had to decide when to issue warnings to the vessels in port that it was time for them to take final leave for the season or be frozen in. It was also at Mr. Kennedy's direction and at the expense of the Montreal Harbour Commission that Dr. T. Howard Barnes, M.E.I.C., commenced his long series of experiments on water temperatures and ice formation, definitely confirming to the profession the fact that running water never falls sensibly below 32 deg. F. in temperature during the winter months and that a very slight rise in the temperature of the mass destroys all the adhesive qualities of frasil ice.

Dr. Barnes' report resulted, amongst other consequences, in the patents taken out by Mr. John Murphy, M.E.I.C., Superintendent of the Ottawa Electric Company, who, in the operations of his company's plant at the Chaudière Falls on the Ottawa River, had then to deal with one of the most difficult ice situations in Canada. The successful result of Mr. Murphy's use of heat as a correcting agency is fully described in his paper presented to the Canadian Electrical Association in September, 1907. So far as the writer knows, no other engineer has as yet made use of heat on a similar major scale in the battle against ice.

The first extensive study of ice conditions along the entire St. Lawrence waterway appeared in the report of the U.S. Deep Waterways Commission which was presented in 1897.

No further studies of the ice problem appear to have been made until the growth of the demand for hydro-electric power resulted in the preparation of the Bowden-Wooten Report on the St. Lawrence Deep Waterway which was presented in 1921. This was followed by the Report of the Joint Board of Engineers which was completed in 1926. The Joint Board made extensive studies of the temperature conditions in the St. Lawrence river during the early weeks of winter.

During the last ten years the Dominion Meteorological Service has made an extended series of observations upon the surface temperatures of the Great Lakes, which study is still being carried on.

During all this time apparently but little attention has been given to two main problems affecting the design and use of the waterway, namely—

1. The control of float ice and the possibility of its exclusion from the major navigable channels.
2. The control of the temperatures of the water in the rivers issuing from the Great Lakes.

Sheet Ice

So far as the writer knows, no extended survey of ice formation and ice movement has ever been made on the Great Lakes and the subject is too vast to be undertaken by other than a government department or a privately endowed scientific institute.

Modern science has placed at the disposal of the profession the equipment and machinery with which such a survey could now be easily and not expensively carried out. It should cover with scientific accuracy:

1. The locations and date of the major formations of sheet ice.
2. The causes that make such ice break away from its moorings and the paths, if any, along which it normally drifts.

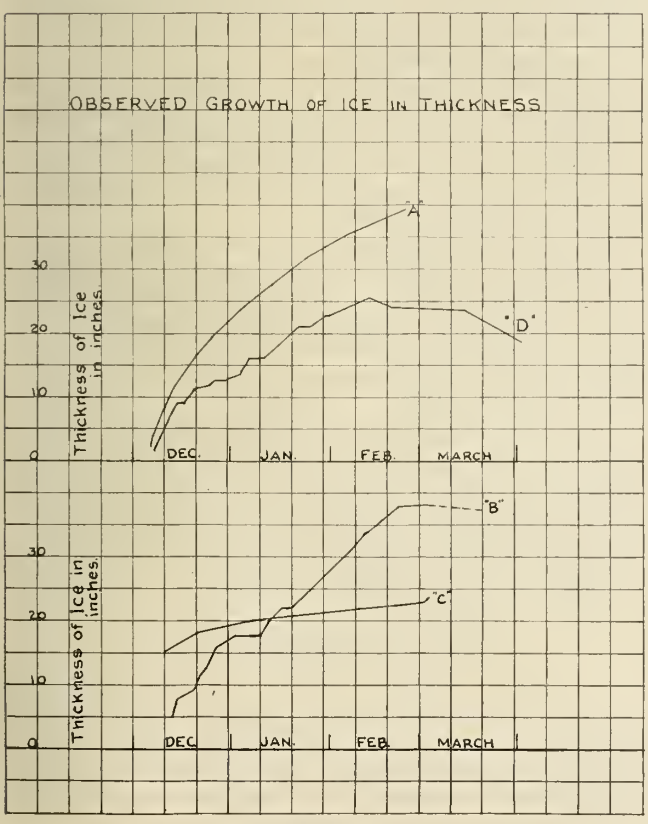

Figure 1.

3. The possibility of designing and constructing detour channels so placed that drift ice will not normally enter into them.
4. The possibility of confining sheet ice to its area of formation and of creating barriers that will close the natural channels through which drift ice frequently passes and from which it finds its way into the regular channels of navigation.

The Montreal Flood Commission gave some thought to the control and permanent anchoring of what is known as "bordage" ice in the province of Quebec—Mr. T. C. Keefer, M.E.I.C., the first engineer of the Montreal Ship Channel and the chairman of the Montreal Flood Commission, was convinced that the control of "bordage" was a reasonable engineering undertaking and he is on record as stating that if the surface of the St. Lawrence River between Montreal and tidewater could be kept as clear of float ice as it actually is between Lake St. Louis and the Lachine Rapids, no difficulty would be experienced in maintaining winter navigation over the section of the waterway between Montreal and tidewater.

The rate at which ice forms along the waterway and the thickness to which it grows are reasonably well known and these facts are illustrated by the curves appearing in Fig. 1. The origins of the curves shown are as follows:

Curve A is a theoretical curve calculated by Dr. Barnes' formula① governing the growth of ice in thickness, and the calculation is based on an assumed air temperature of 14 deg. F.

Curve B is the result of a series of measurements made by the Greater Winnipeg Water District under the direction of the late Mr. W. G. Chace, M.E.I.C., in 1913-14 on Shoal Lake, Manitoba. An area 50 ft. by 100 ft. was kept clear of snow and the ice thickness was measured daily. The average temperature at Shoal Lake during December was 20.1 F., during January 8.2 F. and during February minus 7.2 F.

Curve C is the result of a series of measurements also made by the Greater Winnipeg Water District under the direction of Mr. W. L. Scott in 1942-43 at the same place. The surface of the ice was not swept and measurements were taken weekly. The average temperatures were about minus 7.8 F. for January and plus 6.4 F. for February.

Curve D is the result of measurement taken by Dr. Barnes at Valleyfield, Que., in 1910-1911 and the surface of the ice was not swept. The average winter temperatures in Valleyfield were about 11 deg. F. in January and 12 deg. F. in February, 1911.

The following facts may be noted from Fig. 1:

1. The insulating effect of snow cover as shown by the divergence of Curves B and C and of Curves A and D.
2. The parallelism between Curves A and B although the air temperatures for Curve B during January and February were very much lower than those assumed in the calculations for Curve A. The conclusion may be drawn that the rate of the natural outdoor growth of ice is very appreciably slower than is the same growth under laboratory conditions.
3. The rapidity of the formation of the first few inches of ice. Dr. Barnes' estimate of the time required to form an ice sheet 1 in. thick with an air temperature of 14 deg. F. is very slightly over two hours.

No study as yet appears to have been made for the design of piers and booms to prevent sheet ice from breaking away from its place of formation as contemplated by the Montreal Flood Commission nor has the possibility of using ice as a controller of ice been given attention. There are few engineering structures that can be formed more simply and more quickly than a heavy field of ice; suitable site and air temperatures with an efficient pumping equipment is all that is required for overflooding and very rapid thickening. Yet a heavy snow-covered sheet of ice can serve as an excellent insulator as the curves in Fig. 1 show; it can be made use of as a formidable barrier with which to block and prevent the movement of other ice; and as it is floating it can be moved at will with suitable equipment to any location where it can be of service. Data are not now available concerning the strength of a great ice sheet or of its ability to resist the action of winds and waves. Considered solely as a heat problem it appears likely that ice will not form in quantity on the Great Lakes at any point where the waters have a depth of 200 ft. or over. On the other hand, thicknesses exceeding the thirty-eight inches measured by W. G. Chace at Shoal Lake will rarely be exceeded where the ice is undisturbed, Shoal Lake being both very shallow and very exposed. The formation of surface ice seems to depend mainly upon the depth of the waters and upon the activity of the winds. In general, ice does not form over deep waters but will do so on occasions more or less frequent if by some change in the winds the activity of the internal currents within the waters is checked.

Present-day knowledge of the actual ice conditions far out on the Great Lakes can be described as being decidedly vague and is summarized in the following quotations from a bulletin issued by the American Meteorological Society in 1944: "Do the Great Lakes freeze entirely across ? Aviators flying from Ontonagon, Upper Michigan, to Ile Royale have reported solid ice all the way and on to Canada, but it is believed that there is always some open water in eastern Lake Superior—Lake Michigan often freezes across the north and where there are islands. Railroad car ferry captains report Lake Michigan as frozen over between Milwaukee and Muskegon only once in 25 years of sailing and then for only one day. . . . There appears to be no information that Lake Huron has frozen across except at the south end of the lake. The narrow eastern end of Lake Erie freezes across, probably every winter, and this is true around and to the westward of the islands. . . . Lake Ontario was frozen entirely across during the winter of 1933-1934; this is the first time on record that such a condition has been reported." This is surely vague information after more than one hundred years of active navigation.

One definite fact has been contributed by the year 1945—in the first part of January several new merchant vessels left Duluth and made their way without difficulty to Sault Ste. Marie. These vessels were assisted by ice breakers when leaving Duluth and while passing through the St. Mary River, weather conditions at Sault Ste. Marie were very severe, the thermometer registering about 15 deg. F. below.

The progress in the art of communication made during the late war, especially for aviation service, makes it now possible to keep the Great Lakes carriers warned of nearly all the more serious dangers that beset navigation, such as winds, storms, fog, sleet, and approaching vessels, leaving float ice as perhaps the most serious problem calling for further study. How serious this problem is may be judged from the following extracts from an address given in 1943 to the Royal Meteorological Society of Canada by C. G. Andrus of the United States Weather Bureau:[14]

"The season opens when the ice floes are cleared

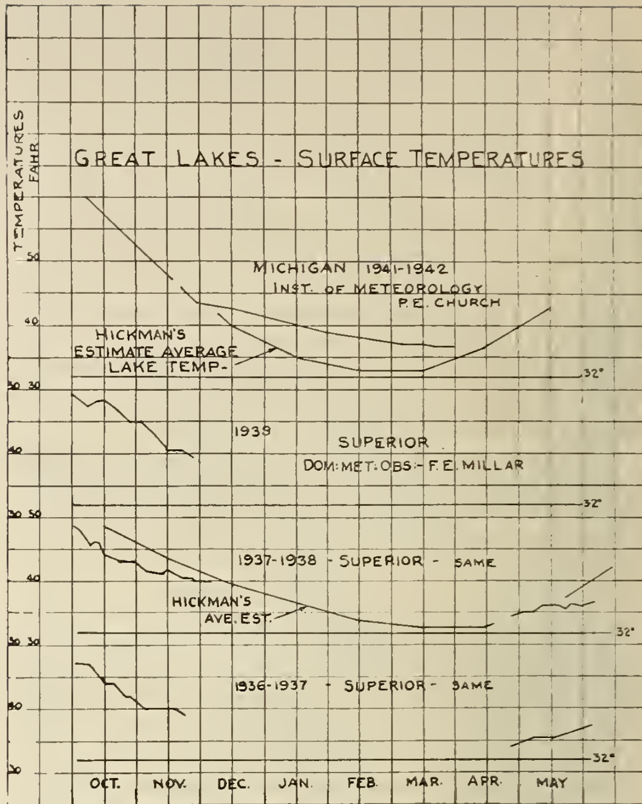

Figure 2.

from the lanes of navigation in the Spring; it closes when iced cargoes and iced harbours combine with the icing of ships to retard movements. In season every ship races continuously up and down the lakes as freely as sea and weather permit. . . . Ice may be classed as derelict material quite beyond human control—floating in great masses, it drifts and packs with the wind and its fields break up and recombine into windrows as wind and current dictate. . . ."

It would now appear to be opportune for proper authority to adopt the policy of the Montreal Flood Commission and to find out by scientific observation just how far this menace can be brought under control. It need not be accepted as an Act of God against which there is no hope of defence.

In those sections of the Great Lakes that are shallow and where the cooling off of the mass will be complete at relatively early dates, surface ice of appreciable thickness will form and those engineering studies may prove most productive of results that are directed to confining the ice to these formation areas or at or near to their place of origin.

In the major gathering areas of float ice such as Whitefish Bay and the southern end of Lake Huron the best promise of relief would appear to be in the construction of detour channels in which the entire discharge of the feeding lake could be confined during the winter months. Until the subject has been scientifically studied no more can be said.

Sub-surface Temperatures

The studies made by Mr. P. E. Church[15] for the Institute of Meteorology (University of Chicago) in the winter of 1941-1942 show that the surface waters of Lake Michigan remained at a temperature above freezing point all through that winter and that the water temperatures at depth coincided almost exactly with

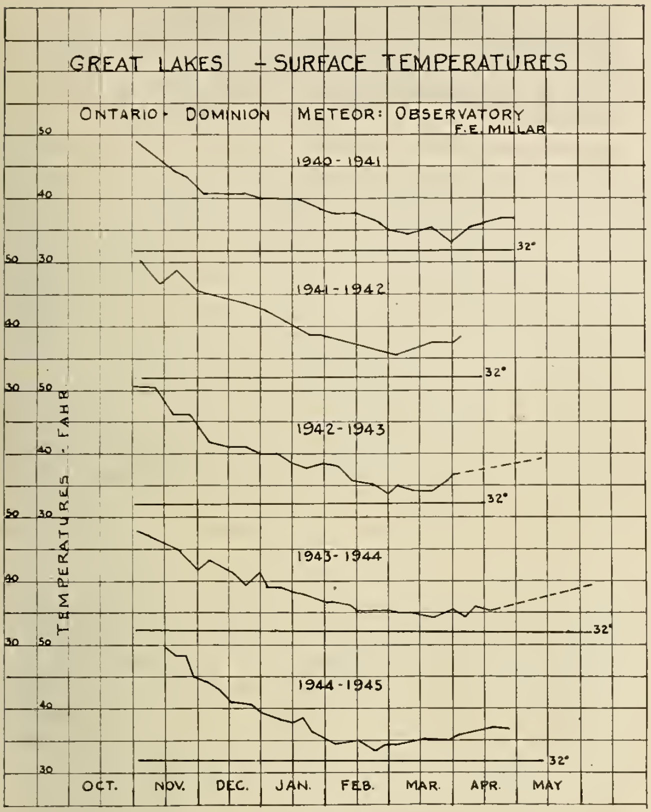

Figure 3.

those on the surface. Figure 2 shows the surface temperatures observed by Mr. Church about the centre of the lake and their change with date. Figure 4 shows a series of depth temperature observations also taken by Mr. Church at about the same place. The measurements were made from the car ferry of the Grand Trunk Western Railway operating between Milwaukee and Muskegon and were taken with recording depth-temperature apparatus that had been developed at the Wood's Hole Oceanographic Institute (Wood's Hole, Cape Cod—Massachusetts Institute of Technology). In Fig. 5 are shown water temperature curves as observed(3) in Lake Mendota, Madison, Wisconsin. Madison lies about 80 miles due west of Milwaukee on Lake Michigan. The temperatures shown are averages and are the result of sixteen years of observation by Dean Birge and Associates. The noteworthy factors are the uniform temperature existing throughout the lake at all depths during the month of November and the temperature gradients that developed just before the freeze-up came. The slow rise in temperature throughout the lake that commenced when the freeze-up took place and that continued all winter should also be noted. In Fig. 4 are shown the results of temperature observations made on Lake Vattern, Sweden,(4) in 1910 in which the practically uniform distribution of temperature is shown to continue well into the spring months. Lake Vattern is situated at Lat. 58 deg.; it is about twice the size of Lake Champlain and of an equal depth. The average annual temperature is about 2 deg. F. lower than that of Madison. Ice forms on this lake.

Mr. Desmond Fitzgerald(5) in certain papers read to the American Society of Civil Engineers in the 1880's and 1890's, was the first to advance the theory that lake waters cool down gradually in the fall until the whole body of the waters has a temperature of 39.4 deg. F., and he argued that when in that condition the waters are very likely to be agitated throughout their depth by winds, there being no differences in weight among the water particles to check movement within the mass. On further cooling, the waters show temperatures steadily if slowly increasing from top to bottom. On Lake Michigan, Mr. Church's observations(2) show almost uniform temperatures as early as December 7th, when the water temperatures were about 43 deg. F., and this condition of almost uniform temperature continues down to Mr. Church's latest observations taken on March 30th when the water temperatures were about 36 deg. F.

The fact that the waters of the Great Lakes do not show any tendency to cool off first at the surface during the winter months is thought to be due to the constant activity of the winds in creating and maintaining internal currents. Wind is the normal air condition over the Great Lakes in winter and calms are definitely a rarity. Meteorogical opinion considers that intensity of any storm is in general considerably more severe when it is sweeping over a lake surface than as it is measured on the adjoining lands.

This condition of open water in spite of low air temperatures does not completely hold on Lake Champlain where on the "broad lake" the dates of the annual freeze-out run as follows:

Freeze-up dates on the "broad" section ot Lake Champlain:

1925	January 20th	1930	January 30th
6	February 9th	1	February 11th
7	March 4th	2	Not closed
8	March 11th	3	Not closed
9	February 6th	4	January 20th
		5	January 20th

the dates being from a bulletin issued by the U.S. Weather Bureau in 1935 and containing a continuous record from the year 1816.

The "broad" lake has depths as great as 400 ft. but the lake is relatively narrow and is protected from wind both on the east and on the west by mountain ranges.

One fact stands out clearly on the entire record of sub-surface temperatures, namely, that no observations have shown in winter sub-surface water temperatures that are lower than the corresponding surface temperatures. In other words, surface lake temperatures are a sure indication of the minimum temperatures that will be found in the river outflowing from the lake, provided that the supply of the river is drawn from a

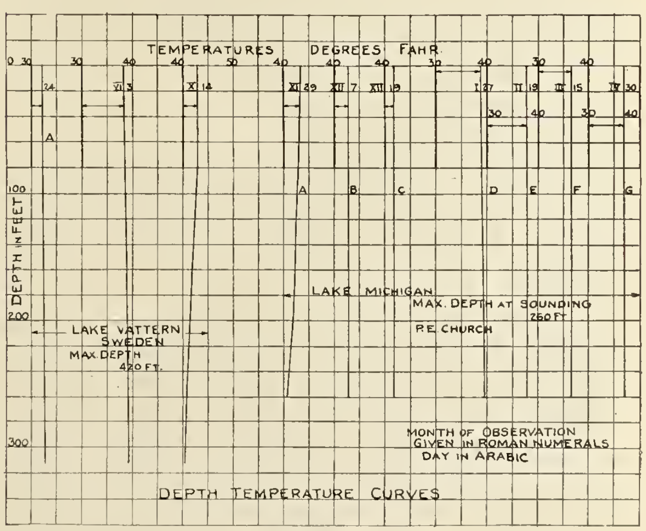

Figure 4.

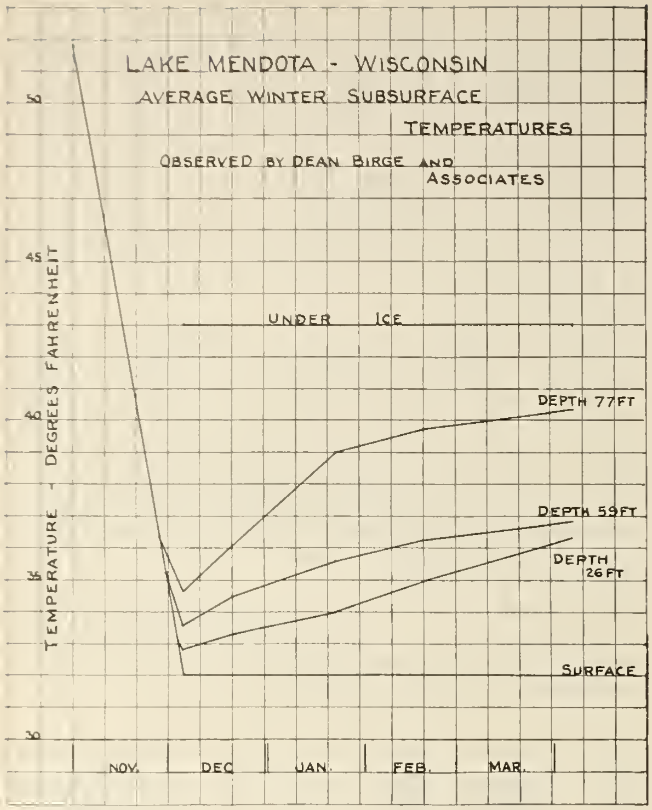

Figure 5.

deep section of the lake. Shallow shore waters always cool off quickly and early.

Surface Temperatures

For ten years past the staff of the Dominion Meteorological Survey under the immediate direction of Mr. F. S. Millar has been recording the surface temperature of the Great Lakes, placing time-temperature recording instruments on various vessels making commercial runs and particularly on the car ferry operated by the Canadian National Railways between Cobourg and Charlotte. A partial summary of results is given on Figs. 2 and 3, which show lake surface temperatures:

(a) Five winters' lake temperatures on the run across Lake Ontario from Cobourg to Charlotte.

(b) Three sets of observations of lake temperatures on Lake Superior in the late fall on the run between Port Arthur and Whitefish Point and two sets in the early spring.

(c) One winter's temperatures on the run across Lake Michigan from Milwaukee to Muskegon as observed by Mr. Church.

It is not certain that the temperature equalization discovered by Mr. Church extends to the bottom of very deep lakes such as Ontario and Superior. On Fig. 6 are shown a series of deep lake water observations⑤ recorded by Mr. Fitzgerald, particulars of which are as follows:

Curve A shows a series of observations made on Lake Superior for the U.S. Lake Survey in August, 1871. The readings were taken at various places and on various dates. Curves B, C and D show a sequence of observations made in 1848-49 by Messrs. Fischer, Ooster and Brunner in Lake Thun, Switzerland. Lake Thun very rarely freezes over but it will be noted in Curve D that temperature equalization has descended to a depth of 500 ft. The month and day of the observations are shown by Roman and Arabic numerals, respectively. Curves E and F show observations made by F. A. Forel in 1879 on the Lake of Geneva which never freezes over. Curve F shows that the temperatures have equalized to a depth of 900 ft.

The Swiss Lakes are much smaller and much better protected from wind by the surrounding mountains than are the Great Lakes of North America. For purposes of comparison, average surface temperature curves for Lake Superior and for Lake Michigan-Huron are also shown on Fig. 6. The data for these average curves are taken from a paper prepared by Lieut. Hickman⑥ of U.S. Lake Survey and presented to the American Society of Civil Engineers in 1939.

From the preceding discussion there emerges the engineering problem of regimenting the outlets of the various Great Lakes so that the outflowing rivers will draw their supply from deep and "warm" waters in the parent lake.

Rate of Cooling-off

The rate at which open water under Canadian winter conditions will give up its heat is difficult to determine, because the geophysical forces which are in action are very sensitive to atmospheric conditions and their effects quantitatively change rapidly and materially with variations in wind, cloud and haze. This makes observational records of little value unless they are continuously maintained. The geophysisist's approach to this problem is discussed briefly later on in this paper.

Such records as are available of direct observation of the rate of cooling-off are in fair agreement if it is assumed that the difference in temperature between the air and the water surface is a measure of the rate of loss. This assumption is not tenable for any long period of time, for there are great geophysical forces at work which are practically independent of changes in the temperature of the air.

The scientifically accurate measurements of Dean Birge and Associates in Lake Mendota③ show that that lake during the month of November has a uniform temperature at all depths and is cooling-off rapidly. The average depth of Lake Mendota is 40 ft. and the average fall of the water temperature during November was from 52.5 to 39 deg. F. The average air temperature is 36 deg. F. The average heat loss per sq. ft. of surface per day was therefore about 1125 B.T.U. or roughly 115 B.T.U. per sq. ft. per day per degree of

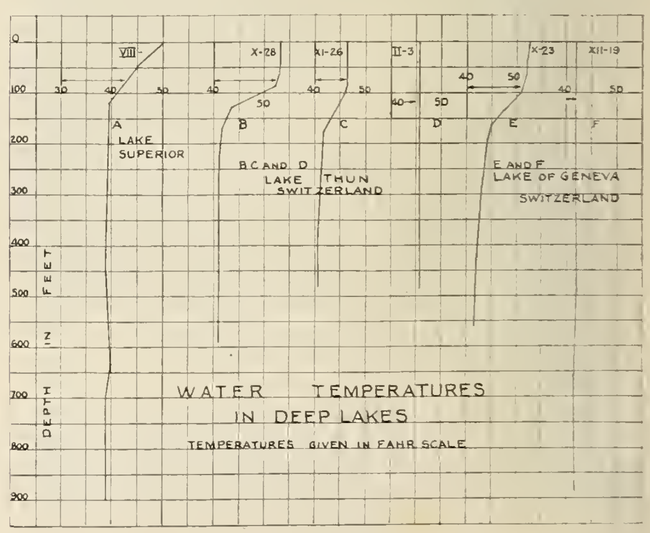

Figure 6.

temperature difference between air and water.

Calculations using the geophysical formulae discussed further on in this paper indicate an average heat loss of about 1175 B.T.U. per sq. ft. per day as likely under average weather conditions at Lake Mendota in November.

The Joint Board of Engineers in their 1926 Report to the International Waterways Commission lists twelve series of measurements made in the early part of December on the St. Lawrence River below Kingston, each experiment extending over ten or eleven days. The results range from a constant of loss per sq. ft. of surface per degree difference of temperature of 83.0 to one of 121.7 and the Joint Board recommends the use of a constant of 95 B.T.U. A plotting of the published results suggests that possibly the governing equation is not a straight line but should flatten off as the amount of the temperature difference increases.

Strictly speaking, the above constant should be applied only to conditions as they are found in the early part of December in any year on the St. Lawrence River.

It may be noted in passing that the curves of average air temperature during the winter months as taken at Madison, Wis., and at Kingston, Ont., are in close agreement, and that the two sets of observations of heat loss are in reasonable agreement with each other and with geophysical theory.

The measurements taken by Mr. P. Church(2) gave the results shown in Table I, calculations being based on an average depth of 300 ft. for Lake Michigan, and the waters in both shore areas being excluded from the calculation. The air temperatures are not definitely known and those used in the calculations are based on the records of nearby land stations as given by Mr. Church slightly modified by reference to the long-time records of Madison, Wis.

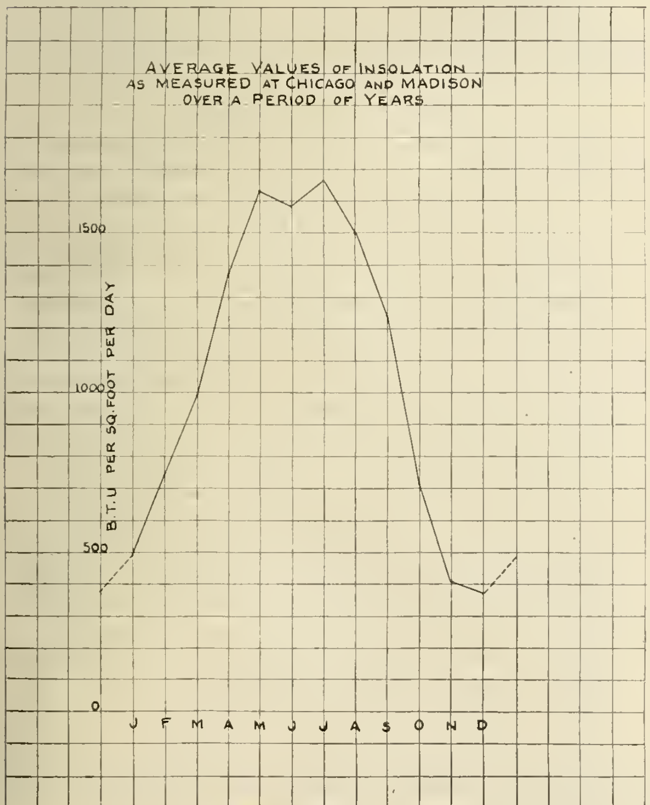

Figure 7.

TABLE I

Heat losses from the surface of Lake Michigan in the winter of 1941-1942 calculated from observations taken by P. E. Church:

Dates	Temp. Drop (°C)	Daily Av. Drop (°C)	Daily Av. Drop (°F)	Loss of Heat on B.T.U. Per Sq. Ft. Per Day
Dec. 15 to Mar. 21	3.18	0.035	0.063	1181
Dec. 7 to Dec. 19	0.55	0.046	0.083	1556
Dec. 19 to Jan. 27	1.94	0.05	0.09	1698
Jan. 27 to Mar. 4	0.94	0.026	0.047	881
Mar. 4 to Mar. 21	0.23	0.013	0.023	431
Mar. 15 to Mar. 21	0.05	0.009	0.016	300

It will be noted that the loss constant falls off sharply as the winter progresses and this is in good agreement with geophysical theory. It is clear that, if the waters of a Great Lake such as Ontario remain consistently at a temperature well above freezing point, the maintenance of an open outflowing river is simply a matter of heat conservation. As Mr. John Kennedy knew sixty years ago, and as Dr. Barnes has pointed out again and again, water will not form ice until it is cooled down to freezing point. To keep the water in a river warm, its channels must be as narrow and as deep as can be secured. The St. Lawrence River would flow comfortably in a channel about 1500 ft. wide and 64 ft. deep with a regulated velocity of about two miles per hour.

What this means may be illustrated by reference to the report of the Joint Board of Engineers from which the figures in columns 1, 2 and 3 of Table II are taken.

TABLE II

Comparison of actual heat records in the St. Lawrence River with obtainable values in a regimented river:

Location of Lower Station	Av. Water Temp. at Kingston	Av. Water Temp. at Lower Stn.	Temp. Diff. between Air and Water	Dist. in Miles to Kingston	Calculated Temp. in a Regimented River (Lake at 44°)
Kingston	40.5		12.0 (av.)	25 (up to lake)	43.8
Brockville	40.5	37.2	16.4	40	43.4
North Channel	41.6	38.7	8.9	64	43.6
Cardinal	38.9	33.8	11.4	67	43.45
Massena Point	39.0	33.6	11.0	103	43.25

In the calculations a loss rate of 100 B.T.U. per degree temperature difference per day was adopted and a stream velocity of two miles per hour. The drop in temperature between the deep lake and Kingston is not surprising for the river flows over vast areas of relatively shallow lake water. It is, however, something of a natural tragedy that of 12 deg. of sensible heat available in the deep lake against freezing, practically one-third of this amount should be lost by the time the waters reach Kingston, the distance to which is less than one-tenth of the distance from the deep lake to tidewater.

It is possible that the assumed figure of 44 deg. F. for the lake temperature is a little too high for the years 1924 and 1925 when the observations by the Joint Board of Engineers were made. The assumption, however, agrees with Mr. Millar's observations in later years.

In 1925 Dr. Barnes has recorded that the water temperature at the Victoria Bridge, Montreal, was 32 deg. F. on December 10th; making the same assumptions as above it would appear that the temperature loss between Lake Ontario and the Victoria Bridge should not exceed 1.5 deg. F. in the first week in December, provided that the waters were brought down in a regimented river flowing at a speed of about two miles per hour. The waters could be made to reach Montreal harbour with a temperature well above 40 deg. F. in early December.

It should be noted that the temperature of Lake Ontario grows steadily lower as the winter proceeds and that it reaches its minimum in March. Fortunately, as Mr. Church's observations show, and as theory confirms, the rate of heat loss per sq. ft. of surface also grows less and less as the winter proceeds and as the sun gains in altitude until at some date in March the waters cease to lose heat and commence to grow warmer. The simultaneous falling off of heat supply in the lake and of heat demand from the flowing river is a most important fact for March lake water, if fed into the river in January, would not be warm enough to provide against the heat losses of the river in January. The writer having examined with some care the charts and topographical maps covering the area under discussion, has not detected any abnormal construction problems that would have to be dealt with in regimenting the St. Lawrence River to the measure required nor any for which precedent cannot be instanced.

Geophysical Laws

The study of the laws that control the heat cycles in the Great Lakes lies within the field of geophysics and has received a fair amount of attention, particularly by the staff of the Scripps Oceanographic Institute in California, which some fifteen-odd years ago took up the problem of determining the rate of water evaporation from the surfaces of the many storage reservoirs scattered about in the State of California. Water evaporation in California and ice formation on the Great Lakes seem at first sight to have little relation to one another, but the forces that are active are the same in both cases and so are the controlling laws. The California study is well summarized by Prof. Burt Richardson in a paper presented to the American Society of Civil Engineers in 1930.[7]

Briefly and disregarding minor causes, Professor Richardson limits the forces that act to raise the temperature of a sheet of open water to solar radiation and considers that only night radiation, evaporation and convection need be taken into account amongst the forces that act to reduce water temperatures.

The heat contribution of solar radiation, technically called insolation, at any point on the earth's surface can be calculated from the known constant of radiation for the sun, taking into account the sun's altitude at the time of observation and the losses of radiant heat that occur during the passage of the rays through the atmosphere. These losses are large and they are found, like nearly all geophysical factors, to vary largely and quickly with changes in the atmospheric conditions. Generally these losses aggregate to more than fifty per cent of the heat that would otherwise reach the earth's surface, so that in general it is more satisfactory to depend upon past records of the measurement of this factor rather than on scientific calculation. The United States Weather Bureau has several stations that regularly record the heat received on a flat surface from the sun and the Dominion Meteorological Service maintains one such station in Toronto. Figure 7 shows the annual variations of insolation, the unit being B.T.U. per sq. ft. per day and the quantities are the means of observations made at Madison, Wis., and at Chicago, Ill. Insolation measurements are regularly reported in the *Monthly Weather Review* published by the U.S. Weather Bureau. The curve as shown on Fig. 7 is from the averages of two stations over many years and would be very much more irregular if only one year's observation at a single station had been used.

Measurements taken by Dean Birge and Associates at Madison show that practically all the radiant heat

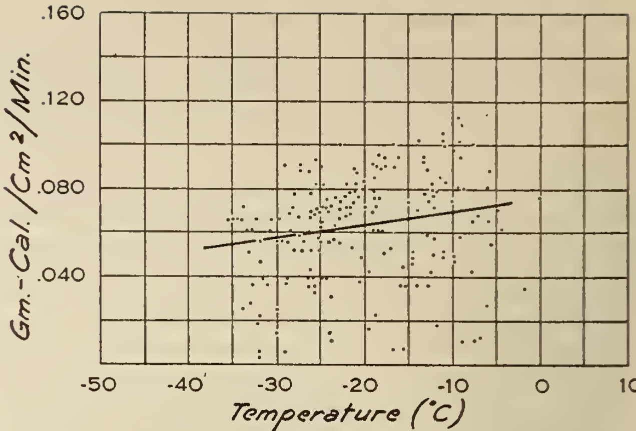

Fig. 8—Observed Values of Outgoing Radiation during Clear Weather at Fargo, N. Dakota, 1936-1938.

from the sun is absorbed in the upper ten feet of any pond. Subsequent distribution of such heat is principally the work of internal currents and is most active when the waters approach uniformity in density and temperature as they do in smaller ponds twice every year.

Back or night radiation is the radiation of heat from the surface of the earth into space. Because night radiation is a relatively long wave radiation it is very subject to atmospheric conditions, as will be seen from Fig. 8, which shows the results of a series of measurements of night radiation made at Fargo, North Dakota[8] for the U. S. Weather Bureau in 1937 and 1938. By use of the theory of least squares, a governing equation of

$$Q = 0.076 + 0.0006\, t$$

was obtained, where t is the air temperature in centigrade units and Q is in gram-calories per sq. centimeter per minute.

In theory the loss of heat by radiation varies as the fourth power of the absolute temperature of the radiating surface and Professor Richardson gives a formula for the calculation of this factor:

$$Q = c\, a\, T_w^4 - b\, a\, T_a^4$$

in which c and b are constants obtained from observations in California, T_w and T_a are the absolute temperatures of water and air, and a is the constant of black body radiation. Professor Richardson's formula has been used in the few calculations included in this paper. The equation is in centigrade units. The Dakota observations were not made from an open water surface.

In general the Dakota observations indicate that night radiation in the winter months is dominated by atmospheric conditions and is only slightly affected by temperature. Its value during the winter months seems to lie between 400 and 500 B.T.U. per sq. ft. per day and it may be considered to be approximately equal in amount to solar radiation during the months of November, December and January. In other words, the loss of heat from an open water surface during those critical months comes almost entirely from the factor of evaporation and from the closely connected factor of convection.

Probably the best known formula for the calculation of evaporation is the Meyer formula[9]:

$$E = 30\,(V - v)\,(0.5 + 0.05w)$$

in which E is the evaporation in inches per month, V and v are the vapour pressures at the surface of the water and in the air passing over it and w is the wind in miles per hour.

Mr. F. E. Millar of the Dominion Meteorological Observatory has more recently advanced the following formula for the determination of evaporation losses, viz:

$$E = \frac{1}{K_o^2} \quad \frac{(e_w - e_a)\ u}{\log_e \frac{Z}{Z_o} \log_e \frac{Z}{Z'_o}}$$

in which

K_o = von Karman's constant = 0.38

E = No. of grams of water evaporated per sec. per sq. centimeter

e_a = No. of grams of water in the air per cubic centimeter at a height Z

e_w = No. of grams of water in saturated air of the same temperature as the open water

u = Speed of the wind in centimeters per sec. at the height Z

If the wind speed and specific humidity, i.e., u and e in the above formula, are observed at various heights and plotted against the logarithms of the heights of observation, it is an experimental fact that the plotted observations will lie on almost straight lines intersecting the axis at heights of Z_o and Z_1^o, respectively.

Practically these formulae have been but little used, reliance being placed on direct observations of evaporation made from special test pans. However, it should be noted that both formulae are governed by the factor $(e_w - e_a)$ denoting the difference of vapour pressure between air and water. In Fig. 9 a curve is drawn showing the relation between vapour pressure and temperature, the data being taken from the Meteorological Tables published by the Smithsonian Institute. It will be noted that vapour pressure does not vary directly with temperature and that therefore evaporation losses and the heat losses from open water that accompany them do not vary directly with temperature changes. Actually a drop of air temperature from 30 to 20 deg. F. will affect evaporation losses about five times as much as a corresponding drop from 0 deg. F. to 10 deg. below.

The actual losses due to evaporation from the surfaces of the Great Lakes are still a matter of controversy and the following figures are taken from two well-known estimates prepared respectively by Dr. J. R. Freeman⑩ and by Lieut. H. C. Hickman of the U.S. Lakes Survey⑥, the figures given being the evaporation losses in inches per month for Lake Huron.

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Freeman.......	3.4	3.2	3.0	2.5	1.8	1.0
Hickman.......	5.6	4.9	4.3	3.4	2.7	2.3

Considering the high standard of the two estimates the need of further series of observations is obvious, for evaporation will be the controlling factor in the net winter heat losses from the surface of the St. Lawrence waterway. In the rough calculations that follow, Lieut. Hickman's estimates have been adopted as being based on the most recent series of observational data. The conversion constant from water to water vapour is 970 B.T.U. per lb. of water evaporated.

The effect of wind upon the rate of evaporation still remains to some extent a matter of scientific dispute. Mr. Millar's experiments⑪ made on a wind tunnel at the Dominion Meteorological Observatory show a direct variation in the rate of evaporation with variations in the difference of vapour pressure and also a direct variation with increase in wind velocity subject, however, to a correcting factor which itself varies with changes in the wind velocity. Lieut. Hickman's curves⑥ show an increase of about 25 per cent in the rate of evaporation at the usual air and water temperatures existing around Kingston during the months of December and January when the wind velocities are increased from five to ten miles per hour.

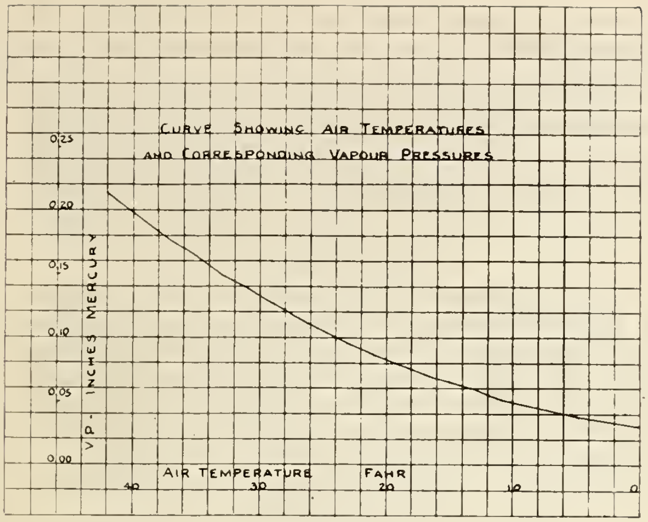

Figure 9.

Comparing the open river with the open lake it may be found by observation that evaporation from the open river will be greater in the winter months because the differences between the effective air and water temperatures will be found to be greater on the river than on the lake and also that the evaporation will be less from the open river because of a decreased effective wind velocity. Only a systematic meteorological survey can supply the necessary data to determine these points.

TABLE III

Calculated Rate (mean) of Heat Loss in B.T.U. per sq. ft. per day as determined from the data listed above:

	December	January	February	March
Night radiation...	619	568	464	247
Evaporation......	648	585	507	355
Convection.......	485	535	392	66
Sub-total......	1752	1688	1363	668
Solar radiation....	376	486	730	990
Net loss.......	1376	1202	633	—

Convection or the carrying away of heat by the air passing over an open water surface takes place at the same time as evaporation and it has been shown mathematically by Dr. Bowen that the heat loss due to convection is directly proportional to the heat loss due to evaporation (at least under California conditions), the connecting formula, known as Bowen's Ratio, being

$$R = 0.46 \times \frac{P}{760} \times \frac{(T_w - T_a)}{(E_w - E_a)}$$

The formula is in metric units, P being the height of the barometer, T_w and T_a the temperatures of water and air and E_w and E_a the water content of the air in contact with the water and of the air passing above it in grams per cu. cm. It is not known whether Bowen's ratio will hold accurately under the weather conditions existing in the Great Lakes basin and in the St. Lawrence valley but it has been used in preparing certain figures that appear later in this paper.

For the purpose of roughly checking by theory the figures in Table I obtained by calculation from Mr. Church's recorded observations, the writer has used the long-time average air temperatures of Wisconsin as published by the Wisconsin Academy of Sciences, Arts and Letters, Mr. Church's observations of water temperatures and Lieut. Hickman's estimates of water evaporation from Lakes Huron and Michigan. The figures (Table III) are intended to be used only as an illustration.

If these figures are compared with those shown in Table I, they will be seen to indicate a close agreement if it be recollected that all the factors entering into the calculation are tremendously variable not only from one year to the next but in some cases from one minute to the next, all depending upon atmospheric conditions.

Conclusions

It is obvious that the profession has need of masses of observational data to be taken in the Great Lakes basin and in the St. Lawrence valley in order to determine dependable average values for insolation, night radiation, evaporation and convection. So large a statistical task lies properly in the field of the great governmental bureaux of the United States and Canada.

Tentatively at least the following conclusions may be drawn from the foregoing discussion:

1. The Great Lakes are great natural accumulators of heat energy.
2. The temperature of the mass of their waters is never as low as freezing point.
3. The temperature of the deeper waters is never lower than that of the surface waters concerning which a considerable mass of statistical data has already been secured.
4. The rate of cooling off of the waters under St. Lawrence Valley conditions has been in some measure determined.

There remains for the profession the two main problems of:

1. Designing outlets to the lakes so that only the "warm" waters of the lakes will be drawn into the outflowing rivers.
2. To regiment the channels of the outflowing rivers so that the loss of heat from their surfaces will be reduced to a minimum.

To the writer the following local problems appear to be worthy of professional study and consideration if the heat energy contained in the waters of the Great Lakes is to be put to beneficial use, viz.:

The location of the principal ice-forming areas in the Great Lakes.

The devising of ways and means to confine sheet ice to its place of formation and to limit as far as possible the movement of float ice when drifting under the influence of current and wind.

The designing of detour channels around the principal gathering areas of drift ice such as Whitefish Bay and the south end of Lake Huron.

The design of outlet rivers that will flow free of ice throughout the winter:

1. From Lake Superior to Lake Huron—Such a river might be either with or without locks.
2. From Lake Michigan to Lake Huron. The winter closing of the Straits of Mackinac and the opening of a suitable channel via Little Traverse Bay and Cheyboyagan is a possibility.
3. From Lake Huron at some point north of Sarnia to a point on the Welland Canal below the guard lock. Lake Erie from the standpoint of winter navigation calls for thorough study. The lake is relatively very shallow and therefore liable to freeze over early, but, in general, climatic conditions in its immediate area are much milder than they are around the larger lakes. It is not a case for offhand conclusions. An isolated channel along the north shore of the lake and carrying most of the flow of the St. Clair River offers one solution to this problem. Such a channel could empty into the Welland Canal below the guard lock and possibly the level of main reach of the Welland Canal could be lowered.
4. From Lake Ontario to a point near Longueuil including the possible extension of the Lake St. Louis level to Longueuil and the construction of a power development of the first order at or near Longueuil.
5. From Montreal to tidewater following the plans suggested long ago by Mr. T. C. Keefer.
6. The extension of the Lake Champlain level from a point on the St. Lawrence River near Laprairie to a point on the Hudson River near Albany. The two main problems in this area are the providing of a sufficient water flow to keep the connecting channels free from ice during the winter months and the control of the surface ice on Lake Champlain.

It may be noted that river channels designed on a principle of heat conservancy will probably always be deeper than would be required to float the largest of present-day vessels.

Considering the ultimate possibilities for improvement of the St. Lawrence and Great Lakes waterway and comparing them with present-day plans, the writer is reminded of the comment made by Mr. T. C. Keefer some seventy-odd years ago: "Canada always builds her canals to designs that are obsolete before construction has commenced."

Acknowledgments

The author would like to place on record his appreciation of the assistance he has received in the preparation of this paper from many correspondents. Thanks are due particularly to the late Mr. George T. Seabury and his colleagues of the Hydraulics Division of the American Society of Civil Engineers for bibliographical data; to Dr. C. G. Abbot, Secretary of the Smithsonian Institute, for references to the work of Dean Birge and his associates; to the officials of the U.S. Weather Bureau for advice concerning the work of Mr. Church; and to Mr. John Patterson, O.B.E., Director of the Dominion Meteorological Observatory for making available the assistance of Mr. Millar and the records compiled under the direction of that gentleman.

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From Month to Month

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

IT CAN'T HAPPEN HERE—OR CAN IT?

It will be encouraging to professional employees of governments everywhere to know that in Great Britain an appreciation of professional services has been proclaimed recently. The *Journal* regrets that the following observations are not based on a Canadian plan, but hopes that the good example of the Old Country will be of some inspiration to Canadian officials.

In September 1945, the Chancellor of the Exchequer presented to Parliament a report wherein he explained that the Government had decided to adopt the recommendations of a special committee which had been appointed to study the "Reorganisation and Recruitment" of the Scientific Civil Service.

The quickest way to describe the proposals is to quote from the report of the Chancellor and from the committee under the chairmanship of Sir Alan Barlow. This committee, by the way, was made up of scientists and laymen, civil servants and industrial leaders, five in all.

Clause 5 of the committee's report puts a finger on the vital spot—in a single short paragraph sums up the whole situation. It reads:—

> "All the evidence before us points to one main conclusion, that the Government failed in peacetime to attract into and retain in its service a proper proportion of the best scientists produced by the Universities. Although Government Departments, like similar departments in industry, do not require more than a certain percentage of first-class men among their scientists, the present situation, in which in general the Universities and industry obtain as compared with the Government an unduly high proportion of the best scientific talent available, is one which must be remedied. The fault seems to us to lie partly in the standards of remuneration and the prospects of promotion offered, but at least as much in general conditions of service and the relations between Government Research organizations and the scientific world outside."

From clause 9 we quote a single significant sentence:—

> "One point, on which those whom we have consulted have been practically unanimous, is the necessity of providing rapid advancement for outstanding men."

The opening paragraph of the Chancellor's report sounds the note for the entire recommendation. It is a nicely restrained acknowledgment of past performances and of hopes for future services. What a thrill it would be to Canadians to see such a statement from the Minister of Finance, instead of the mincing words and non-committal statements of evasion that have been handed out for years by all officials associated with the sad conditions in the civil service of Canada. This is what the Chancellor says:—

> "1. The Government have decided that the Scientific Civil Service is to be reorganised. They are deeply conscious of the contribution made by science towards the winning of the war, a contribution which may have altered the whole course of the war and has certainly shortened its duration. 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 to the means of defence. They are resolved that the conditions of service for scientists working for the Government shall be such as to attract into the Civil Service scientifically qualified men and women of high calibre, and to enable them after entry to make the best use of their abilities, in order that scientists in the Government Service may play their full part in the development of the nation's resources and the promotion of the nation's wellbeing."

From clause 8 these lines are taken:—

> "The salaries of the most highly qualified members of the Scientific Service are to be brought into relationship with those of the Administrative Class;"
>
> "The Committee recommended that the outstanding scientist should have a reasonable expectation of reaching the Principal Scientific Officer grade in the early thirties," (£800 — 1100 about 10 yrs. after graduation).

Clause 9 is a sign of enlightenment—it puts merit above red tape:—

> "Special provision will be made for recruiting above the normal minimum salary University graduates with research qualifications. In exceptional cases, scientists will be recruited direct to grades above the basic, where they possess special qualifications or experience which a Department requires."

Clause 11 describes some of the top salaries. All proposed salaries are shown in the later tabulation, but this clause is quoted herewith for emphasis:—

> "At the present time the highest scientific posts in the Civil Service, excepting the post of Secretary to the Department of Scientific and Industrial Research, carry a salary of £2,000 per annum. This was agreed during the war for the Heads of some of the Research Institutions. In future there will be at the highest levels salaries of £2,250 and £2,500, and in the whole Civil Service two or three posts will be graded at £3,000. The grading of the highest posts has still to be worked out in detail between the Treasury and Departments."

In the appendix, present scales and new scales are shown. For simplicity, the *Journal* quotes only the new figures as they are of greatest interest here. A note accompanies the appendix which to many will indicate that the committee, or the Government, in spite of the modern improvements proposed, is still influenced by the thinking of the horse and buggy days. "In accordance with normal civil service practice, scales for women are somewhat lower."

Here is the new scale using the figures for London. There is in addition a war bonus of £60 on all salaries up to £1,500.

" SCIENTIFIC OFFICERS (men)

Scientific Officer (two to four years, probationary). - - -	z £275-£500 (×£25—£400 on confirmation of appointment).
Senior Scientific Officer - - -	£550-£750 (×£25)
Principal Scientific Officer -	£800-£1,000 (×£30)
Senior Principal Scientific Officer - - - - - - - - - - -	£1,200-£1,400 (×£50)
Deputy Chief Scientific Officer	£1,600-£1,800 (×£50)
Chief Scientific Officer - - -	£2,000
Various posts at - - - - - -	£2,250 and £2,500
Two or three posts - - - - -	£3,000

z Higher starting points for graduates with post-graduate experience in research.

Another encouraging sign is that the Government proposes to set up a Panel, " to maintain a uniform standard for promotions and special advancements in the Scientific Service." The responsibilities of the Panel include, " keeping under review the well-being and efficiency of the Government Scientific Service."

Members of the Institute will be interested in the proposal that, " workers in Government Service (be) encouraged both to publish works of their own and to discuss their work with persons outside the Service engaged on similar problems."

Is it too much to hope that some such enlightenment will come to the Department of Finance and its Treasury Board within the not too distant future. It all seems very simple. It does not take supermen to see simple truths. Any other conclusions than those quoted would indicate shortsightedness, thoughtlessness, and a lack of understanding of economics and personnel considerations.

Can it happen here?

THE GENERAL SECRETARY VISITS THE WESTERN BRANCHES

This year the pleasant custom of the president visiting the western branches could not be maintained. It came as no surprise to anyone that a dean of engineering would not be able to leave his academic duties in the month of November. The unusual inrush of students who want to be engineers has presented such a problem that the heads of engineering faculties will be tied to their offices for a long time to come.

Reluctantly, Dr. Fetherstonhaugh abandoned his plans for the tour, although he was able to visit the branches at Regina and Lakehead, and preside over the regional meeting of Council at Regina. These two branches were just overnight from Winnipeg, and required the minimum absence from the university. The branches farther west were disappointed but readily understood the situation.

The general secretary made the complete circuit, visiting every branch from Sault Ste. Marie to Victoria as well as Saskatoon, Nelson and Trail. Councillor James Vance of Woodstock was present at the Soo, Winnipeg and Regina, being the farthest travelled branch representative at the council meeting. The general secretary visited twelve branches, participated in twenty-one meetings, spoke to the students at four universities, and arranged for the establishment of a new branch — all in four weeks less one day.

The general secretary reports that in most centres there are continuing indications of a general expansion in Institute activities and usefulness. Some branches, notably Calgary and Vancouver, report a greatly increased membership, with new members adding from 20 to 25 per cent to the total, and still more in sight.

At the universities there is developing a demand for a closer type of affiliation. Consideration will have to be given by Council to the possibility and advisability of establishing student sections entirely within the university, rather than continue the present plan of tying the student members to the junior section of the local branch. There are clear signs that the students look with favour on such an arrangement. All in all, it has been an encouraging experience to visit with these undergraduates, and to see the new opportunities that present themselves for service to the future engineers.

An outstanding feature of the trip was a four-day stay at Trail, B.C. Last year the then president, de Gaspé Beaubien, accompanied by R. E. Heartz and the general secretary, made the Institute's first visit to this area. There was a strong demand for the establishment of a branch, and during the ensuing year considerable ground work was done towards this end. During the secretary's visit this year, the members decided unanimously to petition Council for a charter in the name of the Kootenay Branch. There are a large number of engineers in the East and West Kootenays, and it should be easily possible for the Institute to do good work there. The Consolidated Mining & Smelting Company, Ltd., and its various companies, including the Kootenay Power Company, employ great numbers of engineers in all fields. Already there is an excellent nucleus of a branch, and new applications are coming in at an encouraging rate.

At the regional meeting of Council there was a good attendance, with six branches being represented by eight councillors. There were eight guests. The president handled a rather bulky agenda with excellent despatch, without in any way restricting the discussion. Mr. Vance's presence made it possible to discuss, in full detail, the proposed education fund in memory of Harry Bennett. It will be helpful to the committee, of which Mr. Vance is chairman, to have the ideas and the general support of the western councillors.

At Winnipeg, on the return journey, it was everyone's good fortune to have vice-president J. E. Armstrong of Montreal at the meeting. He also joined the president and general secretary on the visit to the Lakehead Branch the following day.

The visits to the universities gave the general secretary a first hand opportunity to see and understand the problems facing the engineering faculties, and to appreciate the bold steps that have been taken to surmount them.

All in all, the trip was a splendid success, although the president was missed greatly. The opinions, information and inspiration gathered all along the line will be helpful to Council and to Headquarters. Such contacts are essential to the life of an organization as widespread as the Institute, and it is to be hoped that they can be increased in number from year to year.

INSTITUTE'S REHABILITATION SERVICE SUBJECT OF BROADCAST

The following talk was given by Major Royd Beamish, in the series "Repat Reporter", over the Canadian Broadcasting Corporation's Trans-Canada network, at 7.45 p.m. EST, (Eastern network) 11.00 p.m. CDT (Western network) on Tuesday, December 4th, 1945.

There are thousands of rehabilitation plans operating in Canada today. They range all the way from small, almost personal plans to programmes that spread across all Canada. The employer with two or three men coming back from the armed forces has his plan. Virtually every large company has one, too. And some of them are most elaborate and detailed. They're all of tremendous help to the men and women who are coming out of the services.

But tonight I'd like to tell you about a rehabilitation program that strikes me as being particularly noteworthy. It has two or three notable features. In the first place, the plan wasn't drawn up by employers in several scattered localities, but by a national organization. Secondly, it deals with a group of ex-servicemen who are going to need a lot of top-drawer technical guidance. And thirdly, it's been operating long enough now to show pretty conclusively that it really works.

I'm referring to The Engineering Institute of Canada and its rehabilitation scheme. The Institute embraces all branches of engineering—civil, electrical, mining, mechanical and all the rest. It has over 7,000 members and probably 2,000 of them were on active service during the war. They were practically all technical experts — building bridges for the Royal Canadian Engineers, keeping tanks and electrical equipment operating for Reme, directing the work of survey regiments with the artillery, handling problems of design and modification of equipment with the Ordnance Corps. There were engineers in every branch of the service—navy, army and air force. And their contribution to victory was virtually immeasurable.

Well, now those engineers are coming back, back to Canada and back to civil life. And they have a lot of problems to contend with on the way. Problems peculiarly their own.

A good many of them were employed before the war and their old jobs are waiting for them now. Well, that's fine for the engineers whose service life was spent in the same type of work they did before the war. But military engineering doesn't cover the same sort of problems you meet in civil life. And so some engineers feel they've gone rusty and need refresher courses before they go back to work. Particularly the lads just out of college when they enlisted. And then there are a lot of undergraduate engineers. They'll either have to finish their university training or go into some other business or profession.

The Engineering Institute of Canada anticipated those problems a long time ago. And the members discussed the best way to meet them. This spring they put the plan into operation.

First thing they did was to appoint a Rehabilitation Committee. It has thirty members, with at least one living in each of the main industrial centres of Canada. Major-General Howard Kennedy was made chairman and Major Donald McCallum of Montreal, was appointed full-time director of rehabilitation and personnel services. Major McCallum went overseas with the Sherbrooke Fusiliers and was later posted to the Three Rivers Tank Regiment in Italy. He saw plenty of action with his new outfit before he was wounded at Lake Trasimeno in June of last year. It's Major McCallum who is applying the Institute plan, working, of course, under the strategic direction of the committee.

Step two in the rehabilitation scheme was to prepare a questionnaire and send it to all Institute members in the armed forces. The Institute was able to reach 1,200 of its members, and most of them sent back replies.

It was really those completed questionnaires that worked out the rest of the plan. The answers of Institute members in England, Italy, and Northwest Europe formed the basis of all subsequent operations. For instance, a large percentage of replies asked questions about university training privileges and things like that. To answer them, the Institute prepared a booklet called " The Engineers' Return to Civil Life " and sent it out to all members in the forces. We'll deal with it in a moment.

The second major demand was for some means of contact between engineers in the three services and the employment situation at home. To meet this demand, the Institute published an " Employment Page " in its monthly *Journal* and pre-printed the page, sending a copy to every member in advance of publication.

In addition, the Rehabilitation Committee has kept an eye on all government rehabilitation measures and made recommendations where they saw fit. I was particularly interested to see that they endorsed the petition of several university veterans' groups urging an increase in maintenance allowances, particularly for married veterans. That's the same petition we discussed a couple of weeks ago, you may remember.

But now I'd like to get back to this Engineering Institute booklet. I've seen a lot of booklets and pamphlets dealing with the demobilization theme, but this one has a number of unique points. It starts out, like all the rest, by listing all the various government benefits a veteran can get on discharge. But then it goes a lot further.

Under the heading of university training, for instance, the booklet lists all the standard information. And then it goes on to discuss the problem as it applies to engineers. I'd like to quote a couple of its more pertinent paragraphs. This one seems particularly sound: " It is natural that engineers who've been absent from their civilian occupations for a long time should feel they've forgotten a great deal. But it should be remembered that training in engineering is a fairly general background, designed to teach men how to think rather than what to think. This sort of thing is not easily forgotten and if you realize that even after a refresher course you'll still have to learn the particular line of your eventual employer, the loss of time and earnings may offset the value of any such course."

Later on, the booklet sums it up this way: " It is not, in general, considered advisable to undertake refresher and brush-up courses because: (a) men who are entering a new field will have to learn on the job anyway; (b) men who are returning to their previous line of work will find that they have forgotten far less than they think they have. And their experience will enable them to pick up new methods quickly. And (c) the universities will be unable to accommodate all the engineers who want to take such courses. Their capacity will be stretched to the limit by undergraduate personnel."

Even in dealing with undergraduates, the Engineering Institute takes a practical view. For men whose university training was begun before joining up, the booklet says, usually it will be worth while to return to university and get their degrees. But men who are thinking of starting an engineering course for the first time are cautioned. Here's what the book says: "Although the degree is very useful, a great deal of earning time will be consumed in getting it. Employment conditions are good now compared to what they may be four or five years hence." In other words, it may be more worth while for such men to find work in engineering fields that do not require an engineering degree.

Even in the matter of post-graduate courses for specialized degrees the Institute keeps both feet solidly on the ground. Its word to the wise is this: " Generally, highly specialized post-graduate courses are not recommended to men who are planning to enter manufacturing or industrial fields. Usually employers do not want specialists. They want men with the general background provided by the original engineering degree, who can learn their methods."

Well, now, that may sound like carrying realism to extremes. And if the Institute didn't have another alternative to offer after talking down college training, perhaps it would be. But the Engineering Institute *has* another plan. And it's been working out remarkably well.

I mentioned it a few minutes ago when I told of the " Employment Page " in the *Engineering Journal*. Any firm seeking to employ an engineer is permitted to announce its vacancies through the *Journal*. And the announcements are very specific as well as amazingly diversified. A pre-print copy is sent to every Institute member in the services, and the Engineering Institute reports that this has resulted in more than a hundred pre-discharge applications being received every month.

In addition, between 80 and 100 engineer servicemen are being interviewed every month, with a view to placement in jobs. Each man reporting for interview and guidance is given at least six likely firms to contact. Somewhere between fifteen to twenty confirmed placements result every month, but as many are not reported, the Institute believes the real total would be nearer forty or fifty.

This may not sound like a very large number, but when you realize that these men are specialists and that their salaries range anywhere from $200 to $500 a month when they are placed, it becomes more significant. The interviews usually produce the actual jobs but the avenue opened up by the announcement of job vacancies is a most important preliminary. In its November " Employment Page " for instance, the Institute lists a total of sixty-five employment possibilities. Those sixty-five announcements represent at least 75 jobs, because several of them call for two or even three men to fill them. And they're not just vague " leads " to employment either.

They tell the sort of experience required for the job, the type of work it will entail and the salary that can be expected. For instance, one advertisement for a civil engineer is worded like this: " Civil engineer, 25 to 35 years old, with some experience in construction and good personality, is required to act as specialist in piling for a company in Montreal. Work would be mostly design but would also involve dealing with engineers and contractors. Preference will be given to a returned man and salary would be about $300 a month.

And there are fascinating vacancies like this one: " Mechanical engineer is required to act as assistant engineer to the superintending engineer of a pulp and paper company in Calcutta, India. The work will be in connection with all the practical maintenance of the plant and a salary of between $4,000 and $6,000 a year is offered, under a three-year contract, including free housing accommodation and full passage expenses."

All told, this sheet lists vacancies for three chemical engineers, 15 civil engineers, six electrical and 21 mechanical engineers and twenty " miscellaneous " vacancies. Members receiving it are told that the sheet offers them three things. It can be considered, first of all, as an indication of present employment conditions in Canada. Service members can reply to any of the announcements that interest them with a view to establishing contact for the future and those whose discharge is imminent can make direct applications for the positions advertised.

That's the schemes. And it has the added merit that it works out in practice as well as in theory. As an example of co-operation between employees, employers, and veterans, I think this engineering program is outstanding. And one thing it shows above everything else, I believe, is the tremendous advantage that lies in having a national organization like this. It would almost suggest that Dominion-wide organizations in other trades and professions could accomplish similar things in their own fields. I wonder how many such organizations do have a plan like this one?

The employment angle of the engineering rehabilitation program is the one that catches your eye most compellingly. But I think the committee deserves a lot of credit for setting out the educational aspects so lucidly in their little handbook.

One engineer I spoke to told me that, before he received the booklet, he'd made up his mind to take a refresher course at university because it seemed the logical thing to do. Then, when he saw what the Institute committee felt about it, and read their caution against further study unless it were really necessary, he began sizing up the employment situation. Here's how he put it.

" The Institute executive is made up of practical engineers. And when they made their suggestions about education, they knew what they were talking about. That booklet kept me from wasting a lot of time lining up a course I didn't need. I used that time to make some business contacts, and I was on the job two months after I got my discharge.

With at least 20 new placements being made every month and perhaps 30 or more in actual fact, and with a good percentage of our serving engineers returning to their pre-war jobs, it really looks as though the Engineering Institute has an excellent answer to what might easily have been a very touchy problem in job placement. And if telling how they've gone about it helps some other group to develop something along the same lines, I think the engineers will be just as pleased as the veterans themselves would be.

CANADIANS LEARN ABOUT GERMAN RESEARCH

Shortly before V-E Day a small number of Canadian scientific and technical experts left for the continent of Europe and followed close on the heels of the invasion troops on their march into Germany. Their purpose was to obtain quick first-hand information that would be of value in the war against Japan. Others left before V-J Day with the same object in view, some 42 going over altogether. They were recruited both from the government services and from industry and represented a wide range of activities. Technical processes, particularly those dealing with new or novel features, received a wide share of their attention. With the sudden advent of V-J Day, however, their tour immediately turned into an industrial rather than a military investigation.

Their work of investigation was conducted in co-operation with other scientific and technical men from the United Kingdom and from the United States. They did not all remain together but travelled singly or in teams made up of two, three or more members whose interests centred upon the same things, though it was found that they could carry on more efficiently if the teams were not too large. On the investigational tour they visited industrial plants, military establishments, scientific laboratories, research institutions, shipyards, devastated areas, and other points of interest throughout Germany, the Netherlands, Luxembourg, Belgium, and France.

The tour on the average lasted for approximately three months. Many have now returned to Canada though at this writing a few of them still remain overseas or are en route home. On Friday, 14th December, at the Chateau Laurier, Ottawa, under the auspices of the Department of Reconstruction there was held a press conference followed by a dinner, at which 27 of these investigators were present. The conference took the form of questions by the press and answers by the experts. Everything was " on the record " except that questions relating to international politics were ruled out and highly technical questions were reserved to be dealt with more properly at subsequent trade-press conferences.

In the interim between the conference and the dinner and also at the dinner itself opportunity was furnished for a more informal get-together between members of the press and those investigators in whose work they might be most interested. The Engineering Institute of Canada was represented by R. C. Purser, M.E.I.C.

V. W. Scully, deputy minister of Reconstruction occupied the chair at the conference, jointly with Col. T. F. Flahiff, assistant director general Industrial Reconversion branch, who organized the visit of the Canadians to the German plants.

From the conference and from conversations afterward with members of the group, it was evident that by and large the investigators felt that Canadian industry and technology is in advance of German thinking. Dr. C. J. Mackenzie, director of the National Research Council, crystallized this thought with the remark that as a result of the investigations " we don't feel terribly unhappy about our own position." Canadians, he said, need have no inferiority complex over their achievements.

Dr. Edwin R. Rowzee, research director of Polymer Corporation Limited, Sarnia, said that the processes in Germany for the production of synthetic rubber were quite similar to those in use in United States and Canada. " Nothing we saw led us to believe that they were any better than we are here," he said. Actual tests made on tires fabricated from German rubber brought over to this country demonstrated their inferiority. " They failed miserably after a few thousand miles of running," he said. Referring to the breakdown of German motor transportatoin during the first winter campaign in Russia, Dr. Rowzee stated that this was not due so much to tire failure as to tube failure. The tubes would split due to low temperatures and manufacturing processes had to be revised to meet these conditions.

He also referred to a research laboratory maintained by the Germans and devoted to synthetic rubber that was better than " anything on the North American continent ". A pilot plant in this connection was capable of the production of 600 tons of rubber per month. In his words it was " a most outstanding setup " and " it was quite evident," he said, " that the expenditure per unit of population on such research is much heavier there than here."

Dr. W. H. Cook, director of the applied biology division, National Research Council, spoke about a new rapid butter-making machine capable of continuous operation in which the cream went in one end and the butter came out the other. Another butter making method used by the Germans is also new and rapid. He also mentioned some ersatz foods such as synthetic butter and synthetic egg powder said to be better than the real thing, though he remarked that such foods would have little interest to Canadians who are able to get the real thing.

Dr. William Boyd Campbell, director of technical research of the Pulp and Paper Research Institute of Canada, Montreal, told the conference that the Germans of necessity were forced to do some things differently from what is done, for instance, in this country. However they " did nothing that we in Canada would not and could not have done under similar circumstances." They converted a large number of sulphite plants to the use of beechwood. This was for making fibre which took the place of cotton, unobtainable in Germany. They also made great use of waste liquors, turning from alcohol to food yeasts when they changed to long-fibred wood.

S. H. Chambers, chemist of Montreal Cottons Limited, Valleyfield, P.Q., whose interests related to textile dyeing, said that the Germans " did lots of good work bleaching fibres without loss of strength, also finishing them to make them acceptable." Referring to the great I.G. Farben-industrie he said he found them far in advance of Canada in some things, such as one or two series of dyes that they had perfected. They had also produced a spun rayon which to the uninitiated eye was no different from wool. It was shrink-proof and water-proof. But " they could not make better rayon stockings than Canada."

Dr. A. C. Burton, University of Western Ontario, remarked that his findings in Germany convinced him more than ever that " science flourishes on the soil of freedom." Some scientists may have been able to carry on more or less freely but most of them were hampered by the Nazi setup. Industry paid more than research and consequently trouble was experienced in getting good research men. Heads of scientific institutions had even been drafted to serve as privates in the Germany army. " They never seemed to be able to wed up brains and money in Germany," he said.

Basic research did not flourish and projects which promised to take more than six months were often ordered abandoned. In spite of this some important discoveries were made but again there was no uniformly rapid application of research in industry. Toward the latter part of the war there appeared to be a change on the part of the Nazi party but by that time it was too late.

Speaking generally, the experts said that they had little difficulty in getting information from German scientists and technicians. Sometimes the latter were reluctant to give original drawings of new machine developments but were quite willing to give copies.

At the dinner given by the Department of Reconstruction to the experts and press representatives, Mr. Scully spoke on behalf of Reconstruction Minister C. D. Howe, who was unable to be present, welcoming the guests and congratulating the experts on the job they did in the German Reich.

Percy J. Philip, president of the Parliamentary Press Gallery, spoke on behalf of the press, commenting upon the difficulty experienced by reporters in their efforts to find out the truth about what has been going on in Germany.

CORRESPONDENCE

"Sin and Salvation" Moment Distribution Method

Vancouver, B.C.,
November 26th, 1945.

Dear Editor:

The Hardy Cross Moment Distribution method of analyzing structures with continuity through the joints or over the supports, as in a building frame or multiple-span girder bridge, has now been tested for about fifteen years.

It is the outstanding new aid for simplifying otherwise complex structural problems.

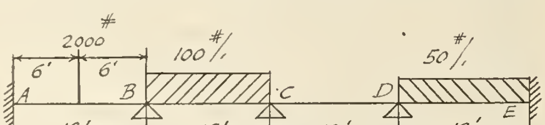
Simplicity is the key to accuracy and thus I would like to present a new variation of moment distribution for the consideration of practical Canadian engineers. This method can be called the Carryover Distribution Method or the *CDM*. Basically it consists of setting up fixed-end moment conditions and also an unbalanced moment table and then using Carryover Distribution Factors (*CDF*) which are products of ordinary Distribution Factors (*DF*) and standard Carryover Factors (*CF*).

For example, if the end B of BA takes 0.50 of the unbalanced joint moment and the carryover to the end A is 0.5 we can say that $CDF = (0.5)\ 0.5 = 0.25 = (DF)\ (CF)$.

In the simple example of Fig. 1, this "shortcut" *CDM* is worked out. This method is increasingly timesaving as the complexity of the structure increases as for example in multistory unsymmetrical building frames or secondary stress determinations for heavy complicated railroad bridges.

In order to aid those who have not used this method I will describe the first few steps. After determining the values I, L, $K = I/L$, *DF*, *CF*, and *CDF* then enter the fixed-end moments (*FEM*) in the table. In the Unbalanced Moment Table (*UMT*) record these *FEM's* and determine the set of *UM's*. We observe that joint B has the largest *UM*, thus we release this joint *first*, carrying over +450 to each of the joints A and C. It is then found that joint C has the next largest outstanding $UM = -750$; release this joint *next*.

This procedure of releasing joints of largest outstanding *UM* at each successive step is a real "timesaver". Continue entering Carried-Over Moments (*COM*) until the desired degree of accuracy is obtained. In the Summation (Σ) we determine *FEM*+*COM* and, using the *UM* table, we find the final *UM's*. These are



L	12'		12'		12'		12'	
Rel. I	48		48		48		48	
Rel. I/L	4		4		4		4	
DF		0.5	0.5	0.5	0.5	0.5	0.5	
CF		0.5	0.5	0.5	0.5	0.5	0.5	
CDF		0.25	0.25	0.25	0.25	0.25	0.25	
FEM	+3000	-3000	+1200	-1200	0	0	+600	-600
COM	+450	⟷		+450				
			+187	⟷		+187		
	-47	⟷		-47	-197	⟷		-196
			+61	⟷		+61		
	-15	⟷		-15	-15	⟷		-15
			+4	⟷		+4		
	-1	⟷		-1	-1	⟷		-1
Σ +	+3450	0	+1452	+450	0	+252	+600	0
Σ −	-63	-3000	0	-1263	-213	0	0	-812
FEM+COM	+3387	-3000	+1452	-813	-213	+252	+600	-812
Distrib^n	—	+774	+774	+513	+513	-426	-426	—
Final M	+3387	-2226	+2226	-300	+300	-174	+174	-812

Moment Diagram

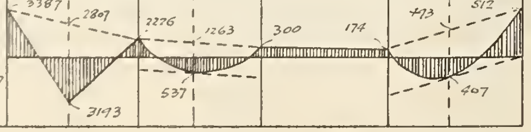


Fig. 1 (a)

UM Table

Joints		B	C	D
FEM		-3000	-1200	+600
		+1200	+450	+187
COM'S & UM'S		-1800	-750	+787
		+187	-197	+61
		+61	-47	+4
		+4	-244	
			-15	
			-15	
			-30	
FEM+COM		-3000	-813	+252
		+1452	-213	+600
UM		-1548	-1026	+852

Fig. 1 (b)

distributed in *one* operation of distribution so that we can calculate the final moments which can be graphically represented as shown in Fig. 1.

If this method of using *CDF's* and if moments of largest successive unbalance are distributed in the balancing process for a really complex problem, the saving of designer's time is really remarkable.

In closing I would like to mention that the Moment Distribution Method of Hardy Cross, University of Illinois, is a brilliant example of the use of what is known as the "Fault and Reform" method of structural analysis. The "faults" in this method are the artificial joint-clamping moments or sidesway prevention forces and the "reforms" are the joint balancing moments or sidesway correction forces. A more humorous way of describing this method is that of "Sin and Salvation" where salvation rectifies all the structural designer's sins in the process.

Yours truly,

(*Signed*) C. W. Deans, M.Sc., M.E.I.C.

Would Regulate Supply of Engineers

Department of Transport,
Ottawa, Ont.,
December 2, 1945.

The Secretary,
Engineering Institute of Canada,
Montreal, Quebec.

Sir:—

Much has been written and spoken about the low rates of pay for engineers, but very little, in a practical way, has been done to ameliorate this condition.

During the war years while there was a shortage of engineers, salaries were much improved, but during periods of depression new graduates accept positions at low salaries and find it difficult to improve their economic condition.

The economic law of supply and demand works the same with engineers as with agricultural or manufactured goods. It therefore appears logical that some control should be exerted over the supply of engineers.

This proposed control would be voluntary, exerted by universities in co-operation with the Engineering Institute. A commission could be set up which would estimate the probable demand of engineers for a ten-year period, revised from year to year.

A table could be set up indicating the number of graduates from each university that would be able to find satisfactory employment in the various engineering fields. Using this information, the university authorities would be able to direct students into likely branches or discourage them from entering fields already at the saturation level.

The enormous size of classes in engineering for this year will only mean a glut on the market four years from now. So far as I am aware, no effort has been made to guide students into fields where there is likely to be a fair chance of success, they just go willy nilly wherever their fancy takes them.

Sincerely,

(Signed) C. K. Hurst, M.E.I.C.

IT'S BEING TALKED ABOUT

The *Journal* is not the only publication that finds fault with the government policy of "penny wise and pound foolish," in relation to remuneration of professional workers in the Civil Service. The following short article is quoted from "Backstage at Ottawa" in *Maclean's* magazine of December 1st, 1945.

The *Journal* has been given to understand that the salary situation at the Research Council referred to in *Maclean's* has been rectified just recently.

"Reconversion is waking the Government to something any Deputy Minister could have told them years ago—that you can't hire a good man for peanuts. Unless something is done very fast to raise salaries in key Civil Service jobs, and to raise the myopic sights of the Treasury Board and the Civil Service Commission, the Government's elaborate reconstruction plans will break down hopelessly for lack of competent personnel.

In the Public Works Department, the Treasury Board authorized the employment of 32 new men as reconstruction planners, at salaries the Treasury Board thought pretty generous. Up to now, Public Works has been able to hire only seven, and has 25 jobs still open. The men they want aren't interested in the money they offer.

In the Department of Natural Resources, keystone of the federal conservation and development programme, 48 experienced and highly skilled technicians have quit within the past few months. They've gone to private industry for salaries often double what the Government was paying them—and even at that they're mostly getting less than $4,500. In the Civil Service many of them had been getting between $2,000 and $2,500.

For the National Research Council there are no late figures, but the turnover there is popularly reported to be worse than anywhere else. The peculiar irony is that the Research Council has a fairly generous schedule of salaries, but isn't allowed to live up to it—men qualified for senior jobs, and actually doing senior jobs, are kept at junior rank and pay. They're moving into commercial and industrial laboratories in droves, for double and triple the money but for work of much less value.

One department lately interviewed an Army officer of fairly senior rank. They offered him $2,100 to start. The officer, who has a wife and two children, said he couldn't live on that, and the Civil Service official looked hurt: "That's what we pay beginners," he said. Finally, after much cogitation, the department decided to offer him the Grade Four salary of $3,600. But meanwhile he'd taken a job in industry at $8,000."

SIXTIETH ANNUAL GENERAL

MONTREAL - MOUNT

THURSDAY, FRIDAY and SATURDAY,

R. C. FLITTON
General Chairman

H. F. FINNEMORE
Vice-Chairman

THURSDAY, FEBRUARY 7th

9.00 a.m. (all day)—Registration. There will be a registration fee of two dollars per person for Members, Affiliates, and guests, and one dollar for Juniors. No registration fee for ladies and Student members.

9.30 a.m.—Annual General Business Meeting of the Institute. Address of the retiring president, Dr. E. P. Fetherstonhaugh.

12.30 p.m.—Luncheon — Speaker: H. M. Scott, M.E.I.C., Manager, Toronto Branch, Atlas Construction Company. **The Engineers' Civic Responsibility in Community Planning.**

2.30 p.m.—Professional Session (Ball Room). **Design, Installation Characteristics and Performance of Rolls-Royce Nene and Derwent Gas Turbines (with special reference to jet propulsion),** by J. D. Pearson, Chief Technical Services Engineer, North American Technical Office, Rolls-Royce Limited, Montreal.

2.30 p.m.—Professional Session (Convention Room). **Evaluation of Light Metal Alloys,** by J. A. Van den Broek, M.E.I.C., Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Mich., U.S.A.

8.30 p.m.—Montreal Branch Annual Smoker—Out-of-town members who are not familiar with the outstanding character of Montreal Branch Smokers will be well advised not to miss this event.

FRIDAY, FEBRUARY 8th

9.30 a.m.—Professional Session (Ball Room). **The Winter Temperature Cycle of the St. Lawrence Waters—A Plea for More Data (Is Winter Navigation Possible on the St. Lawrence and the Great Lakes?)** by J. G. G. Kerry, M.E.I.C., Consulting Engineer, Port Hope, Ont.

9.30 a.m.—Professional Session (Convention Room). **The Future of Radio Communications in Canada,** by A. B. Hunt, M.E.I.C., Manager, Elec-

C. A. LAVERTY
Chairman of the Entertainment Committee

L. A. DUCHASTEL
Secretary

J. J. H. MILLER
Chairman, Finance Committee

E. E. ORLANDO
Chairman of General Arrangements

AND PROFESSIONAL MEETING

ROYAL HOTEL

EBRUARY 7th, 8th and 9th, 1946

tronics Division, Northern Electric Company, Limited, Montreal.

12.30 p.m.—Luncheon — Speaker: Harry S. Rogers, President, Polytechnic Institute of Brooklyn, New York, U.S.A., and President, Society for the Promotion of Engineering Education.

What the War has done to Engineering Education

2.30 p.m.—Professional Session (Convention Room). **Pre-stressed Concrete,** by T. C. Creaghan, M.E.I.C., President, Creaghan and Archibald, Engineers and Contractors, Montreal, and by V. S. Murray, Engineer of Bridges, Department of Highways of Ontario, Toronto.

2.30 p.m.—Professional Session (Ball Room). **British Engineers' Contribution to the Allied Cause,** by P. Dunsheath, C.B.E., President, The Institution of Electrical Engineers (Great Britain), London, England.

7.00 p.m.—Annual Banquet (Normandie Roof). ***Dress—Dinner jackets or business suits.***

Speaker: Dr. P. Dunsheath, C.B.E., President, The Institution of Electrical Engineers (Great Britain), London, England. **The Engineer Family in the Commonwealth.** Presentation of prizes and medals of the Institute. Induction of the new president and presentation of new officers.

10.00 p.m.—Reception and Dance.

SATURDAY, FEBRUARY 9th

9.15 a.m.—VISIT to C.N.R. Rectifier Room (Central Station) and Control Tower at Lachine Canal.

9.15 a.m.—VISIT to C.P.R. Angus Shops to witness locomotive, wood and steel freight and passenger car repairing. Casting of car wheels. Blacksmith shop.

LADIES' PROGRAMME

Ladies are invited to all functions on the general programme. In addition, special entertainment is being arranged for them.

A bridge party at the Women's University Club is being arranged for Thursday night, February 7th.

MRS. R. E. HEARTZ
Ladies' Convenor

H. B. HOWE
Vice-Chairman of the Entertainment Committee

C. A. PEACHEY
Chairman of the Papers and Meetings Committee

J. M. CAPE
Chairman of Transportation and Plant Visits Committee

A. BENOIT
Chairman of Hotel Arrangements Committee

W. SHARPLES
Chairman of the Publicity Committee

COMMUNITY PLANNING COMMITTEE

Ross L. Dobbin, of Peterborough, has accepted the chairmanship of the Institute's Committee on Community Planning. He is a member of the City Planning Commission of Peterborough, and for five years was chairman of the Wartime Housing Committee of his city. These qualifications, along with his professional experience as General Manager of the Peterborough Utilities Commission and his broad knowledge of Canadian affairs, place him in an excellent position to do justice to the assignment.

Mr. Dobbin is a graduate of Toronto—1910, B.A.Sc., 1911, and joined the Institute as a Student in 1910. He has been chairman of the branch, councillor and vice-president for Ontario. He has rendered excellent and frequent service to the Institute through membership on various committees. He joined the Association of Professional Engineers of Ontario in 1922 and was on its council for 1927-28.

In 1931 he was made president of the American Water Works Association, a unique distinction for a Canadian. He was also president of the Association of Municipal Electric Utilities in 1930.

He was a member of the Senate of the University of Toronto for 1927 to 1932.

Mr. Dobbin has many other interests related to his profession and to good citizenship. For years he has been active in the Canadian and American Gas Association, and the Canadian and American Public Health Associations, the Illuminating Engineers Society, the New England Water Works Association, and Rotary International.

Members may feel confident that the Institute's interest in the important topic of community planning is in good hands.

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, December 15th, 1945, convening at nine-thirty a.m.

Present: President E. P. Fetherstonhaugh in the chair; Past-President deGaspé Beaubien; Vice-Presidents J. E. Armstrong and E. V. Gage. Councillors A. Cunningham (Kenogami), W. L. Saunders (Ottawa), H. R. Sills (Peterborough), H. E. Brandon, W. H. M. Laughlin and W. S. Wilson, of Toronto; R. S. Eadie, R. C. Flitton, J. A. Lalonde, and C. C. Lindsay, of Montreal; Treasurer R. E. Chadwick; R. E. Heartz, chairman of the Committee on Employment Conditions and member of the Harry Bennett Memorial Committee; J. B. Stirling, chairman of the Committee on Professional Interests; General Secretary L. Austin Wright, Assistant General Secretary Louis Trudel, Secretary Emeritus R. J. Durley, and Major D. C. MacCallum, Rehabilitation Officer.

Harry Bennett Memorial Fund—The president called on Mr. Heartz, as a member of the Harry Bennett Memorial Committee, to present the report of the committee, explaining to Council that Mr. Heartz had just returned from a trip to London, Ontario, where he had discussed this matter with the other members of the committee, namely, James A. Vance, chairman, and E. V. Buchanan.

Mr. Heartz presented the committee's recommendations for the rules of governance for the Harry Bennett Memorial Fund. Each clause was examined separately, and was followed by a broad discussion. Mr. Wilson believed that the minimum number of restrictions should be required. The experience of various funds with which he had been associated was that the fewer restrictions there were, the better it was for everyone. At the same time, their loss experience had been very low.

It was thought also that the rules should specify the number of members of the Board which would constitute a quorum. It was thought, also, that the reference to a "high school" should be broadened to "school". It was agreed, finally, that the requirement that a student securing a loan should furnish life insurance as collateral be eliminated.

Finally, on the motion of Mr. Beaubien, seconded by Mr. Lindsay, the rules, as amended, were accepted unanimously.

There was further discussion as to the objective of the committee and Mr. Heartz stated that the committee had in mind $20,000.00 to $25,000.00. Mr. Gage and Mr. Laughlin were of the opinion that the amount should be higher but eventually, on the motion of Mr. Eadie, seconded by Mr. Lindsay, it was agreed unanimously that in the publicity material associated with the campaign for funds the ultimate figure be limited to $25,000.00.

Mr. Heartz pointed out that with the acceptance of this report the terms of reference of the committee were fulfilled. It was moved by Mr. Eadie, and seconded by Mr. Beaubien, that the present committee be continued, with power to add to its numbers.

In response to an inquiry, Mr. Heartz explained the procedure which the committee proposed to take to collect the funds. This was approved by Council and upon the motion of Mr. Armstrong, seconded by Mr. Eadie, it was unanimously agreed that the committee be authorized to proceed on the basis outlined by Mr. Heartz.

The president thanked Mr. Heartz for the interest he had taken and for the excellent report he had presented on behalf of the committee.

Rehabilitation of Members in the Armed Forces: Major MacCallum presented an interim report on the work of his rehabilitation service. He drew attention to the fact that conditions had changed somewhat and that to-day there were more members looking for employment than there were openings. At the same time there were several openings still not filled as persons with the proper qualifications have not applied. He thought this change, to some extent, would be seasonal, but the main reason was that opportunities were definitely dropping off.

Major MacCallum reported that the committee, under Major-General Howard Kennedy, recommended sending out letters to five thousand potential employers, telling them of the Institute's service and of the availability of certain members who had returned from overseas service. He thought that in this way several additional openings could be discovered. Council approved of the proposal.

Mr. Eadie described the experiences at his company's plant to illustrate how the opportunities for employment were falling off, and Mr. Stirling referred to figures released by the Dominion Bureau of Statistics which showed that although contracts awarded for the first eleven months of the year were up 37 per cent, as compared to last year, employment in the construction industry was only up 3.4 per cent, this situation being due to the shortage of materials.

Major MacCallum inquired of Council as to instructions for continuing the service to non-members of the Institute. Mr. Armstrong pointed out that the service affected members in two ways, one as employers, and one as employees. He thought that in every instance a member employee should be given the first opportunity, but if no member is available with the qualifications for the opening it should be offered to a non-member who had the qualifications rather than deny to the employer member the opportunity to interview a prospect. This interpretation was approved by Council.

Major MacCallum pointed out that up to the first of December at least forty non-members who had been interviewed by him had applied for membership in the Institute. Major MacCallum's report was accepted, it being pointed out that the complete report will appear in the February *Journal* as part of the annual report of Council.

Amendments to the By-Laws: The proposed changes to Sections 21, 22, 26, 28 and 66, as recommended by the Finance Committee, were presented by Mr. Armstrong and considered section by section. Following discussion, each section was approved unanimously with the exception of Section 21, in which case Mr. Sills voted against the proposed amendment.

The general secretary then presented proposed changes to Sections 7, 9, 10, 23, 45 and a new Section 50A, submitted by the Membership Committee with a view to implementing the recommendations of that committee and the Board of Examiners, all of which had been discussed and commented upon by the various branches. Following discussion, and with slight amendment to Section 7, the proposed changes were unanimously approved and the general secretary was instructed to proceed with the proposals in accordance with the by-laws.

Annual Meeting, 1946: Mr. Flitton, chairman of the annual meeting committee, reported that all arrangements were proceeding satisfactorily. Since the last meeting of Council there had been some doubt as to whether hotel accommodation would be available, but the committee had now been assured that a certain number of rooms would be available at the Mount Royal Hotel, where the meeting was being held, and also at two or three other centrally located hotels. Speakers had been secured for the banquet and for the two luncheons and some excellent technical papers were being prepared. Arrangements were proceeding for the students' conference, which would be an important feature of the meeting. This was noted as a progress report.

Community Planning: The general secretary outlined the action taken by the president since the last meeting of Council relative to amendments to the National Housing Act of 1944. The Institute's attention had been called to an amendment to the Act whereby the compulsive requirement that an official plan be approved by the Minister before government funds were available was modified so that money could be given at the Minister's discretion without an official plan.

This clause in the original Act was mandatory and the money could not be loaned unless the plan had been approved. To make the official plan an optional requirement might mean the end of all community planning. It was from this aspect that the Institute was concerned.

The president, Vice-President Armstrong and the general secretary discussed the amendment in Winnipeg on December 6th and it was agreed that a message should be sent to the Minister of Finance asking that the mandatory clause be reinstated, also requesting that an engineer with community planning experience be appointed to the Central Mortgage Housing Corporation.

The matter was discussed at some length and eventually, on a motion by Mr. Beaubien, seconded by Mr. Flitton, and carried unanimously, the president's action was approved and he was authorized to take whatever further action should be required before the next meeting of Council.

Planning for Ottawa Federal District: The general secretary reviewed the situation with regard to the planning of the city of Ottawa as a national memorial. He reminded Council that it had been agreed that further action would be delayed until certain authorities in Ottawa had been consulted in order to be certain that the Institute's position was a sound one.

He reported that he had heard through one of the members that a National Committee, to be in overall charge of the work, was to be established, upon which various interested groups would be represented. He had been informed that the Royal Architectural Institute of Canada had already been invited to name its representative but that no word had come to the Engineering Institute. This was accepted as a progress report. (The week following the Council meeting the general secretary visited Ottawa and had several interviews that have a bearing on this subject. He had lunch with Mr. F. E. Bronson, chairman of the Federal District Commission, and was assured by him that when the final plans were agreed upon the arrangements would be entirely to the satisfaction of the Engineering Institute. Mr. Bronson admitted that his proposal had not yet been accepted, but he anticipated that it would be completed and ready for announcement within a very short time. This material will be presented in greater detail at the next meeting of Council.)

Montreal Branch By-laws: A draft revision of the by-laws of the Montreal Branch were submitted for the approval of Council. The general secretary reported that he had read the draft and it appeared to be in order but that one or two points might be improved with some editing. On the motion of Mr. Eadie, seconded by Mr. Lalonde, it was unanimously resolved that the branch by-laws as submitted be approved subject to such editorial revision as may be agreed upon.

Engineering Education: The general secretary reported that the question of the Institute establishing a Committee on Engineering Education had been discussed at the regional meeting in Regina in November. Certain proposals were made at that time which he had since had the opportunity of discussing with several deans of engineering in various parts of Canada. One of these proposals was that Dr. Fetherstonhaugh, as president of the Institute, should invite all the deans of engineering to a conference about the time of the annual meeting of the Institute. Mr. Wright stated that approval was given to this proposal by each of the deans with whom he had spoken. They were of the opinion that they should meet soon in order to discuss many things of common interest, including the courses themselves. Each dean had made a long study of these matters but felt there would be considerable advantage to getting the ideas of the other deans as well. Accordingly, on the motion of Mr. Brandon, seconded by Mr. Flitton, it was unanimously agreed that the president be authorized to write to the deans along the lines suggested.

Suggestions were made that certain other individuals or representatives of groups might meet with the deans, but Mr. Eadie suggested that it was highly desirable that the deans should be left alone throughout their conference as they could readily invite the participation of anyone they desired to have with them. Council agreed with this.

Increase of Fees: At the Finance Committee meeting consideration was given to arrangements which might be made with the provincial associations with which the Institute has agreements with regard to the proposed increase of fees in those provinces. It was agreed that the matter of an increase in fees for the entire Institute was wholly a matter for the Institute to decide but that, subsequent to this decision to increase the fees, negotiations should be carried on with the associations in order to agree upon a basis that would apply to joint members.

It was suggested that a conference might be called between representatives of the five provincial associations and the Institute's Committee on Professional Interests and the Finance Committee to discuss this subject. It was also agreed that it would be desirable to have such a conference before the annual meeting so that the deliberations of the conference could be reported at the annual meeting of the Council.

On the recommendation of the Finance Committee it was unanimously resolved that the Committee on Professional Interests be empowered to negotiate with the provincial associations to the end that such a conference be arranged.

Toronto Branch Junior Section: Consideration had been given by the Finance Committee to a letter from the chairman of the Junior Section of the Toronto Branch requesting Council to donate a sum of $50.00 to the section as the first prize in the papers competition on Students' Night. Also, a letter had been received from Mr. Dibblee, chairman of the Students' Committee on the Toronto executive, in which he recommended that Council make the grant. Mr. Laughlin, as councillor from the Toronto Branch, supported the proposal very strongly.

At the meeting of the Finance Committee attention had been called to the position in which the Institute might find itself in relation to other junior sections if this grant were made. Following a long discussion it had been agreed to recommend to Council that the money be made available as the first prize for the best paper presented at the Toronto Branch Students' Night on January 24th, 1946. This recommendation was approved unanimously by Council.

Committee on Professional Interests: Mr. Stirling, chairman of the Committee on Professional Interests, reported that in November, at the time of the annual meeting of the American Society of Mechanical Engineers, three Institute representatives (R. S. Eadie, G. Lorne Wiggs and Louis Trudel) had met with a similar group from the A.S.M.E. to discuss certain suggested changes in the co-operative agreement between the two societies. These changes had developed in the course of interviews that Mr. Stirling had had in Toronto with representatives of the Ontario Section of the A.S.M.E.

Mr. Eadie reported on the actual meeting and stated that there was very little discussion as to the suggested changes, but that considerable time was spent in determining methods and procedures by which the two organizations could expand their programme of co-operation. He was assured by the A.S.M.E. representatives that the revised agreement would be accepted by their Board of Management at the December meeting. Mr. Stirling now asked the Council of the Institute to approve the revised agreement. Accordingly, it was moved by Mr. Eadie, seconded by Mr. Cunningham, and approved unanimously that the revised agreement be approved.

Mr. Eadie reported that the A.S.M.E. was holding its mid-year meeting in Detroit in the month of June. Past-President Parker (A.S.M.E.) had suggested that this should be a joint meeting with the Institute similar to the one held in Toronto in 1943.

Mr. Eadie also reported that there had been some definite suggestions as to means by which Institute members could carry out activities in Association with the research committees of the A.S.M.E.

Council approved of the suggestions of further co-operation, including the joint meeting.

Establishment and Operation of Branch Sections: The general secretary presented a set of suggested rules governing the establishment and operation of branch sections submitted by the executive of the Winnipeg Branch. He reported that the branch was anxious to establish a Students' Section, and he had informed them that in accordance with the Institute by-laws it would be in order for them to establish such a section, without authority from Council, if the branch executive approved.

Following some discussion, it was unanimously agreed that Council approves of the principle of establishing student sections, and the general secretary was requested to study the rules submitted and make suggestions to the Winnipeg Branch before they are presented to Council for final approval.

New Branch at Trail, B.C.: The general secretary presented a petition signed by fourteen members and one junior of the Institute, requesting the establishment of a new branch to be known as the Kootenay Branch, with headquarters at Trail, B.C., such branch to include the district extending from the Okanagan Valley on the west to the British Columbia border in the east and including the districts known as the West and East Kootenays and the Okanagan Valley. Additional signatures were being secured from members residing outside of the immediate Trail area and these will be forwarded to Headquarters as soon as received.

This area at present forms part of the Vancouver Branch district and the possibility of establishing such a branch had been discussed with the officers of the Vancouver Branch, who had been decidedly of the opinion that there was room for a new branch in that area.

On the motion of Mr. Lindsay, seconded by Mr. Lalonde, it was unanimously resolved that the application for a new branch with headquarters at Trail be accepted and approved.

Conference of British Engineering Societies: The general secretary read a letter signed by the secretaries of the Institutions of Civil, Mechanical and Electrical Engineers (of Great Britain), asking if the Institute would be prepared to participate in a conference of officers of similar societies of Australia, New Zealand, South Africa and India, the representatives to be guests of the three British Institutions. The matter had been discussed with President Fetherstonhaugh, Vice-President Armstrong and President-Elect Hayes, all of whom were very much in favour of it. On the motion of

Mr. Brandon, seconded by Mr. Chadwick, it was unanimously agreed that the Institute should participate in such a conference.

Application through Associations: A letter was presented from the registrar of the Association of Professional Engineers of New Brunswick regarding the recent admission to the Association of a candidate whose application for membership in the Institute had, a short time previously, been declined. Application was now being made for membership in the Institute under the terms of the co-operative agreement. The secretary was directed to discuss the matter further with the Association and report to a later meeting of Council.

ELECTIONS AND TRANSFERS

A number of applications were considered, and the following elections and transfers were effected.

Members

Adams, Edward Campbell, B.Eng., (Elect.), (Nova Scotia Tech. Coll.), design engr., special projects dept., Defence Industries Limited, Montreal, Que.

Barnes, James C., B.A.Sc., M.A.Sc., (Univ. of Toronto), asst. research engr., National Research Council, Ottawa, Ont.

Cochrane, Peter William Fitzgerald, (Aero. Engr., R.C.A.F.), B.Eng., (Mech.), (McGill Univ.), 310 York St., London, Ont.

Croft, Philip James, (London Polytechnic Inst.), elect. engrg. dept., Canada Wire and Cable Co. Ltd., Toronto, Ont.

Daly, Robert Emmet, (Capt., R.C.E.M.E.), B.Eng., (Chem.), (McGill Univ.), prod. engr., Dept. Munitions & Supply, Montreal, Que.

Denton, Herschel Eugene, B.Sc., (Mech.), (New Mex. Coll. A. & M. Arts), consultg. engr., Denton & Spencer, Calgary, Alta.

Donald, Robert Johnston, B.A.Sc., M.A.Sc., (Univ. of British Columbia), asst. chief chemist, Imperial Oil Limited, Sarnia, Ont.

Dyke, Frederick Ian Latham, (Elect. Lt., R.C.N.V.R.), B.Sc., (Elect.), (Queen's Univ.), Calgary, Alta.

Goring, Gilman Rogers, B.Eng., (Mech.), (McGill Univ.), asst. divn. engr., Consolidated Paper Corp., Grand'Mere, Que.

Hanrahan, Frank Edward, (Elect. Lt., R.C.N.V.R.), B. Eng., (Elect.), (N.S. Tech. Coll.), 81 Spadina Ave., Ottawa, Ont.

Hemphill, James Laird, (Ltd. Cmdr. (E), R.C.N.V.R.), B.A.Sc., (Univ. of Toronto), Canadian Joint Staff, Washington, D.C.

Hillary, Bertrand Bristow, M.A., Ph.D., (Univ. of Toronto), mtce. & process engr., Dow Chemical of Canada Ltd., Sarnia, Ont.

Hubble, Charles William, (Works Liaison Officer, R.A.F.), B.Sc., (Civil), (Univ. of Sask.), 17 High St., Cricklade, Wilts., England.

Lundie, William Earl, B.Eng., (Civil), (Univ. of Saskatchewan), mech. supt., British American Oil Co., Ltd., Clarkson, Ont.

McGeachy, Robert Andrew, B.Sc., (Civil Engrg.), (Univ. of Michigan), engr., mech. dept., Imperial Oil Limited, Sarnia, Ont.

McNellis, Ralph Stewart, B.A.Sc., (Mech.), (Univ. of Toronto), contract estimator & project engr., John Inglis Co., Ltd., Toronto, Ont.

Phelps, Charles Stewart, B.A.Sc., (Eng.), (Univ. of Toronto), elect. engr., St. Clair Processing Corp., Sarnia ,Ont.

Pirnie, Malcolm, M.C.E., (Harvard Univ.), Hon. D. Eng., (Rensselaer Poly. Inst.), consultg. engr., 25 West 43rd St., New York 18, N.Y.

Pollard, Roy, (Accrington Tech., England), water rights engr., Dept. of Lands & Forests, Prov. of British Columbia, Nelson, B.C.

Raymond, Jean Maurice, S.B., (Chem.), (Mass. Inst. Tech.), president, Raymond Hardware Ltd., Montreal, Que.

Russell, Andrew, (Cmdr. (E), R.C.N.R.), (Rutherford Tech. Coll., Newcastle, Eng.), Chief Engr., H.M.C. Dockyard, Halifax, N.S.

Russell, Bruce Hamilton, (W/C., R.C.A.F.), B.A.Sc., (Mech.), (Univ. of Toronto), Mount Hope, Ont.

Smith, Osborne Kingdon, (Works Off., R.C.E.), B.A.Sc., (Univ. of Toronto), M.D. No. 1, London, Ont.

Thompson, Howard Bell, B.A.Sc., (Univ. of Toronto), mech. & elect. engr., Imperial Oil Limited, Sarnia, Ont.

Walsh, Frederick Francis, B.A.Sc., (Mech.), (Univ. of Toronto), tech. supervisor, steam & power plant, St. Clair Processing Corp., Sarnia, Ont.

Watt, William C., (Glasgow Tech. School), district chief engr., Dept. of Munitions & Supply, Toronto, Ont.

Juniors

Blayney, James Porter, B.A.Sc., (Mech.), (Univ. of Toronto), jr. engr., engrg. dept., Dow Chemical of Canada, Ltd., Sarnia, Ont.

Boggs, William Brenton, Jr., (Engr., Aero., R.C.A.F.), B.Eng., (Mech.), (McGill Univ.), awaiting discharge, Noranda, Que.

Caron, Maurice Charles (Lt. Elect., R.C.N.V.R.), B.Eng., (Elect.), (McGill Univ.), 83 St. Cyrille Blvd., Quebec, Que.

Casson, Harold Vincent, (Lt. (E), R.C.N.V.R.), B.A.Sc., (Elect.), (Univ. of British Columbia), Seaview Road, Cadboro Bay, B.C.

Craig, William Hardy, B.A.Sc., (Mech.), (Univ. of Toronto), construction supvr., Dow Chemical of Canada Ltd., Sarnia, Ont.

Delage, Jean Baptiste, (Lieut., R.C.S.), B.Sc., (Mining), (Laval Univ.), M.D. No. 4, Montreal, Que.

Livingstone, James George, B.A.Sc., (Univ. of Toronto), engr., Imperial Oil Limited, Sarnia, Ont.

Macdonald, Allan George, (Sub. Lt. Elect., R.C.N.V.R.), R.R. No. 1, Victoria, B.C.

McDiarmaid, Robert Batson, B.Sc., (Elect. Engrg.), (Univ. of Alberta), resident elect. engr., Dept. of Transport, Edmonton, Alta.

McLeod, Cedric William, (Lieut. R.C.E.M.E.), B.Eng., (Mech.), (N.S. Tech. Coll.), (Workshop Officer, 2 H.A.A. Regt., Cdn. Army Overseas).

McRae, William Robertson, B.Sc., (Chem. Engrg.), (Washington State Coll.), mgr. dir., Western Clay & Chem. Supply Co., Ltd., Calgary, Alta.

Rose, Harold Thomas, B. Eng., (N.S. Tech. Coll.), designing dftsman., H. G. Acres & Co., Niagara Falls, Ont.

Tiedje, John Louis, B.A.Sc., M.A.Sc., (Univ. of British Columbia), chem. engr., tech. research dept., Imperial Oil Limited, Sarnia, Ont.

Transferred from the class of Junior to that of Member

Gorowski, Charles S., B.Eng., (Elect.), (Univ. of Manitoba), asst. mgr., sub-contract dept., de Havilland Aircraft, Toronto, Ont.

Transferred from the class of Student to that of Member

Kingsland, Edward N., (F/O., R.C.A.F.), B. Eng., (McGill Univ.), 544 Lansdowne Ave., Westmount, Que.

Vail, Gilbert Frank, (Elect. Lieut., R.C.N.V.R.), B.Eng., (Elect.), (N.S. Tech. Coll.), teacher. Electronic Industrial Control, Nova Scotia Technical College, Halifax, N.S.

Transferred from the class of Student to that of Junior

Auger, Roland Albert Auger, B.A.Sc., C.E., (Ecole Poly.), asst. to mtce. and utilities engrs., Shell Oil Refineries, Montreal East, Que.

Beaudry, Roger Joseph, B.Sc., (Queen's Univ.), on staff Sound Maintenance & Research, National Film Board, Ottawa, Ont.

Dinsmore, Clarence Sherman, B.Sc., (Univ. of Toronto), secretary-treas., and mgr., Grenville Castings Limited, Merrickville, Ont.

Galli, Joseph N., B.Sc., (Civil), (Univ. of Manitoba), H. E. McKeen & Co., Ltd., Montreal, Que.

Kirkwood, John Gordon, B.Sc., (Civil Engrg.), (Univ. of Michigan), welding design engrg. dept., The Canadian Bridge Co., Ltd., Walkerville, Ont.

Livingston, Charles Burton, (Elect. Lt. Cmdr., R.C.N.V.R.), B.A.Sc. (Univ. of Toronto), 160 Glen Road, Toronto, Ont.

MacLeod, Frederick James Gordon, (Constructor Lt., R.C.N.V.R.), B. Eng., (Civil) (McGill Univ.),N.S. H.Q., Ottawa, Ont.

Mitchell, E. Roe, (Capt., R.C.E.M.E.), B.Sc., (Mech.), (Queen's Univ.), 580 McLeod St., Ottawa, Ont.

Pink, John Frederick, (Lieut. Elect., R.C.N.V.R.), B.Sc., (Elect.), (Univ. of Manitoba), engrg., design & drafting, E. I. DuPont de Nemours Co., Wilmington, Del.

Poirier, Leo Joseph, B.Eng., (Civil), (N.S. Tech. Coll.), detailer & designer, Truscon Steel Co. of Canada, Montreal, Que.

Admitted as Students

Hershman, Henry Phillip, B.Eng. (Mech.), (McGill Univ.), jr. engr., United Shipyards Ltd., Montreal, Que.

Lassman, Salomon H., B.Sc., (Elect. Engrg.), (Univ. of New Brunswick), layout dftsman, amphibious vehicles, Dept. of Munitions & Supply.

Mackay, William Donald, dftsman., Canadian National Railways, Prince Rupert, B.C.

McDonald, Rheo Michael, (Univ. of New Brunswick), Fredericton, N.B.

Murray, William A., (St. Francis Xavier Univ.), Box 401, Pictou, N.S.

Pimenoff, Vladimir John, B.Eng., (McGill Univ.), Dept. of National Defence.

Taylor, Leonard Harold, B.A.Sc., (Univ. of British Columbia), 2456-W. 6th Ave., Vancouver, B.C.
Watson, William Scott, B.Sc., (Elect. Engrg.), (Univ. of Manitoba), test engr., English Electric Co. of Can., St. Catharines, Ont.

Students at University of Manitoba

Alexander, Gordon Alan, 27 Digby Ave., Winnipeg, Man.
Anderson, Kristjan Gunnar, Box 218, Univ. of Manitoba, Fort Garry, Man.
Anderson, Robert Gordon, 575 Victor St., Winnipeg, Man.
Arnason, Franklin Marino, 594 Alverstone St., Winnipeg, Man.
Bachynski, Nicholas, Pine Falls, Man.
Caton, A. Richard, 687 Walker Avenue, Winnipeg, Man.
Ellis, Arthur Lyman, Box 204, Univ. of Manitoba, Winnipeg, Man.
Everall, Ronald S., McCreary, Man.
Halter, G. Sydney, 37 Beveridge Block, 802 Main St., Winnipeg, Man.
Harding, Harvey John, 91 Kanata St., Transcona, Man.
Hoffer, Arnold Hyman, Room 28, Cambridge Hotel, Winnipeg, Man.
Karlinsky, Julius, 423 Dufferin Ave., Winnipeg, Man.
Leslie, Walter Alexander Grant, 157 Kenny St., Norwood, Man.
Lundman, Edward Arvid William, 57 Carmen Ave., Winnipeg, Man.
Lytle, Clifford Hunter Britton, 160 Assiniboine Drive, Winnipeg, Man.
Manchul, Edward Donald, Box 292, Rivers, Man.
Martin, Eric Henry, 679½ Jubilee Ave., Winnipeg, Man.
Matthews, William Hollis, 427 Borebank St., Winnipeg, Man.
McCall, Lawrence Victor, 174 Canterbury Place, East Kildonan, Man.
Morton, Francis Lionel, 10 Bryce Apts., Winnipeg, Man.
Ousman, William Douglas, 598 Greenwood Place, Winnipeg, Man.
Peterson, Grant Austin, Box 280, Estevan, Sask.
Presky, Albert G., 492 Powers St., Winnipeg, Man.
Saari, Roy August, 358 Morley Ave., Winnipeg, Man.
Sanderson, Roy Morley, 160 Linden Ave., Winnipeg, Man.
Smith, Donald Bentley, Box 220, University of Manitoba, Winnipeg, Man.
Surtees, Russell Charles, 80 St. Vital Road, St. Vital, Man.
Wong, James Yetow, Y.M.C.A., Vaughan St., Winnipeg, Man.
Worby, Charles Douglas, 409 Princeton Apts., Winnipeg, Man.

Students at University of British Columbia

Andrew, Frederick John, 2116—West—22nd Ave., Vancouver, B.C.
Cheriton, William Ross, 1996 W. 14th Ave., Vancouver, B.C.
Galloway, Leslie Charles, 2060 Comox St., Vancouver, B.C.
Greenaway, Norman Edward, 24 East Boulevard, Eburne, B.C.
Harris, Robert Gordon, 4606 West 11th St., Vancouver, B.C.
Herring, Philip S., 3862 W. 12th Ave., Vancouver, B.C.
Hooley, Roy Francis, 2121 MacDonald St., Vancouver, B.C.
Johannson, Edgar Freeman, 3707 Dunbar, Vancouver, B.C.
Johnson, **Leonard Cecil**, 1066 Oliver St., Victoria, B.C.
Manning, David John, 3234 W. 21st Ave., Vancouver, B.C.
McNaughton, James Hugh, 4583 West 12th Ave., Vancouver, B.C.
Robinson, William George, 828 West 69th Ave., Vancouver, B.C.
Thomson, Thomas Moncrieff, 4340 Locarno Crescent, Vancouver, B.C.

Students at McGill University

Dorey, John David, 540 Cote Saint Antoine Road, Westmount, P.Q.
Galbraith, John Douglas, 1441 Drummond St., Montreal, Que.
Langsner, Lawrence Lyon, 1560 Van Horne Ave., Outremont, Montreal 8, Que.
Livis, Seymour, 1469 Drummond St., Montreal Que.

Students at Nova Scotia Technical College

Breau, Cyril Gerard, 59 Morris St., Halifax, N.S.
Hession, James Fred, 59 Morris St., Halifax, N.S.
Messervey, Donald Forbes, 14 Cherry Street, Halifax, N.S.
Wickwire, Robert Donald Thomas, 56 Edward St., Halifax, N.S.

Students at Queen's University

Bird, Charles Gordon Wright, 162 Earl St., Kingston, Ont.
Carothers, Dave R., 562 Johnson St., Kingston, Ont.
MacVicar, David Campbell, 162 Earl St., Kingston, Ont.
Taylor, Clive Gilbert, 473 Princess St., Kingston, Ont.

Students at University of Toronto

Campbell, David Alexander, 32 Wilfrid Ave., Toronto, Ont.
Illaszewicz, Jerzy, 136½ Beaconsfield Ave., Toronto, Ont.
Paget, John Arthur, 52 College St., Toronto, Ont.
Vandecan, Constant Edward, 557 Huron St., Toronto, Ont.

Students at University of Alberta

Brown, Ray Alexander, 11013—81st Ave., Edmonton, Alta.
Hemstock, Russell Alexander, 11043—90th Ave., Edmonton, Alta.
Olson, Carlton Henry, 10936—87th Ave., Edmonton, Alta.
Shannon, Harold Cecil, 10214—124th St., Edmonton, Alta.
Wetterberg, Donald Carleton, 10803 Whyte Ave., Edmonton, Alta.

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

Alberta

Member

Keith, Leslie Stephens, (Univ. of British Columbia), sr. asst. airways engr., Dept. of Transport, White Horse, Y.T.

New Brunswick

Junior to Member

Ball, Elmer Langdon, B.Eng., (N.S. Tech. Coll.), Dept. of Public Works of Canada, Saint John, N.B.

Nova Scotia

Members

Fournier, Robert Noel, B.Sc., (Engrg. Physics), (Univ. of Saskatchewan), industrial heating section, Canadian General Electric Co., Toronto, Ont.
Thorne, Edward Lefferte Jr., B.Sc., (Civil Engrg.), (N.S. Tech. Coll.), 18 Bloomingdale Terrace, Halifax, N.S.

Quebec

Members

Farquharson, Andrew Gray, B.Sc., (Queen's Univ.), mgr., refining dept., McColl-Frontenac Oil Co. Ltd., Montreal, Que.
Tremblay, Charles, B.A.Sc., C.E., (Ecole Poly.), engr., Quebec Electricity Board, Montreal, Que.

Junior to Member

Benoit, Andre Persillier, B.Eng., (Civil), (McGill Univ.), sales engr., mech. divn., Dominion Rubber Co., Montreal, Que.

Student to Member

Lamb, Hugh, B. Eng., (Civil), (McGill Univ.), (overseas with R.C.A.F.), 1061 Richard Ave., Verdun, Que.
Marcotte, Benoit, B.A.Sc., (Ecole Poly.), Sullivan, Abitibi, Que.
Thibaudeau, Guy, B.A.Sc., C.E. (Ecole Poly.), civil engr., Dept. of Mines, Province of Quebec, Quebec, Que.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their December 1945 copy to headquarters.

On account of difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

Personals

Relatives and friends of members in the active forces are invited to inform the Institute of news items, such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form a basis of personal items in the *Journal*.

News of the Personal Activities of members of the Institute

C. C. Parker, M.E.I.C., has recently entered a consulting practice in Hamilton, Ont., specializing in a structural service to architects and consulting service to municipalities on bridges, grade separation and similar structures.

C. C. Parker, M.E.I.C.

Mr. Parker graduated in civil engineering from the University of Toronto in 1929, following which he spent several years with the Manitoba Bridge and Iron Works Limited in Winnipeg, on the detail and design of steel and reinforced concrete construction. Returning to Toronto in 1931, he spent a year with James, Proctor and Redfern, notably on the design of the high level bridge into Hamilton. Then followed a year in structural research, at the University of Toronto, with a research bursary. Mr. Parker then spent seven years with the Department of Highways of Ontario on the design and field supervision of bridges.

With the beginning of the war and cessation of highway activity, he secured leave of absence to work with the Hamilton Bridge Company Limited as a structural designer. He participated in the design of a number of industrial plants, lock gates, hammerhead cranes, railway bridges and other structures directly and indirectly connected with the war effort, and located throughout Ontario, Quebec and the Maritimes.

A. M. Paull, M.E.I.C., is being released from the R.C.A.F. and is returning to his former position as office engineer with the Department of Public Works, Edmonton, Alta. Mr. Paull served for four years with the Works & Buildings branch of the Air Force, with the rank of squadron leader.

V. S. Thompson, M.E.I.C., who has served overseas as a lieutenant-colonel in the Royal Canadian Engineers, has been engaged by the Department of Reconstruction as chief of the design division, and has taken up his permanent residence in Ottawa.

G. W. F. Ridout-Evans, M.E.I.C., has accepted an appointment with the Department of Reconstruction at Ottawa, Ont. Major Ridout-Evans was mentioned in despatches and won the Military Cross while serving overseas in the Royal Engineers from 1915 to 1919. For the past four years he has been in the Small Arms Ammunition Division of the Inspection Board of United Kingdom and Canada.

L. S. McGregor, M.E.I.C.

L. S. McGregor, M.E.I.C., who recently returned to the Canadian National Railways, after over five years service overseas, has been appointed mechanical inspector in Montreal.

Mr. McGregor joined the Canadian National Railways as office boy in 1926 and became a machinist apprentice two years later. He went to McGill University in 1931 and graduated with the degree of B.Eng. (Mech.) in 1936.

He continued his apprenticeship in the Canadian National Railways shops in the summer months while attending college and completed it in 1937, when he became a machinist. Later in the same year, Mr. McGregor was promoted to assistant foreman, and, in 1939, inspector and transferring to the department of research and development, assistant engineer. Enlisting as a lieutenant with the R.C.E.M.E.'s he attained the rank of lieutenant-colonel and was assistant director of the unit overseas.

A. D. Hogg, M.E.I.C., who until recently was lecturer in mechanical engineering in the Department of Applied Science, University of Alberta, is now employed as assistant research engineer for the Hydro-Electric Power Commission of Ontario in Toronto.

Dr. Otto Holden, M.E.I.C., chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was elected president of the Engineering Alumni Association of the University of Toronto at the 12th triennial reunion, last November.

S. McEachern, M.E.I.C., has recently joined the staff of Ross Engineering of Canada Limited at Montreal as plant manager. He was previously associated with Westeel Products Limited at Montreal.

D. R. McGregor, M.E.I.C., has been discharged with the rank of lieutenant from the R.C.N.V.R. and has returned to his former position in the engineering department of the Canadian General Electric Company in Peterborough, Ont.

D. W. Laird, M.E.I.C., has returned to the staff of the C. D. Howe Company Limited, Port Arthur, Ont., where he was formerly employed as designing engineer prior to his enlistment in the Royal Canadian Engineers. Mr. Laird has been serving as a lieutenant with No. 6 E.S. & W. Company, stationed in Halifax, N.S.

J. P. Leroux, M.E.I.C., has recently been discharged from the Canadian Army after three and a half years' service with the R.C.E. in Canada and abroad. Lieutenant Leroux returned from overseas in July, 1945, where he served in North West Europe with the 3rd Bn. R.C.E. He has now resumed his position with the Department of Transport, Civil Aviation Division, as resident engineer at Montreal. He is presently engaged in soil mechanics investigations for the Montreal (Dorval) Airport in the Soil Mechanics Laboratory at McGill University.

F. R. Barnsley, M.E.I.C., of Canadian General Electric Company has recently been transferred from Peterborough, Ont. to Vancouver, B.C., where he is manager of the supply division.

Dr. Charles Camsell, M.E.I.C., Canadian deputy minister of mines and resources, and a past-president of the Institute, has been awarded the R. B. Bennett Empire Prize of 100 guineas for his paper " Canada's New North ". The paper was read to the Royal Society of Arts last April by Captain W. M. Gilchrist.

R. W. Diamond, M.E.I.C., whose association with the Consolidated Mining and Smelting Company of Canada began in June, 1917, has recently become vice-president and general manager, and a member of the board of directors of that company. Mr. Diamond, who graduated from the University of Toronto in 1913 with the degree of B.A.Sc. in Mining and Metallurgical Engineering, was closely associated with the development of successful processes for the concentration of Rossland and Sullivan mine ores, and with the design, construction and operation of the group of plants built by the company for the production of chemicals and chemical fertilizer at Trail, B.C.

In assuming his new responsibilities, Mr. Diamond fills the vacancy created by the death of S. G. Blaylock, M.E.I.C.,

G. P. Duncan, M.E.I.C., has been released from the R.C.A.F., in which he served as a flying officer, and is at present working as instrument man with the City of Edmonton, Alta.

F. G. Ewens, M.E.I.C., has returned to the University of Toronto as assistant professor of mechanical engineering in the Faculty of Applied Science and Engineering, after five years in Montreal at the head office engineering departments of Canadian Industries Limited and Defence Industries Limited.

W. M. Veitch, M.E.I.C., has returned to his position as city engineer of London, Ontario. He served as district engineer officer of M.D. No. 1, London, with the rank of lieutenant-colonel. Colonel Veitch was twice decorated with the Military Cross while serving overseas with the Canadian Engineers from 1914 to 1919.

Eric E. Wheatley, M.E.I.C., formerly with the Consolidated Paper Corporation Limited, at Grand'Mere, Quebec, has accepted the appointment of professor of mechanical engineering at the University of New Brunswick, Fredericton.

R. H. Ansley, JR.E.I.C., who for nearly four years served as a lieutenant with the Royal Canadian Engineers in Italy, Belgium, Holland and Germany, has recently been released from the Canadian Army and has been employed with the City of Winnipeg Hydro-Electric System at Slave Falls where additional units are being constructed.

Stewart Barkwell, JR.E.I.C., has returned to civilian life and is now employed in design engineering at the Davenport Works of the Canadian General Electric Company Limited, Toronto, Ont. Mr. Barkwell joined the Test Department of this company upon graduation from the University of Manitoba in 1940. He recently obtained his release from the army with the rank of second lieutenant.

Flying Officer R. L. Blackett, JR.E.I.C., has retired from the R.C.A.F. and has accepted a position as junior engineer with the Tropical Oil Company, Barrancabermeja, Colombia, South America.

Raymond LeBel, JR.E.I.C., has recently returned from overseas and, upon being discharged, has resumed his connection with J. M. Eugene Guay, Inc., consulting engineers, Montreal. He served as a lieutenant with the Royal Canadian Engineers in Canada and overseas for the past four years.

Maurice Magnan, JR.E.I.C., has joined the Eagle Pencil Company of Canada Limited, Drummondville, Que. Since his graduation from the Ecole Polytechnique in 1943, he had been employed with the Imperial Oil Company, Sarnia, Ont.

E. N. Parker, JR.E.I.C., has been discharged from the R.C.N.V.R. with the rank of lieutenant (E), and has returned to the Dominion Bridge Company Limited, at Lachine, Que., where he was employed as a mechanical engineer prior to his enlistment.

R. G. Rowan, JR.E.I.C., was released by the Royal Canadian Air Force in September, 1945 and has returned to his former position with the Bell Telephone Company of Canada as an assistant engineer on the staff of the Laurentian District Engineer. He served as a flight lieutenant with number 10 B.R. Squadron in Newfoundland.

E. P. Stephenson, JR.E.I.C., who has served as captain and major with the R.C.E.M.E. on the technical staff at N.D.H.Q. and overseas, has now returned to his former position with the Canadian General Electric Co. Limited at Peterborough, Ontario.

W. M. Brenan, S.E.I.C., is now employed with D. O. Turnbull, consulting engineer, Saint John, N.B. Mr. Brenan has recently been discharged from the Royal Canadian Air Force, with which he has served overseas since 1942. Prior to enlistment he was with Dominion Bridge Company Limited.

C. Brown, S.E.I.C., has resumed his civilian occupation with the Bell Telephone Company at Quebec City, Que. After joining the Royal Canadian Air Force in January, 1942, Mr. Brown served overseas for three years, returning recently to retire with the rank of squadron leader.

W. M. McKie, S.E.I.C., has returned to the Canadian General Electric Company Limited, after overseas service as a flight lieutenant in the Royal Canadian Air Force. Mr. McKie has joined the Switchgear Section, Central Station Division, Apparatus Department, of the company.

Lorne Page, S.E.I.C., is at present doing post-graduate work in physics in the Graduate School at Cornell University in Ithaca, New York.

I. F. Ronalds, S.E.I.C., has recently been discharged with the rank of flight lieutenant from the Royal Canadian Air Force, in which he has been serving since 1942. He graduated from the University of New Brunswick in 1941 and is now employed with the Ontario Hydro-Electric Power Commission at Toronto.

H. G. Roy, S.E.I.C., is now with Commonwealth Plywood Company Limited at Ste. Therese, Quebec.

R. E. Stone, S.E.I.C., has been released from the Royal Canadian Corps of Signals, with which he was serving as a lieutenant, and is now attending the University of Western Ontario, where he is working towards his master's degree in electronics and communications.

A. E. Street, S.E.I.C., is now employed as assistant engineer in the Bridge Engineer's Department of the Canadian National Railway Company in Winnipeg. Mr. Street has recently returned from overseas, where he served as a lieutenant in the Royal Canadian Engineers.

Obituaries

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

S. G. Blaylock, M.E.I.C.

SELWYN GWILLYM BLAYLOCK

"A time like this demands strong minds, great hearts, true faith and ready hands."

So often in studying the history of a section of Canada we find the life story of a man. There are not many places where this is truer than in the Kootenay, British Columbia. The story of Trail and Kimberley and the Consolidated Mining and Smelting Company of Canada Limited is essentially the story of S. G. Blaylock, who died in Trail on November 18th, 1945, at the age of sixty-six, after forty-six years service with one company.

Mr. Blaylock rose within the ranks of the company from assayer to president, and at the time of his death was chairman of the board, having relinquished the presidency but a few months earlier.

He was also vice-president and director of Coast Copper Company Limited, a director of Electrolytic Zinc Process Company, Montana, Buena Vista Mining Company, and the Bank of Montreal.

Mr. Blaylock was born in Paspebiac, Quebec, and attended Bishops College School at Lennoxville. In 1899 he was graduated from McGill in metallurgy.

One of Canada's greatest industries grew up in an obscure part of British Columbia. There were difficulties of finance, power, transportation and refining that beset the industry in its early days, and nothing but the dogged perseverance, the resourcefulness, and the intelligence of its guiding genius could have made it the giant it is today. He would not be beaten—and fortunately so for Canada.

The company's war record is unique. The quantities of metals and chemicals that were produced are staggering. The whole programme was shaped to the needs of the Allies and in his drive to get high production in the materials so precious and so essential to success, Mr. Blaylock spared himself least of any.

In the course of his life he received many honours and recognitions. He was an honorary member of the American Institute of Mining and Metallurgical Engineers, and the Canadian Institute of Mining and Metallurgy, and was president of the latter organization in 1934-35. Twice he was given honorary degrees, and at the time of his death was a member of the Board of Governors of McGill University.

Mr. Blaylock will be sadly missed in many places. It is difficult to imagine Trail without him, but actually Trail will never be without him while the plants of the company continue to operate. Verily it has been said "An institution is but the lengthened shadow of a man". Emerson might well have been writing about this company and this man.

Major Francis Lorn Campbell Bond, D.S.O., M.E.I.C., a prominent figure in railroad circles for many years, died in Montreal, Que., on December 9th, 1945. Born in Montreal on February 21st, 1877, he graduated as a B.Sc. from McGill University in 1898.

Shortly after graduation he entered the service of the Grand Trunk Railway and became assistant engineer in charge of double track in 1901. He worked on the construction of the New York subway in 1902. In the following year he was named resident engineer for the eastern division of the Grand Trunk Railway. Ten years later he was appointed division engineer. He enlisted with the Canadian Army in 1916 and became a major in the battalion of railway troops in France. He was mentioned in dispatches twice and in 1918 he won the Distinguished Service Order.

Returning to Canada after demobilization, Major Bond was appointed chief engineer of the Grand Trunk Railway System and, following amalgamation of the lines comprising the Canadian National Railways, he was appointed regional chief engineer, central region, with headquarters at Toronto. In 1924 he became general superintendent, Montreal district, and twelve years later he was appointed general manager, central region, to which was added the position of vice-president in 1940.

In 1942 he retired after 45 years of service with the railway. Before his retirement he also held the position of managing director of the Montreal Stockyards and Montreal Fruit and Produce Terminal Limited.

Major Bond joined the Institute as a Student in 1898, transferring to Associate Member in 1902 and to Member in 1919.

Chauncey Marsh Goodrich, M.E.I.C., consulting engineer for the Canadian Bridge Company, died on December 9th, 1945, in Windsor, Ont. Born on April 8th, 1875, in Burlington, Vermont, he graduated with honours in 1896 from the University of Vermont with an A.B. degree. During the following year he did post-graduate work in Berlin and Leipzig. In 1898 he received his A.M. degree with honours from Harvard University. Two years later he returned to the University of Vermont and received a B.S. in civil engineering in 1901, and a C.E. in 1903.

After teaching for a term at Williston Seminary, Easthampton, Mass., he worked for a time with the B. & O. Railways. In 1901 he became associated with the Canadian Bridge Company at Walkerville, Ont., as draughtsman. Four years later he became assistant engineer, and in 1909 designing engineer. He was appointed chief engineer in 1927 and at the time of his death he held the position of consulting engineer.

Mr. Goodrich was given leave of absence from the Company from 1917 until 1919 when he served in World War I in the United States Army as officer in charge of technical engineering, design and procurement division. He was head of Board of Contract Review for the division and engineer member Superior Board of Contract Review. He was contracting officer for Board on Engineer Troops and for the Director-General of military railways. He wrote and signed the agreement with France covering the sale of 500 locomotives and 20,000 freight cars. He changed the 1864 equipment which the army had already bought to carry the camions and such loads as the 8" and 9" Howitzer trains.

Mr. Goodrich spent about four years abroad representing Canadian Bridge Company and United States Steel Products, travelling east to Ceylon and west to Australia.

He developed limit design methods in 1909 for transmission towers for the Hydro-Electric Power Commission of Ontario ten years before the method was announced abroad. Several of his patents were assigned to the United States. In all he had about 27 patents.

Mr. Goodrich joined the Institute as an Associate Member in 1907, transferring to Member in 1916.

Captain James Huntington Cranbrook, M.E.I.C., died on September 29th, 1945, in Henderson Memorial Hospital, Henderson, Texas. Born in London, England, on October 4th, 1890, he received his preliminary education at Faribault, Minn., then studied civil engineering at the University of Minnesota.

Captain Cranbrook was associated for several years with companies in the railway and highway fields in both Canada and the United States. In 1936 he joined the United States Steel Corporation. He left the employ of the Company in 1941 to join the Royal Canadian Engineers at Halifax, N.S., as a lieutenant. He supervised the construction of various works under the Department of National Defence, including the Naval Arsenal at Bedford and a number of important Coast Defence Works.

When the United States came into the war in December, 1941, he transferred to the American forces with the rank of captain, his promotion to that rank in the R.C.E. having come through shortly before. In the American forces he served with the air force engineers, first with a construction battalion and later in the organization and installation of air field defences. He retired from military service at the end of 1943 on account of impaired health. During 1944 and 1945 he carried on his engineering work in various locations until a few months ago.

Captain Cranbrook joined the Institute as a Member in 1941.

News of the Branches

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

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

The November general meeting of the Edmonton Branch was held during the general secretary's annual western visit, in the Macdonald Hotel at 6.30 p.m. on November 20th in the form of a dinner meeting. Dr. L. A. Wright showed the sound film "A Harbour Goes to France", and explained that the Institute had wanted to bring the harbour model to Canada so that the profession would realize the outstanding contribution that the British engineers had made to victory in Europe. In the final part of the meeting Dr. Wright discussed Institute activities.

The meeting was conducted by the chairman, F. R. Burfield, who introduced Dr. Wright. A hearty vote of thanks to him was moved by B. W. Pitfield. The attendance was 64.

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Speaking on **Rural Electrification in Alberta** before the Edmonton Branch in the Macdonald Hotel on December 10th, Mr. F. T. Gale, electrical engineer with the Calgary Power Co., foresaw that electricity on the farm will bring a greater advance than did the introduction of the tractor. An extension of electrical power to rural districts, Mr. Gale stated, should raise the level of farm work and increase farm produce.

The situation in Alberta is unique, the speaker claimed. Statistics show that the number of farms electrified in Canada is only 20 per cent. In contrast Denmark has 98 per cent, Sweden 75 per cent, U.S.A. 40 per cent. Canada is behind because the expenses for greater distances between farms is paid for by fewer people. For the same reason there is a marked difference in the percentage across Canada. Ontario has 40 per cent of its farms electrified but Alberta only ½ per cent. The West has a problem of its own.

Three inseparable factors, namely engineering, economics and social conditions must be considered if Alberta is to supply electric power to as many people as possible as cheaply as possible. Associated with the engineering, economic and social factors there are three others; patience, because the programme will require twelve to fifteen years (2/3 of a man-year being required to electrify one farm); hard work, because both the manufacturer and farmer must be made to understand the problem; and finally co-operation, because manufacturers must adapt their products to the farmers' needs and agricultural departments must be prepared to train the farmers to make maximum use of their equipment.

The speaker expected little trouble solving the engineering problems, but hoped we would make our power lines adequate for future extensions, and thus avoid a weakness of United States systems.

He outlined the economic aspect of the problem. The report on a survey of eighteen typical areas in Alberta made under the direction of Professor A. Stewart, University of Alberta, gave the average cost of electrification per farm as $600.00. For further study the Calgary Power Company developed the Olds district which came closest to the average of the typical districts served by the Company. The Canadian Utilities conducted a similar investigation. The results obtained in the Olds area came very close to the estimates and included a contribution from the farmer amounting to $100.00 and a monthly charge of $5.00 covering depreciation, power losses, operating costs and rent of equipment on the farm. Mr. Gale emphasized that the scheme was not practical unless the farmer used electrical appliances in addition to electric lighting.

The distribution of Alberta's population was shown graphically to be related to the colour of the soil and precipitation. The areas of expected population could be estimated without much concern about the frost-free time.

After his address Mr. Gale showed a coloured film entitled " Farm Life in Wartime ", which showed how electrical appliances increased food production on farms in the United States.

The chairman of the meeting was Professor J. W. Porteous. G. H. Milligan introduced Mr. Gale, and E. Nelson proposed a much applauded vote of thanks to the speaker. The meeting adjourned at 9.35 p.m. The dinner attendance was 36.

HALIFAX BRANCH

S. W. Gray, M.E.I.C. - *Secretary-Treasurer*
C. D. Martin, M.E.I.C. - *Branch News Editor*

On October 22nd, 1945, the first dinner meeting for this season was held at the Nova Scotian Hotel.

The attendance was 94, including several senior students of the Nova Scotia Technical College who were guests of the Branch.

We were very fortunate in having as the guest speaker, Mr. Huet Massue, statistical engineer with the Shawinigan Water and Power Company. Mr. Massue has made an intensive study of the Tennessee Valley Authority developments, and he is exceptionally well qualified to give the very instructive illustrated address which he delivered to a most receptive audience.

At the end of his talk a vote of thanks was extended to Mr. Massue.

L. E. Mitchell, chairman, presided at this meeting. It is interesting to note that F. H. Palmer, Canadian Foreign Trade Commissioner, was in the city at the time, and was able to be present.

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The regular monthly dinner meeting of the Halifax Branch was held at the Nova Scotian Hotel, November 22nd, 1945. The attendance, including guests, was 112.

Besides several members of the senior class at the Nova Scotia Technical College, the following were also guests of the Branch.

A. M. Butler,	Mayor of Halifax,
C. A. Fowler,	President of the Nova Scotia Association of Architects,
C. L. Beazley,	Municipal Commissioner for Nova Scotia,
R. D. Hurst,	Secretary of the Regional Reconstruction Council,
A. M. MacKay,	Chairman of the Regional Reconstruction Council,
Ira Macnab,	Chairman of the Civic Planning Committee,
G. L. Dickson,	Moncton, N.B. Regional Vice-President of the E.I.C.

The speaker of the evening was J. L. Gray, Director of Housing Research of the Research and Development Branch, Department of Reconstruction, Ottawa. Mr. Gray and the above guests were introduced by chairman L. E. Mitchell, who also welcomed members of the Association of Architects.

The subject of Mr. Gray's talk was **Research in Connection with Canada's Housing Programme.** He covered the various aspects of housing from the point of view of the elements, and also told of the amount of research being done, and the amount of information available at Ottawa.

Following Mr. Gray's talk a discussion period took place, and judging from this it was quite evident that this subject had aroused considerable interest.

At the end of the meeting C. Scrymgeour moved a vote of thanks to Mr. Gray. This motion was seconded by J. L. Wichwire.

HAMILTON BRANCH

W. E. Brown, M.E.I.C. - *Secretary-Treasurer*
L. C. Sentance, M.E.I.C. - *Branch News Editor*

McMaster University was the scene of the regular monthly meeting of the Hamilton Branch held on October 15th, 1945. Approximately 65 members and guest were present.

N. Eager, branch chairman, opened the meeting; H. J. A. Chambers introduced the speaker of the evening, Mr. J. Nichols, design engineer with the Hamilton Bridge Company who chose as his subject **Steel Nesting Barges.**

Mr. Nichols began with a historical outline of the project of manufacturing steel nesting barges in Canada. By means of lantern slides, the various types of barges which could be fabricated from the basic components were illustrated.

By means of further lantern slides and moving pictures, Mr. Nichols traced the manufacture of the components in the Hamilton Bridge Company plant from raw material to final trial run on the Hamilton Bay.

The mass production of nesting barges involved a very substantial tooling programme. Elaborate but sturdy welding jigs and fixtures were made in quantity. In all cases the fixtures were arranged for maximum accessibility, and minimum clamping time — hydraulic and air clamping arrangements were used throughout.

Both hand welding and automatic welding were used. On long regular seams, several installations of automatic submerged melt welding equipment proved very economical.

All parts were required to be completely interchangeable, and a shop assembly to check such interchangeability was necessary. After completion of this check, barges were dismantled and loaded on flat cars. The nesting feature made it possible to load a complete barge on a single flat car.

In a test performed at a Hamilton marine railway, a crew of ten men with no previous experience unloaded, completely assembled and launched a barge in eight hours.

At the conclusion of a question period, Mr. Nichols was thanked by Norman Eager.

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On Thursday, November 15th, eighty members of the Hamilton Branch and their guests met at McMaster University to hear a most timely dissertation on **Urban Transportation Problems.** H. A. Cooch introduced the speaker of the evening, Mr. Charles E. DeLeuw, consulting engineer and senior partner of the firm of DeLeuw, Cotter & Company, of Chicago, Illinois.

Mr. DeLeuw was eminently qualified to present his topic, having spent the major portion of his professional career on traffic and transportation problems of various kinds, including work in Baltimore, Chicago, Montreal, Los Angeles, St. Louis and Washington, D.C. He has been engaged recently as consultant on the Toronto Subway Project.

While transportation problems have existed for many years, and have received some thought and some remedial action, efforts in general, usually tending to widening of thoroughfares, proved almost completely unsatisfactory. The building of regional highways in past years has done much to help rural areas, but has imposed a tremendous load on the urban streets.

In recent years it has been recognized by transit operators that there are other equally deserving users of the public streets. Fact finding surveys in which the Public Roads Administration of the United States had been a prime mover have been far reaching in scope, and have resulted in great improvements towards safe and expeditious travel. These problems were being solved by grade separation, improved street plannings and rapid transit. The tendency today was towards construction of parkways, or depressed express routes, for fast automobile traffic, unhampered by side streets, stop lights, left turns. In conjunction with such automobile facilities, rapid transit rail traffic may be accommodated between lanes. While this type of express way greatly relieved over-crowding of existing grade level streets, its cost, in the neighbourhood of $3,500,000 per mile, rendered it prohibitive to smaller communities. However, Mr. DeLeuw stated that such express ways had been found practical and very successful for cities of 200,000 and greater population. One of the most successful projects was New York's Parkway System, now comprising almost 100 miles of expressway.

For larger cities, grade separation becomes a necessity, and subways must be used to segregate rail or rapid transit from street level auto and pedestrian traffic. Mr. DeLeuw discussed the Montreal and Toronto Subway projects with which his firm had been connected. A series of slides served to illustrate proposed installations, and furnished data on actual subway and expressway systems in American cities.

At the close of this talk, Mr. DeLeuw answered many questions put by an interested assembly. The modern trend in relation to civic transportation was stated to be toward curb loading, where feasible. The use of motor busses or trackless trolleys was dependent upon local configuration, traffic volume and distances involved.

The operation of a good transit system is one of the easiest ways of minimizing a bad traffic situation. Good transit service encourages the use of the public transportation, private automobiles are left at home and traffic and parking problems reduced.

Mr. DeLeuw considered his views on the parking problem were somewhat radical. In his estimation there was no part in the modern scheme for parking in busy sections. Eventually, he felt, communities such as Hamilton would be forced to provide off-street parking facilities.

At the conclusion of the discussion, Mr. DeLeuw was thanked on behalf of the branch by Chairman Norman Eager.

KINGSTON BRANCH

J. Douglas Lee, Jr.E.I.C. - *Secretary Treasurer*
T. L. Brock, M.E.I.C. - - *Branch News Editor*

A meeting of the Kingston Branch was held in the Old Arts Building, Queen's University, on Friday, November 23rd. The principal speaker was Mr. John L. Long, president of the Association of Professional Engineers of Ontario, who discussed the relation of the engineer to present-day and future social and business problems, and the importance of professional aim on responsibilities to the Engineer. A second speaker was Lieut.-Col. T. M. Medland, personnel consultant and "trouble shooter" for the Association of Professional Engineers of Ontario. Col. Medland told of some of the problems which come before him where he is able to help further the professional standing of the individual engineer, particularly in regard to salaries. A spirited discussion followed the two addresses. Mr. Lang was introduced by Dean Ellis, and the speakers were thanked by J. D. Lee. J. D. Calvin, vice-president of the Branch, acted as chairman. Following the meeting, refreshments were served.

LETHBRIDGE BRANCH

T. O. Neumann, M.E.I.C. - *Secretary-Treasurer*
A. G. Donaldson, M.E.I.C. - *Branch News Editor*

Dinner music, songs and an address on Manchuria featured the annual joint meeting of the Association of Professional Engineers of Alberta and the Lethbridge Branch of the Institute held in the Marquis Hotel on Friday, November 30th, at 6.30.

Head table guests were J. G. Dale of Edmonton, registrar of the Association, A. L. H. Somerville, councillor of the Association and past-chairman of the Lethbridge Branch of the E.I.C., Mr. C. G. Anderson of Claresholm, the guest speaker, J. McMillan of Calgary, president of the Association, P. E. Kirkpatrick, chairman of the Lethbridge Branch of the E.I.C., A. G. Donaldson who introduced the speaker, C. W. Carry of Edmonton, councillor of the Association, L. C. Stevens of Edmonton, vice-president of the Association, and D. A. Hansen of Calgary, councillor of the Association. President McMillan was in the chair.

Other prominent visitors were Messrs. Ben Russel, P. M. Sauder, and Dr. Clarke, councillor.

Dinner music played by Mr. and Mrs. G. Brown and Mr. Henderson added much to the enjoyment of the evening. Mr. Bob Laurence led a hearty sing-song, and excellent solos by Mr. Tom Pizzey and Mr. Ted Laurence were warmly applauded. Mrs. Brown accompanied both soloists.

A one-minute silence was observed in memory of "Bill" Meldrum.

Mr. Donaldson, in introducing the speaker, said Mr. Anderson was a graduate in agriculture of the University of Alberta, and had been a supervisor of forestry and grazing. In 1930 while studying Canadian drought problems, he became interested in Manchuria where similar problems existed. During the war Mr. Anderson served with the R.C.A.F., and had been adjutant on many western stations.

Mr. Anderson had maintained his interest in Manchuria to the present time. His address was followed with great interest as he presented a complete picture of that country, its effect on past and present history, and its potential place in the future, and in the next war.

Until Admiral Perry's visit in 1853, Japan had been an insignificant country. After that time through the influence of the powerful families and the Blue Dragon Society the country embarked on a programme designed to make her a world power. At home she had unlimited cheap labour and abundant electrical power, but many raw materials were lacking. Her agriculture suffered from a deficiency of soil nitrogen.

Japan's army was patterned after the German system, her navy after Britain's, and her industry was copied from the United States. Observers sent to work in America returned and built identical factories, and turned out identical items, without regard for patents or rights.

To obtain raw materials, and allegedly to obtain room for her population, Japan invaded Korea and later Manchuria. At that time Manchuria was similar to Canada, with potential agricultural plains, grazing lands and forests, and the same varieties of climate. Russia had done considerable railroad development, building the Chinese Eastern across central Manchuria, and the South Manchurian to the Laotung peninsula from Harbin. At the southern terminus Port Arthur was built giving Russia an all-year port on the Yellow Sea. Russian development had been arranged with China.

In 1904, seeing a threat in Port Arthur, Japan made her first " Pearl Harbor " attack, and in an undeclared war seized the port and part of Manchuria. By the Treaty of New Hampshire in 1905 Japan was forced by the other great powers to relinquish Manchuria, except for a 99-year lease on the Laotung Peninsula, and the South Manchurian Railroad and its right-of-way. Along this strip the largest coal mine in the world was developed at Fushan near Mukden. A mountain of iron provided another raw material, and oil strata were also found. The S.M.R. began a colonization programme and brought in Chinese farmers, and built up a large agricultural industry. Many grains grown in Canada were produced there, and also the all-important soya bean. The industrial residue of the bean was rich in nitrogen, and was taken to Japan to enrich the soil. Darien was developed as a naval base in preference to Port Arthur.

The industrial centre of Manchuria around Fushan and Mukden was bombed by the Allies because of its importance to Japan's war effort. Realizing the value of Manchuria, and its strategic importance, Russia bided her time and seized the country at the end of the war, and is rumoured to have moved some of the key industries to Siberia.

The advanced development of Siberia and its self-contained resources were described. Pointing out that Siberia was only 32 miles from the closest Alaskan Island, the speaker said he hoped that Canada would not be the Belgium of the next war, when and if it comes.

J. M. Campbell expressed the thanks of those present to Mr. Anderson.

MONTREAL BRANCH

L. A. Duchastel, M.E.I.C. - *Secretary-Treasurer*
Hyman Schwartz, S.E.I.C. - } *Branch News Editors*
Eli Ilovitch, S.E.I.C. - }

A partial lifting of the wartime restrictions made it possible for F/L R. W. Wilton of the R.C.A.F. to explain **Pulse Techniques,** the principles and application of the fundamental circuits used in radar and other electronic timing devices, at a joint meeting which was held on Thursday evening November 15th under the auspices of the Montreal branches of the E.I.C. and Institute of Radio Engineers.

In opening his address the speaker mentioned briefly the difficulties of obtaining and maintaining a perfect sine wave through various stages in a radio circuit. He then discussed the necessity for the theoretical square waves and the reasons why such waves are impossible. However by means of circuits having many stages, known as triggering circuits, it is possible to get wave forms which show up as pips (pyramids) on an oscilliscope screen. The distance between pipe which may be from a quarter to three inches represents the time interval which may be anything from one down to $5x10^{-7}$ seconds according to the setting of the apparatus.

F/L Wilton made the rather complicated subject very clear by the use of a carefully prepared set of slides and specially built demonstration equipment.

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A glimpse of what the general public may expect in the near future from the aeroplane operators was given to the members of this branch at a meeting held on Thursday evening November 22nd, by Mr. Jack Dyment, supervisor and engineer of the T.C.A., Canada's national airline, who spoke on the **Trends of Development of Airline Aircraft.** He told the meeting that the great shortage of aircraft, especially of the heavy four-engined class, could be only partially overcome by converting bombers, and that new machines now on order will be essentially those of prewar design. However they will include many improvements and electronic devices that have been developed during the war.

He then went on to describe some new blind landing devices, based on radar, making it possible for an aircraft to land and take-off without the slightest help from the pilot.

Mr. Dyment devoted the second half of his talk to a discussion of what the airline operators would like incorporated in new designs in order to give better passenger convenience, simplify maintenance and generally to reduce costs, but with increases in safety and speed. He then explained the importance of good landing fields which are provided by local governments.

In concluding his address the speaker predicted that gas turbine jet engines would be in general use within the next ten years but that rocket propulsion was still something for the distant future.

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On Thursday evening November 29th, Mr. Eric C. Molke gave an interesting lecture on the **Application of the Cylinder Shell for Concrete Roofs,** which is

Group of Students and their lady-friends at the first Annual Dance of the Junior Section, Montreal Branch, in the Ritz-Carlton Hotel, Montreal, November 23rd, 1945.

used in various structures requiring large expanses of clear areas such as aircraft hangars, hockey arenas, auditoriums and manufacturing plants.

With the aid of an excellent set of slides Mr. Molke explained the types and essential features of shells for roofs which are mounted on columns as compared to shells for sewers and tunnels which may be considered to have continuous support. He then went on to show the direction and concentration of the stresses in these shells and how the steel reinforcing is distributed.

The speaker then described in considerable detail the methods developed for building concrete hangars on an economical " mass production " scale. This was illustrated by a coloured film taken during the construction of several large projects in the United States.

In concluding his address Mr. Molke pointed out the advantages of such concrete structures and especially their resistance to fire.

A discussion which was presided over by S. R. Banks followed the meeting.

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The **Fundamentals of Gas Turbines** was explained to the members of the Montreal branches of the A.I.E.E. and of the E.I.C. by Mr. Dale D. Streid of the General Electric Company, Lynn, Mass., at a joint meeting held on December 6th.

In discussing the basic features of the turbine jet, the speaker showed that the engine could be considered to contain three sections viz. the compressor, the burner, and the turbine which drives the compressor, and in some designs a propeller through suitable gear reducers. He then pointed out that the engine contains only one major moving part which rotates at high speed. It is the simplicity of the engine and the absence of oscillating parts that give this type of engine great smoothness and the highest H.P. per pound weight.

A description of the heat equations and entropy curves used in the design and test of these engines was given by the speaker. Although the engine consumes twice the weight of fuel compared to a standard engine it is still economical since it burns kerosene and is only a third as heavy. And further it is the only system yet devised to give aircraft speeds over 600 m.p.h. at altitudes over 40 thousand feet.

After the lecture a thirty-minute coloured film entitled " Report on Jet Propulsion ", was presented which showed the Bell Aircomets (P-59) in flight. These machines are the first jet-propelled planes built in the United States and were used for experimental and training purposes. Performance data on these machines are still restricted.

Following the film there was a lively discussion which might have gone on until midnight had not the late hour compelled the chairman, Mr. Dyment, to adjourn the meeting.

PETERBOROUGH BRANCH

E. Whiteley, m.e.i.c. - *Secretary-Treasurer*
J. C. Allan, m.e.i.c. - *Branch News Editor*

A paper on the **Manufacture of Heavy Aircraft** was presented by Mr. David Boyd, general manager, Victory Aircraft Limited before the November 20th meeting of the Branch. In his introduction, Mr. Boyd gave a brief description of the Lancaster Bomber, which was the subject of the paper, and which dropped more tonnage of destruction on Germany than any other type of aircraft. The Lancaster is an all-metal midwing heavy bomber of the following dimensions and performance:

Span	102′ 0″
Length	69′ 6″
Gross Weight	63,000 lbs.
Empty Weight	36,000 lbs.
Rated Bomb Load	18,000 lbs.
Cruising Speed	200 m.p.h.
Max. Speed	300 m.p.h.
Extreme Range	3,000 miles

The Canadian " Lancaster " programme was conceived in the dark days of August 1941 when the Germans were rolling eastward across Russia, but it was not until January 1942 that the official instructions to proceed with 300 bombers were issued to the National Steel Car Corporation.

Mr. Boyd outlined the procedure followed for the project as a whole beginning with photographic negatives of drawings which arrived from England in February, 1942. Because of the bombing of England and submarine activity, the aircraft was to be fully Canadian. However all of the 23 major components had to be completely interchangeable with British Lancasters wherever produced.

The extent of the problem may be better realized when it is known that over 30,000 drawings were involved, and there are 31,000 different fabricated parts not including bolts, nuts, rivets or free issue equipment.

Methods peculiarly adapted to aircraft manufacture were stressed. These included prototype fabrication, lofting and the use of rubber presses. The engineering and associated work involved over 2,000,000 man hours quite exclusive of tool and jig building. Sixteen thousand, five hundred and ninety-two tools were made, including those made obsolete, due to modifications. The largest tool was 30 ft. wide, 100 ft. long, and 5 ft. high. It incorporated two radial drills, and 18 drills that had a diameter of 1½ in.

There were 276 Canadian modifications and 1,303 English modifications which together represented a drawing change every 12 minutes of every working day.

Delays incidental to the differences between British and Canadian Standards for screw threads, etc., and methods of preparing material specifications were described, as were delays over secret "proprietory materials".

Mr. Boyd urged that steps be taken to make certain that data on British standards and materials be readily available in Canada at all times. The advantages of much wider standardization between Britain and America were also discussed.

The paper was illustrated throughout by lantern slides.

A lively question and discussion period followed the presentation of the paper. W. T. Fanjoy expressed the thanks of the meeting to Mr. Boyd.

SAGUENAY BRANCH

H. R. Fee, M.E.I.C. - *Secretary-Treasurer*

On November 21st Mr. D. J. O. Barry, of the Aluminum Company of Canada, Limited, Shipshaw, Que., addressed the Saguenay Branch on the subject **Sailplanes; Their Construction and Operation.**

Mr. Barry pointed out that in soaring an elevation higher than that of the starting point was attained, while in gliding the altitude decreased from the starting point. He stated that gliders are primary trainers and are inexpensive and inefficient machines, consisting merely of a truss carrying controls and a supporting surface. Sailplanes are expensive but efficient aircraft and are classified as secondary, intermediate, and high performance, in order of efficiency.

By means of slides the speaker traced the development of modern gliding in Germany subsequent to World War I, and then on the North American continent, particularly in Canada.

Another series of slides depicted the various steps involved in the construction of a sailplane, and a short motion picture was shown picturing gliders in action at Elmira, New York.

Mr. Barry had assembled, and displayed in the lecture room, his own type H-17 sailplane, which was inspected with interest. This sailplane was built by the speaker and two partners, Squadron Leader A. A. Reid, and Capt. Alex Ross.

A vote of thanks on behalf of the Branch was moved by B. L. Davis.

SAINT JOHN BRANCH

E. L. Ball, Jr.E.I.C. - *Secretary-Treasurer*
I. O. Cass, M.E.I.C. - *Branch News Editor*

On Tuesday, October 30th, a dinner meeting was held at the Admiral Beatty Hotel at 6.30 p.m. Mr. Huet Massue, statistical engineer, Shawinigan Water and Power Company, Montreal, was guest speaker (while on tour of the Maritimes). The subject of his address was **A Factual Analysis of the Tennessee Valley Authority.** J. M. Lamb, chairman, presided at the meeting.

A vote of thanks was extended to the speaker by G. G. Murdock, and seconded by R. M. Richardson who expressed his appreciation of Mr. Massue's illustrated lecture on the relative merits of private and public enterprise. The films shown were: "Curves of Colour" and "History of X-Ray". The total attendance was 51.

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A dinner meeting at which H. W. Hole, manager of the New Brunswick Gas and Oil Fields Limited was the guest speaker, was held on Friday, November 16th, at the Admiral Beatty Hotel. The subject of the address was **The Formation and Development of Stoney Creek Oil and Gas Field, Albert County, New Brunswick.**

Mr. Hole spoke of the value of oil and its products to the engineer, giving details of gas and oil exploration in New Brunswick. He told how the Albert County field was formed, giving interesting analogies to other gas and oil fields in North America. He also dealt with the exploration and operation of the Stoney Creek field and told of modern methods of geological survey now being used there. The address was illustrated by slides.

Major W. B. Akerley, vice-chairman, presided in the absence of Chairman J. M. Lamb. R. M. Richardson and A. A. Turnbull moved and seconded a vote of thanks to the speaker.

Three moving pictures were shown at the meeting: "Getting out the Coal", "Highway North", "10,000 Feet Deep". The attendance was 58.

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At a dinner meeting on December 6th at the Admiral Beatty Hotel, John Flood presented a paper which was written by an eminent British engineer and issued under the Port of London authority. The paper, illustrated by slides, dealt with the history and development, types of cargo, loading equipment, and other features of the immense port facilities which make London the commercial centre of the world. The meeting was presided over by Chairman J. M. Lamb.

The total attendance was 59. The Saint John Branch has enjoyed a marked increase in attendance over preceding years due largely to an increase of Branch Affiliates.

QUEBEC BRANCH

Leo Roy, M.E.I.C. - *Secretary-Treasurer*

On November 19th, 1945, in the Amphitheatre of the Faculty of Science, Laval University, Mr. Marcel Laflamme, lighting expert of the Canadian General Electric, gave a talk before an audience of 115. The subject was **What's New in Light Sources.**

The meeting was under the chairmanship of J. O. Martineau. The speaker was presented by J. U. Jacques.

Mr. Laflamme talked on fluorescent lamps, including " circline " Slimline Germicide and the most recent development on cold cathode and instant start lamps. Numerous questions were answered by the speaker who was thanked by G. Sarault.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

A.S.T.M. Methods of Chemical Analysis of Metals, 1943:
Recommended practices for Apparatus and Reagents, Analytical Procedures for Ferrous and Non-Ferrous Metals, Spectrochemical Analysis Methods.
Philadelphia, American Society for Testing Materials, 1943. 6 x 9½ in., 323 pp., $2.50.

PROCEEDINGS, TRANSACTIONS

Eno Foundation for Highway Traffic Control, Inc:
Highway Traffic Conference Proceedings, 1945.

North East Coast Institution of Engineers and Shipbuilders:
Transactions, Vol. 61, 1945.

ANNUAL REPORTS, YEARBOOKS, ETC.

American Society for Testing Materials:
Year Book, 1945.

Anglo-American Caribbean Commission:
Report to the Governments of the United States and Great Britain for the Year 1944.

Canada. Department of Labour:
Annuol Report, 1944-45.

Carnegie Corporation of New York:
Annual Report, 1945.

McGill University:
Annual Report, 1944-45.

Quebec (Prov.). Department of Mines:
Mining Industry of the Province of Quebec in 1943.

United Nations Relief and Rehabilitation Administration:
Report of the Director General to the Council for the Period 15 September 1944 to 31 December 1944;
1 January 1945 to 31 March 1945. Washington, 1945.

TECHNICAL BULLETINS, ETC.

American Society for Testing Materials:
Preprints 1945:—*No. 4—Report of Committee A-5 on Corrosion of Iron and Steel.—No. 22—Effect of Combined Stresses on the Mechanical Properties of Steels Between Room Temperature and-188 C. by D. J. McAdam, Jr., G. W. Geil, and R. W. Mebs.—No. 28—Sulfur Print Method for the Study of Crack Growth in the Corrosion—Fatigue of Metals, by R. C. Brumfield.—No. 49—Comparison of Absorption and Soundness Tests on Maine Sands, by Andrew Adams and Horace A. Pratt.—No. 63—Report of Committee D-13 on Textile Materials.—No. 72—Fatigue Tests of a Laminated Mitscherlich-Paper Plastic, by William N. Findley.*

American Standards Association:
American Standard Building Requirements—A59.1-1945-Reinforced Gypsum Concrete.

Canada. Department of Mines and Resources. Dominion Water and Power Bureau:
Water Resources Paper No. 88—*Surface Water Supply of Canada, Arctic and Western Hudson Bay Drainage . . . Climatic Years 1939-40 and 1940-41. Ottawa, 1945.*

Canadian Standards Association:
B51—1945—Canadian Regulations for the Construction and Inspection of Boilers and Pressure Vessels, 2d ed. Ottawa, 1945.

Codes of Practice Committee:
British Standard Code of Practice—CP(B)502—Code of Functional Requirements of Buildings—Chapter VII—Services.

Electrochemical Society:
Preprints:—*88-12—Electric Steel Making in the Arc Furnace, by Conrad Wissmann.—88-13—Some Thoughts on Experimental Electric Arc Furnace Smelting, H. S. Newhall.—88-14—Acetylene Polymer from Silent Discharge Reactions with Hydrogen Halides, George Glockler and Alvin Walz.—88-15—Binary Alloys of Indium and Tin, Colin G. Fink, Eric R. Jette, Sigmund Katz and Frank J. Schnettler.—88-16—Porous Carbon Electrodes, N. M. Winslow.—88-17—Electric Induction Steel "E.I.S.", Frank T. Chestnut.—88-18—Influence of Structure and Strain in a Metal Cathode on the Electrolytic Reduction of Nitrobenzene to Aniline, Dushyant Narasingasa Solanki.—88-19—Use of Zirconium in the Vacuum Tube, Alfred N. Rogers.—88-20—Thermal Engineer's View of an Arc Furnace.—Survey of Some Heat Problems in Arc Furnaces, Victor Paschkis. 88-21—Thermodynamic Study of the Tin-Antimony System, Rudolph O. Frantik and Hugh J. McDonald.—88-22—Thermodynamic Study of the Tin-Silver System, R. O. Franktik and H. J. McDonald.*

Forest Research Institute, Dehra Dun:
Indian Forest Leaflet No. 79—1945 (*Utilization*)—*Laminated Skis.*

Ingeniörs Vetenskaps Akademien (Royal Swedish Institute for Engineering Research):
Handlingar (Proceedings)—*Nr 156, 1940—Sakerhetsproblemet i byggnadskonsten, Walter Knellman och Georg Wastlund,—Nr 157, 1941—Kinetics of the Order—Disorder Transformation*

in Cuau, O. Kallback, J. Nystrom and G. Borelius.—Nr 158, 1941—Wind Effect on Lakes and Rivers, B. Hellstrom.—Nr 159, 1941—Fernwirkbetrieb in Stromversorgungsnetzen, von Hakan Sterky.—Nr 160, 1941— Krypgransbestamning hos Stal, Gunnar Wallgren.—Nr 161, 1941—Hallfasthetsegenskaper hos Svejskt Furuvirke Utan Kvistar och Defekter, Bertil Thunell.—Nr 162, 1942—Die Stochiometrie des Fichtenlignins, von Bror Holmberg und Nils Gralen.—Nr 163, 1942—Undersokningar over Rostning av Jarnplat i Vatten och Bensin, Johan Morsing.—Nr 164, 1942—Om Barverkan vid Tunna Cylindriska Skal och Karlvaggar, Folke K. G. Odqvist.—Nr 165, 1942—Untersuchungen uber Nitrocellulose, von Carl Kullgren.—Nr 166, 1942—Varmegjennomgang i Ammoniakkfordamper med $CaCl_2$ Lake, A. Watzinger og G. Lorentzen.—Nr 167, 1943—Byggnadsteknisk Varmeekonomi, Axel Eriksson.—Nr 168, 1943—Arbetsledning och Personurval, Rudolf Anderberg och Gunnar Westerlund.—Nr 169, 1943—Thermal Investigations on Constitution and Ageing of Aluminium-Copper Alloys with Low Copper Content, G. Borelius, J. Andersson and K. Gullberg.—Nr 170, 1943—Metod att Direckt i Marken Bestamma Jordlagrens Skarhallfasthet, Walter Kjellman.—Nr 171, 1943—Om Destillat fran Trakolning, Nils Hellstrom.—Nr 172, 1943—Geokemiska Studier Over Grangesbergsfaltets Jarnmalmer, Sture Landergren.—Nr 173, 1943—Om Lindens Olja, Allan Dahlen.—Nr 174, 1943—Drehungsvorgange und Gebundene Kippung bei Geraden, Doppelsymmetrischen I-Tragern, Henrik Nylander.—Nr 175, 1943—Über die Bestimmung von a-Zellulose, Hilding Tyden.—Nr 176, 1943—Der Schwarzschildexponent bei Entwicklungspapieren, Helmer Backstrom and Heinz Gordon.—Nr 177, 1944—Investigation of the Reaction Between Ligninsulfonic Acid Compounds and Hide Protein, K. H. Gustavson.—Nr 178, 1945 Measuring Stresses and Deformations in Solid Materials, Nils Hast.—Nr 179, 1945—Studier Rorande Jonbytande Fasta Amnen, Olof Samuelson.—Nr 180, 1945—Skifferundersokningar VII, Bror Holmberg.—Nr 181, 1945—Das Rosten von Intermittierend in Salzlosungen Eingetauchten Eisenproben, F. Steckel.—Nr 182, 1945—Uber die Bestimmung der Spannungen und Formanderungen von Holzbalken mit Rechteckigem (Querschnitt, Arvo Ylinen.—Nr 183, 1945—Yields and Characteristics of Charcoal Produced at Different Temperatures, Allan Wetterholm.—Nr 184, 1945—On the Deflection Theory of Suspension Bridges, Sven Olof Asplund.

Instituto Nacional de Tecnologia:

Bulletins: *No. 79, 1942—Ensaios Estaticos de Madeiras em Dimensoes Estruturais, Hugo Cardoso da Silva.—No. 80, 1943—O Que Deve Ser O Ensino de Enginharia No Brasil, Francisco Lessa and others.—No. 85, 1943—O Emprego de Terpenos de Oleo Citricos Como Solventes, Waldemar Raoul.—No. 89, 1943—Abonos Familiares, 2d ed., Paulo Sa.—No. 90. 1944—Carvao Petroleo, Sal-Gema e Enxofre, S. Froes Abreu.—No. 91, 1944—Reflexao, Luminosa, Aguinaldo Barcellos.—No. 91, 1944—A Estatistica Na Technologia, Paulo Sa.*

Joint General Committee of Edison Electric Institute and Bell Telephone System:

Reports on Physical Relations Between Electric Supply and Communication Systems, Reissued July 1945.

Joint Committee on Plant Coordination of the Edison Electric Institute and the Bell Telephone System:

Report on Joint Pole Practices for Supply and Communication Circuits, 1945.

PAMPHLETS

Canada and International Cartels; *an Inquiry into the Nature and Effects of International Cartels and other Trade Combinations, Report of Commissioner, Combines Investigation Act. Ottawa, 1945.*

Consulting Chemist and Your Business:

N.Y., Foster D. Snell, Inc.

Contractors' Pump Manual:

Wash., Associated General Contractors of America, Inc.

Development and Welfare in the West Indies, 1943-44:

Lond., H.M.S.O., 1945 (Colonial 189).

Dimensional Coordination:

M. W. Adams and Prentice Bradley. (Reprinted from the Journal of the American Chemical Society, Vol. 28, No. 8, August 1945.)

Discharge of Saturated Water Through Nozzles:

R. S. Silver and J. A. Mitchell. North-East Coast Institution of Engineers and Shipbuilders, November, 1945.

Farming in Canada:

Duncan Marshall. Brantford, Ont., Cockshutt Plow Co. Ltd., 1945.

Power Behind Their Wings; *An Account of the Part Played by Sir Henry Royce and the Rolls-Royce Engineers in the Development of the in-line Liquid-Cooled Aero-Engine in Great Britain.*

Quality Control Chart Technique when Manufacturing to a Specification:

B. P. Dudding and W. J. Jennett. Lond., General Electric Co., 1944.

Some Facts about the Sugar Research Foundation, Inc. and its Prize Program:

N.Y., Sugar Research Foundation, Inc., 1945.

What the Factory Worker Really Thinks about Wages and Hours, Strikes, Full Employment, and Veterans:

Reprinted from, Factory Management and Maintenance, December 1945.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

CANADA YEAR BOOK 1945:

Dominion Bureau of Statistics. Ottawa, King's Printer, 1945. $2.00.

The present edition continues the policy of giving such space as can be spared to feature articles of special importance. Such articles give additional meaning and substance to the purely statistical and analytical material that constitutes the basic chapter material.

Among the special articles appearing in the present edition are: Physical Geography of the Canadian Eastern Arctic, Canada's Growth in External Status and Canada's Part in the Relief and Rehabilitation of the Occupied Territories, Canadian Oil Production, Changes in Canadian Manufacturing Production from Peace to War, International Air Conferences, The Wartime Role of the Steam Railways in Canada, Canada's Northern Airfields, the Democratic Functioning of the Press, and the Activities of the Wartime Prices and Trade Board in Controlling Prices, Rents and Supplies.

In addition to the Special Articles, the regular chapter material has undergone thorough-going revision to reflect latest developments.

Although the statistical lag is necessarily such that for most chapters the record still lies in the period before V-E Day, yet the reader is kept abreast of developments by up-to-date textual analyses and discussions. Where statistics of current operations have been compiled even on a preliminary basis, such as in the case of Family Allowances, these are included.

A five-year review of manufacturing developments for war needs serves as general background for the Manufactures Chapter and places in proper perspective the industrial achievements and contributions of the Dominion to Victory.

The External Trade Chapter has been very considerably reorganized. The extended general review at the opening of the Chapter draws attention to the influences that will affect post-war world trade and Canada's relation to them.—Statistics of External Commodity Trade—the series of detailed tabulations of principal imports and exports that, because of wartime restrictions, could not be published from 1942 to 1944, is now reinstated from the point where they were previously dropped.

The Chapter on Internal Trade contains several new features. The wartime controls affecting distribution and trade are explained. In Part II a section on the Consumption of Foods is given. The final results of the Census of Merchandising and Service Establishments as derived from the Census of 1941 are given in this Chapter.

The chapters dealing with primary resources have been brought up-to-date and attention is directed to all major trends.

A new section explaining the Manpower and Selective Service organization is introduced into the Labour Chapter.

It has been found possible to include more than the usual number of maps and charts in this volume.

By a special concession, a limited number of paper-bound copies have been set aside for ministers of religion, bona fide students and school teachers, who may obtain such copies at the nominal price of $1.00 each. Application with remittance for special copies must be forwarded to the Dominion Statistician, Dominion Bureau of Statistics, Ottawa.

The Canada Year Book (Cloth-Bound Edition) is held for sale by the King's Printer, Ottawa, at $2.00 a copy.

Remittance should be made by money order, postal note or accepted cheque payable to the Receiver General of Canada.

CONTRACTORS' PUMP MANUAL:

Wash., Associated General Contractors of America, Inc., 1945. 39 pp., illus. $0.50.

This manual was designed to supply information on portable pumps and guidance to pump users in the construction, mining, industrial and other fields. Based on the experience of manufacturers regarding the characteristics of the several types of portable pumps, the manual discusses the selection of the proper kind and size of pump for the particular water-moving job at hand, and the correct operation of the pump, together with its maintenance and repair. Four types of pumps are presented—self-priming centrifugal; diaphragms; well-point; road pumps. In each case the pumps are described and their particular advantages and limitations outlined. A pump selection table is included to serve as a guide in the choice of the kind of pump which can be most advantageously applied to the job to be done.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

ACIERS à OUTILS

By A. Michel. Dunod, Paris, 1944. 246 pp., illus., diagrs., charts, tables, 9½ x 6 in., paper, 245 frs.

This treatise on tool steels describes the different types, covering constitution, structure, properties, heat treatment, etc., In addition to the steels and steel alloys whose principal constitutent is iron, the book also deals briefly with stellite, the iron-cobalt-tungsten alloy (50% iron) and the metal carbides. The final chapter discusses temperature measurement.

ADVANCING FRONTS in CHEMISTRY, Vol. 1—High Polymers.

Edited by S. B. Twiss. Reinhold Publishing Corp., New York, 1945. 196 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $4.00.

A group of ten lectures is presented giving a logical development of the recent chemistry of high polymers. The first two chapters contain elementary information on the relation between structure and properties. Chapter 3 covers applications of catalysis to important hydocarbon reactions. Chapters 4 and 5 give a review of evidence for the free radical mechanism of addition polymerization. Chapters 6 and 7 discuss the importance of chain length and size distribution. Chapters 8, 9 and 10 deal with further aspects of the nature and properties of chain polymers, with special treatment of textile fibers.

CHEMICAL CONSTITUTENTS of PETROLEUM.

By A. N. Sachanen. Reinhold Publishing Corp., New York, 1945. 451 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth $8.50.

This volume gives a detailed description of the latest developments in methods for separating the many constituents of petroleum, covering both theory and practice. A considerable part of the book is devoted to individual hydrocarbons and compounds as well as to the methods of separation and identification. The separate chapters deal with petroleum gases and natural gasoline, physical and chemical methods of determining hydrocarbons in distillates, hydrocarbons of straight-run and synthetic distillates, petroleum wax, oxygen compounds, sulphur and nitrogen compounds, resins and asphaltic products, and classification of crude oils. Several hundred literature references are provided for further study.

COLLECTED PAPERS on METALLURGICAL ANALYSIS by the SPECTROGRAPH.

Edited by D. M. Smith. British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1, 1945. 162 pp., illus., diagrs., charts, tables, 10 x 6 in., cloth, 21s.

The thirteen papers included in this collection are grouped under the following headings: processing and calibration of the photographic plate; analysis of aluminum and aluminum alloys; analysis of lead and lead alloys; analysis of zinc alloys; analysis of copper alloys; analysis of platinum. The text material is supplemented extensively by tables and diagrams.

ELECTROLYTIC CAPACITOR.

By A. M. Georgiev. Murray Hill Books, Technical Division, New York and Toronto, 1945. 191 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $3.00.

The author's primary objective is to describe the design, construction, manufacture, function and testing of dry and wet electrolytic capacitors, to explain the operating characteristics of various types, and to indicate both their useful applications and their limitations. He discusses briefly electrolytic capacitors versus non-electrolytic, and gives some consideration to causes and detection of defects and methods of emergency repairs. A glossary, a bibliograpny and a list of patents are appended.

HANDBOOK of NONFERROUS METALLURGY, Principles and Processes.

Prepared by a Staff of Specialists; D. M. Liddell, Editor-in-chief. 2 edit. McGraw-Hill Book Co., New York and London, 1945. 656 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $6.50.

Volume I of this comprehensive two-volume handbook deals mainly with general principles and processes. Separate chapters, written by authorities in the field, deal with those operations, apparatus and methods fundamental to all branches of nonferrous metallurgy. Sample chapter headings are: crushing and grinding; classification; filtration; roasting and sintering; metallurgical fuels; refractories; power plant and accessories; and the electric furnace. There are also chapters on plant layout, materials of metallurgical construction, and applied electrochemistry.

MACHINISTS' AND DRAFTSMEN'S HANDBOOK

By A. M. Wagener and H. R. Arthur. D. Van Nostrand Co., New York, 1945. 662 pp., illus., diagrs., charts, tables. 8 x 5¼ in., fabrikoid, $4.50.

The beginning chapters of this reference work deal chiefly with geometrical and trigonometrical constructions and calculations. Basic information on drills, threads, spur gearing, milling, speeds and feeds, and cutting tools is next presented. A considerable amount of tabulated information on the composition, heat treatment, etc., of important metals and alloys is followed by substantial chapters discussing mechanics, logarithms and the strength of materials. Tables of weights and measures are included.

MANUAL of FIREMANSHIP, a Survey of the Science of Firefighting, Part 6A, Practical Firemanship—I.

His Majesty's Stationery Office, London, 1945. 249 pp., illus., diagrs., tables, 8¼ x 5½ in., paper, (obtainable from British Information Services, 30 Rockefeller Plaza, New York, $0.75).

Practical methods of dealing with fires in ordinary city buildings are described in this recent volume of a series on firefighting. Methods of entry, use of equipment, methods of rescue, ventilation at fires and salvage procedure are covered. Useful knots and slings are described, and there is a special chapter devoted to the proper organization and handling of men and equipment for efficient fire control.

NETWORK ANALYSIS and FEEDBACK AMPLIFIER DESIGN.

By H. W. Bode. D. Van Nostrand Co., New York, 1945. 551 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $7.50.

Originally written as an informal mimeographed text exclusively on the design of feedback amplifiers, this book now includes an extensive preliminary development of electrical network theory as well. It now also covers non-feedback amplifiers and miscellaneous transmission problems arising in wide band systems generally. On the other hand, transmission line and filter theory are omitted. Design information for amplifiers used as repeaters in long distance telephone systems is particularly exact.

PRINCIPLES of INDUSTRIAL PROCESS CONTROL

By D. P. Eckman. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 237 pp., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.50.

The purpose of this book is to treat, in a logical manner, the important laws of operation of industrial automatic control systems and to provide a practical background of theory. It presents a comprehensive treatment of measuring characteristics of controllers, controller characteristics, the effect of process load changes, the effect of valve characteristics, and correlated or multiple control systems. The principles that apply to the operation of a process when under automatic control are emphasized.

NOTICE

Bank, Customs, 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.

(*Continued on page 62*)

PRELIMINARY NOTICE

for Applications for Admission and for Transfer

December 29th, 1945.

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 be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examination of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations or Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiner that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall nor remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty seven years, 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 attainment 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

BARDSLEY—LEONARD WALTER. Capt., E.M.E., Canadian Army Overseas. Born at Saint John, N.B., July 28th, 1920. Educ.: B.Eng., (Elect.) McGill Univ., 1943; 1938-39, (summers), engr.'s asst., engaged on Ford plant constrn., Saint John, N.B., with Carter, Hall, Aldinger Constrn. Co.; 1941 (summer), chemist, Port Royal Pulp & Paper Co., Saint John; 1944-45, with Cdn. Army Overseas, as Capt. E.M.E., (Telecom.); at present working on elect. traction with English Electric Co., Bradford, Yorkshire, Eng., having been granted a six months leave of absence by the Army, 15 Linden Ave., Bradford, Yorkshire, England.

References: E. V. Christie, C. A. Davidson, R. DeL. French, E. Brown, J. J. O'Neill, A. R. Roberts.

BIGNELL—FREDERICK REGINALD, of Nitro, Que. Born at Quebec City, Que., April 11th, 1906. Educ.: Montreal Tech. School (nights), 1933-35; 1921-28, foreman constrn., genl. constrn. power plants, steam boilers, engine erection and operation, Atwood Ltd.; 1928-29, jr. engr., C.N.S.; 1930, (8 mos.), erector, Dominion Engineering Co.; 1930, (4 mos.), genl. foreman, erection, Canadian Foster-Wheeler Co.; 1933-37, shift engr., Shell Oil Co., Ltd.; 1937, shift engr., McColl-Frontenac Oil Co.; 1937-38, asst. to chief engr., Ste. Anne Paper Co.; 1938-39, shift engr., Northern Elect. Co. Ltd.; 1939-41, plant engr., Carnation Co. Ltd.; 1941, chief engr., steam plant, Canada & Dominion Sugar; 1941 to date, supt., light, heat & power dept., also, plant fire marshall, responsible for full time fire brigade and plant fire protection, de Salaberry Works, Defence Industries Ltd., Nitro, Que. (Applying for admission as Affiliate).

References: I. R. Tait, H. C. Karn, C. R. Bown, K. H. Bjerring.

BUSBY—ARTHUR HENRY WILSON, of Trail, B.C. Born at Birmingham, Eng., April 16th, 1900. B.Sc., (Mining Engrg.), Univ. of Birmingham, 1923; R.P.E., British Columbia; 1915-19, apprentice (not articled due to war), General Elect. Co., Witton, Eng.; 1918-19, W-T Observer, Royal Air Force; 1919-23, vacation work at various power plants and mines while at univ.; 1923-24, (6 mos.), elect. research engr., investigating elect. exploders for shotfiring in coal mines, H.M. Mines Dept.; with C. M. & S. Co., Trail, B.C., as follows: 1924-27, on constrn. rotary converter instaln., Trail, elect. equipt. of turbo-alternators, Kimberley, other constrn. jobs, 1927-30, asst. supt., electrolytic divn. of zinc plant, 1930-42, sr. research asst., research dept., specializing in electrochemistry and physics, organized instrument divn. of company in 1935, 1942-45, sr. research engr. & supvr. instrument & physical testing divn., and at present supt. physical research, research dept., Trail, B.C.

References: S. C. Montgomery, A. C. Ridgers, R. W. Diamond, E. M. Stiles, C. E. Marlatt, J. V. Rogers, E. A. G. Colls.

DALRYMPLE—JAMES ROSS, of 17 Fairholt Rd., Hamilton, Ont. Born at Toronto, Out., Aug. 9th, 1920. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1944; R.P.E., Ontario: 1940-43, (summers), Dominion Foundries & Steel Co., Aluminum Goods Co., Toronto, John Inglis Co., Toronto, and Armstrong Wood & Co., Toronto; 1944 to date, staff engr., various duties in all phases of industrial engrg., engrg. dept., Dominion Foundries & Steel Co., Ltd., Hamilton, Ont.

References: E. A. Allcut, R. C. Wiren, W. E. Brown, F. W. Paulin, H. S. Philips, R. W. Angus, W. B. Ford, H. A. Ricker.

deWITT—GEORGE HARDING, of Shawinigan Falls, Que. Born at Wolfville, N.S., June 14th, 1918. Educ.: B.Eng., (Elect.), McGill Univ., 1941; 1940-41, (summers), Shawinigan Water & Power Co., Montreal; 1941-45, Chief Engr. Officer, R.C.A.F., 2 yrs. in England on research & development of gas turbine engines for jet propelled aircraft; at present, elect. engr., Shawinigan Water & Power Co., Shawinigan Falls, Que.

References: C. V. Christie, R. H. Mather, J. H. Frégeau, J. Morse, B. E. Bauman.

FORD—WILLIAM REX, Lieut., Cdn. Army, of Bedford, Que. Born at Montreal, Que., Feb. 24th, 1922. Educ.: B.Eng., (Civil), McGill Univ., 1944; 1938-43, (summers), surveying La Tuque Power Development; instru'man., Hydro-Electric Power Co., Lake Nipigon; asst. office engr., Shipshaw Power Development; dfting., Ford Motor Co., Windsor; 1943 to date, Active Service, Army, St. Johns, Que.

References: G. R. Rinfret, H. J. Racey, R. DeL. French, E. Brown, G. J. Dodd, J. Farmer, F. Keith.

GRIFFITHS—GARTH, Major, A.D.M.E. (Tels), of Ottawa, Ont. Born at San Diego, Calif., November 14th, 1913. Educ.: B.A.Sc., (Elect. Engrg.), Univ. of British Columbia, 1941; R.P.E., Ontario; 1941-42, testman, Canadian Genl. Elect.; with R.C.E.M.E., as follows: 1942-44, Elect. & Mech. Engr., Tech. Staff Officer, Grade III Radar equipt., 1944-45, Major, Tech. Staff Officer, Grade II, Asst. Director Mech. Engrg. Telecommunications, and at present Asst. Dir. of Mech. Engrg., (Tels), New Army Bldg., Ottawa, Ont.

References: E. C. Mayhew, L. S. Brodie, C. A. Manson, J. N. Finlayson, H. J. MacLeod.

HAWKINS—CURRIE W., Elect. Artificer, R.C.N.V.R., of Almonte, Ont. Born at Almonte, Ont., Feb. 7th, 1916. Educ.: 1945 graduate of special electrical course at the Nova Scotia Tech. Coll., given to selected personnel in the Navy qualifying them for commissioned officer. (Course approved by Council as meeting requirements for Junior); 1937-42, machinist apprent., C.N.R., Stratford, Ont.; 1942-45, with R.C.N.V.R., as instructor, Naval Elect. Artificers, Univ. of Alberta., and at present Elect. Artificer, H.M.C.S. Donnacona, Montreal, Que.

References: F. H. Sexton, G. H. Burchill, M. L. Baker, W. Porteous.

HELLIWELL—ALFRED LLOYD, of Corunna, Ont. Born at Toronto, Ont., Mar. 21st, 1898. Educ.: B.A.Sc., Univ. of Toronto, 1922; with Imperial Oil Limited, as follows: 1926-29, dfting. room, 1929-36, tech. & research dept. 1936-43, i/c experimental plant, 1943-45, genl. inspection dept., and at present supervisor of testing engine laboratories, Sarnia, Ont.

References: G. L. Macpherson, F. F. Dyer, P. Warkentin, M. L. Walker, G. W. Christie.

KENNY—HARRY JAMES, of 764 Egan Ave., Verdun, Que. Born at Ottawa, Ont., Feb. 3rd, 1911. Educ.: corr. courses, American School, Chicago, British Inst. of Engrg. Technology; topographical land surveyor, Army, 1933; with Military District No. 4, as follows: 1935, responsible for design of misc. structl. steel & reinforced concrete works, alterations to military bldgs., specifications, estimates, road constrn., field layouts and surveying, 1940, design & layout of heating systems, field engr. for layout & constrn at Farnham of rifle range, etc., incl. roads & drainage, 1941, estimates, specifications & design of water supply, pumping stn., Three Rivers Exhibition grounds, 1943, estimates, specs. & design of several misc. reinforced concrete bldgs. incl. mech. work at Longue Point Ordnance Depot, Longue Point, P.Q. 1942-45, layout of water & sewage disposal systesm for military camps, and at present chief dftsman, estimating, valuating & structl. design, Military District No. 4, Montreal, Que.

References: A. J. Kerry, H. L. Trotter, H. P. Hamilton, R. B. Jennings, M. Nantel.

MacLEOD—GORDON ROSS, of Vaudreuil, Que. Born at Outremont, Que., July 5th, 1911. Educ.: B.Eng., (Mech.), McGill Univ., 1937; 1937-38, dftsman, worked at machine design, etc., engrg. dept., Canadian Industries Ltd., Montreal; 1938-39, dftsman, worked at design & layout of mech. equipt. for industrial bldgs., Walter J. Armstrong, consultg. engr. Montreal; 1939-45, employed as res. tech. officer & inspector at various aircraft contractors in England, Canada & U.S., British Air Commission, 1785 Massachusetts Ave., Washington 6, D.C.

References: G. L. Wiggs, J. J. Frost, S. H. Clarke, E. Brown, W. J. Armstrong.

McLELLAN—JOHN GILMORE, of Montreal, Que. Born at Prince Rupert, B.C., March 10th, 1916. Educ.: B.A.Sc., Univ. of British Columbia, 1936; with Northern Electric Co., Ltd., as follows: 1937-39, sales engrg., wide range elect. equipt., incl. elect. power equipt., motors, mercury arc rectifiers, meters, electronic equipt. of all kinds, etc., Vancouver, B.C., 1939-40, similar work for co., West Kootenay, B.C., 1940-41, same work, Vancouver, 1942, power apparatus sales engr., Alberta, 1942-45, marine fittings supervr., including organization & development of all manner elect. equipt for use in Canada's shipbuilding programme, cargo vessels, vessels built for R.C.N. and British Admiralty, writing specifications for & engrg. sets of degaussing equipt supplied to Naval vessels for protection against magnetic mines, and at present sales engr. i/c motor control apparatus & instruments in power apparatus dept., Montreal, Que.

References: E. W. Jeffery, C. C. Simpson, E. S. Braddell, W. R. Bunting.

MILNE—FRANK ERIC, of 79 Sussex Ave., Hamilton, Ont. Born at Edinburgh, Scotland, April 12th, 1902. Educ.: B.Sc., Univ. of Edinburgh, Scotland, 1922; R.P.E., Ontario; with Otis Fensom Elevator Co., Ltd., as follows: 1922-24, student apprentice, 1924-25, chief engr.'s office, New York, 1926-27, engrg. dept., Hamilton, Ont., 1927-29, i/c Calgary office, 1930 to date i/c order, engrg. & specifying divn., service dept., Hamilton, Ont.

References: W. D. Black, E. G. Wyckoff, W. J. W. Reid, H. E. Steventon, E. T. W. Bailey, W. A. T. Gilmour.

MONTGOMERY—EDWARD WILFORD, of 1205 Fort St., Montreal, Que. Born at East St. Paul, Man., Sept. 19th, 1918. Educ.: B.Eng., (Metallurgy), McGill Univ., 1943; 1943-45, Lieut. (Engr.), R.C.N.V.R., i/c machinery various ships afloat; and at present metallurgical engr. with development & engrg. dept., Canadian Liquid Air Co., Ltd., Montreal, Que.

References: G. J. Dodd, R. E. Jamieson, F. G. Kerry, J. R. Stewart.

NELSON—HILDING WILLIAM, 445 Waverley St., Winnipeg, Man. Born at Winnipeg, Man., Dec. 16th, 1906. Educ.: completed 3 yrs. in engrg., Univ. of Manitoba, 1924-27; with Vulcan Iron Works Ltd., Winnipeg, as follows: 1927-32, dfting, detailing, 1933-45, design engr., responsible for design of various types of boilers, high & low pressure, locomotive, low pressure steel welded heating, high pressure water tube types, etc., pressure tanks of all types, these designed to comply with A.S.M.E. & A.P.I. codes, responsible for design structl. steel framing for bldgs. and other structures, also, coal & ash handling equipt., etc., during period have been consultg. engr. to architects, etc., in design of power houses, such as being built for Deer Lodge Military Hospital, Winnipeg, and at present acting chief engr.

References: H. C. D. Briercliffe, R. H. Robinson, G. Andrews, G. Herriot, F. Adamson.

RODEN—BERKELEY, of 4722 Queen Mary Rd., Montreal, Que. Born at Toronto, Ont., Aug. 22nd, 1914. Educ.: B.Sc., M.Sc., (Aero.Engrg.), Univ. of Michigan, 1943, (accredited E.C.P.D.); R.P.E., Manitoba; with National Research Council, as follows: 1944, jr. research engr., sent to England to study jet propulsion while working for Rolls Royce, (was employed in tech. office there until July, 1944), recalled to Canada for work in Winnipeg on jet propulsion, employed as engr. on design board, 1945, promoted to Group Leader i/c of air frame, (fuselage & empennage), design office, Canadair Limited, Montreal, Que.

References: R. C. C. Brown, E. A. Harvey, W. E. Seely, S. Warnock.

SALMON—KENNETH WATERBURY, of 154 Princess St., Saint John, N.B. Born at Wolfville, N.S., March 27th, 1920. Educ.: B.Sc., (Elect. Engrg.), Univ. of New Brunswick, 1941; 1941-45, Active Service, Royal Canadian Navy (Engr. Officer), trained in turbine cruiser, i/c machinery in 3 Canadian Naval ships, 10 mos., elect. overseeing of naval refits, 6 mos., training engine room personnel; at present with New Brunswick Telephone Co., Ltd., Saint John, N.B., for experience in telephone engrg. & genl. telephone practice.

References: A. F. Baird, A. A. Turnbull, R. M. Richardson, J. Stephens, E. O. Turner, C. E. Simms.

SALTER—GORDON WILSON, of Arvida, Que. Born at Smiths Falls, Ont., July 24th, 1918. Educ.: Geology, Queen's Univ., 1939-41; 1941-42, with Dept. of Munitions & Supply, Ottawa, as asst., shell divn., ammunition filling, amm. records & statistics; with Aluminum Co. of Canada, Ltd., as follows: 1942-43, pot room engr., Arvida, Que., 1943, (1 mo.), pot room engr., Beauharnois plant, 1943, (1 mo.), constrn. & mining supvr., Isle Maligne works, 1943-45, suprv., pot mining dept., Arvida works, and at present carbon plant supvr., i/c development, control & engrg., Arvida, Que.

References: C. A. Antenbring, F. T. Boutilier, D. D. Reeve, C. Miller, C. M. Manson, B. E. Bauman.

SCHUETT—GEORGE HERBERT, of Montreal, Que. Born at Niagara Falls, Ont., March 2nd, 1919. Educ.: B.Sc., (Civil Engrg.), Queen's Univ., 1943; 1943-45, Engrg., Works & Buildings Officer, R.C.A.F.; and at present engr., Anglin Norcross, Quebec Ltd., Montreal, Que.

References: P. N. Gross, C. L. Woolward, R. W. Johnstone, R. Duquette, M. S. Nelson.

SIMPSON—JOHN RAYMOND, of 44 Simcoe St., Victoria, B.C. Born in Edmonton, Alta., Sept. 16th, 1914. Educ.: B.Sc., (Civil Eng.), Leeds Univ., Yorks., Eng., 1939; 1939-40, eng. asst., genl. constrn. supervision underground, of structures in mass & reinf. concrete, structl. steelwork, conveyors, sewers, excavations, paving, etc., this work connected with underground munitions storage, War Dept., Wiltshire; 1940-41, setting out, survey work & supervision of constrn. of bldgs. in steel, brick work, reinforced concrete, drawing office work, Ministry of Supply; 1941-44, engr., i/c of numerous contracts & dealt with all phases of following work: structures in reinforced concrete, power stns., cooling towers, bunkers, retaining walls & jetties, drawing, designing & detailing of reinf. concrete slab & beam floors, columns, foundations, etc., Holst & Co., Ltd., reinf. concrete engrs., Westminster, Eng.; 1944-45, with Dept. Public Works, British Guiana, as asst. dist. engr., engaged in sea defence work, also acted as dist. engr. for six months i/c road & bldg. constrn., design & drawing in connection with above work, and at present in Canada.

References: Mr. Simpson has arrived only recently in Canada and references will be supplied later.

SIMPSON—ROBERT E., of 7 Lazard Ave., Town of Mt. Royal, Que. Born at Ottawa, Ont., Oct. 3rd, 1917. Educ.: B.Sc., (Metall.), Queen's Univ., 1940; 1940, Consolidated Paper Corp.; 1940-41, Combustion Engrg. Corp., Montreal; 1941-45, Army Service, R.C.E.M.E.; now demobilized and with White Motor Co., Montreal.

References: L. T. Rutledge, R. A. Low, J. B. Baty, D. S. Ellis, D. M. Jemmett, A. Jackson.

TODD—WILLIAM LAWRENCE, Lieut. Elect., R.C.N.V.R., of Huntingdon, Que. Born at Ormstown, Que., May 3rd, 1916. Educ.: B.Eng., (Mech.), McGill Univ., 1941; 1941-42, nitro-cellulose area engr. i/c of mtce., Defence Industries Ltd., Nitro, Que.; 1942, (10 mos.), design, layout & constrn. of new sulphate pulp & paper mill, Brompton Pulp & Paper Co., Ltd., Red Rock, Ont.; 1942-45, Royal Canadian Navy ,as Engr. Officer i/c of all main & auxiliary, steam & diesel machinery on board ships incl. Minesweepers, Frigates & Destroyers, 36 mos. at sea; at present on pre-discharge leave.

References: R. DeL. French, A. R. Roberts, E. Brown, G. J. Dodd, C. M. McKergow.

TOMLINSON—WALTER JOHN, Jr., of Montreal, Que. Born at Edmonton, Alta., March 3rd, 1909. Educ.: B.S., (Chem. Engrg.), 1931; Chem. Engr., 1936, Lehigh Univ., Bethlehem, Pa. (accredited E.C.P.D.); with Betz Laboratories Ltd., as follows: 1936-38, W.H. & L. D. Betz, Philadelphia, Pa., 1938-44, tech. director, divn. of Wood Industries Supply Co., Ltd., Montreal; 1944 to date, tech. director, i/c of all tech, work in field of boiler water conditioning, functional design of water conditioning systems & field investigation of water problems, Montreal.

References: J. L. Bieler, R. E. MacAfee, R. A. Yapp, W. G. Scott, C. K. McLeod, A. H. Chisholm, J. A. Shaw.

WILLMOT—RICHARD STEWART, of 124 Glen Road, Toronto, Ont. Born at Toronto, Ont., Dec. 21st, 1921, Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1943; R.P.E., Ontario; 1944-45, E.M.E. Officer in R.C.E.M.E., 2nd–C., Workshop, Vernon, B.C., I/C Light Aid Detach., Pacific Command, I–C, Recovery Section, Continental Europe; and at present registered at Univ. of Western Ontario for post-graduate course in intensive business.

References: E. R. Jarmain, C. R. Young, W. S. Wilson, R. F. Legget, R. W. Angus, C. F. Morrison.

FOR TRANSFER FROM THE CLASS OF STUDENT

TULK—EGBERT GORDON, Elect. Lieut., R.C.N.V.R., Toronto, Ont. Born at Sydney, N.S., Dec. 4tb, 1919. Educ.: B.Eng. (Elect.), Nova Scotia Tech. Coll., 1943; 1943-44, Elect. Sub. Lt., Base Mtce. Officer, i/c mtce. on magnetic minesweeping equipt., 1944, Elect. Lt., Elect. Anti-Mining Mtce., 1945 (1 mo.), N.S.H.Q., and at present Naval Electrical Obverseer. (St. 1942).

References: G. H. Burchill, F. H. Sexton, D. S. Nicol, M. Harrigan.

WOOLSEY—EDGAR GARNET, of 160 Bay St., Ottawa, Ont. Born at Ottawa, March 19th, 1912. Educ.: B.Sc., (Civil), Queen's Univ., 1945; 1939-44, Officer, R.C.E., and at present jr. engr. i/c survey party, Calgary Power Co., Calgary, Alta. (St. 1944).

References: T. D. Stanley, H. Randle, J. McMillan, L. F. Grant.

LIBRARY NOTES

(*Continued from page 60*)

SHORT DICTIONARY OF ARCHITECTURE

By D. Ware and B. Beatty. Philosophical Library, 15 East 40th St., New York, 1945. 109 pp., diagrs., 6¼ x 5¼ in., cloth, $2.75.

Both the terms used in classical architecture and the common building terms in current use are included in this dictionary. A great many clear and easily understood drawings illustrate such definitions as need it. The dictionary also includes a number of terms from fields allied to the two main ones. A brief bibliography is appended.

SPUN RAYON WARP SIZING Special Summary Report on Weaving Efficiency of Warp Sizing Materials, a research project of the Textile Research Institute

Conducted at the North Carolina State College School of Textiles and the Research Laboratories of the Textile Foundation at the National Bureau of Standards, Washington, D.C.; issued by the Textile Research Institute, Inc., 10 East 40th St., New York, May 1, 1945. 91 pp., illus., diagrs., charts, tables, 10½ x 8 in., paper, $1.50.

Part I of this research report is designed to throw light on certain problems peculiar to the sizing of staple rayon warp yarns, including possible laboratory test methods. Part II deals with the weaving, efficiency and film properties of warp sizing materials.

TRANSMISSION LINES, ANTENNAS AND WAVE GUIDES

By R. W. P. King, H. R. Mimno and A. H. Wing. McGraw-Hill Book Co., New York and London, 1945. 347 pp., diagrs., charts, tables, 9 x 5¾ in., cloth, $3.50.

This book presents, with some additions, the material given in the lectures on transmission lines, antennas, wave guides and wave propagation that constitute part of a course in pre-radar training given to officers in the armed forces. Transmission lines are presented exclusively from the high-frequency point of view; antennas are presented from the viewpoint of electromagnetic theory; and wave guides from the viewpoint of generalized transmission circuits. There is a brief treatment of wave propagation

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET,
MONTREAL 2, QUE.

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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.

NOTICE

SERVICE PERSONNEL: The completed rehabilitation questionnaires have indicated a need for the employment service to be made available to all members of the E.I.C. in the Armed Forces. It is suggested that all those who are interested—

1. **Consider these positions as indicative of present conditions.**
2. **Reply to interesting advertisements to establish contact for the future.**

Apply for any of these positions when discharge is imminent.

CIVILIAN TECHNICAL PERSONNEL should not reply to any of the advertisements for situations vacant unless—

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

A person's services are considered available only if he—

(a) is unemployed;
(b) is engaged in work other than of an engineering or scientific nature;
(c) has given notice as of a definite date; or
(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.

Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.

Situations Vacant

AUTOMOTIVE

SERVICE ENGINEER is wanted to promote specialized automotive service in Quebec and the Maritimes. Work will involve a study of existing methods, and demonstration and introduction of new ideas and improvements in shops, garages, service stations and clinics. Candidates must have good practical experience in servicing electrical, carburetion, fuel brake and shock absorber systems of automobiles, must be bilingual, and must have the personality and tact necessary to advise and convince experienced automotive service men. Future prospects depend entirely on successful applicant, and starting salary will be about $250 per month. Apply to Box No. 3077-V.

CHEMICAL

CHEMICAL ENGINEER, young graduate, necessarily with some pulp and paper mill experience is required to take over control of the testing laboratories and to take charge of various engineering problems in a mill in the Eastern Townships of Quebec. Salary would be about $250 a month. Apply to Box No. 3211-V.

CHEMICAL ENGINEER, age about 34, graduate, preferably with some experience in the sale of chemical products is required by a company in Toronto for work in connection with problems of distribution, merchandising and selling. Salary would be about $300 a month plus share in profits. Apply to Box No. 3215-V

CIVIL

RESIDENT ENGINEER, not necessarily a graduate, with considerable construction experience, is required to represent a firm of architects on a large contract in Nova Scotia. Salary would be from $300 a month according to experience. Apply to Box No. 3189-V.

CIVIL ENGINEER, preferably discharged service man with considerable experience in construction, maintenance and servicing of buildings and real estate generally, is required to act as the manager of a company of this nature in a small town on the lower St. Lawrence. The successful candidate would be expected, in addition, to supervise the maintenance staff, rentals, sale of properties, town services, etc. Apply to Box No. 3198-V.

CIVIL ENGINEER from recent graduate up, about 25, preferably a veteran, is required for design and estimating in connection with steel plate work. This position would be in Toronto, and salary would be from $150 to $250. Apply to Box No. 3207-V.

SEVERAL CIVIL ENGINEERS, not necessarily graduates but with from at least three years up to very extensive experience in construction, are required by a company in Montreal to estimate several big new developments. Salary would range from $200 to $450 a month depending on experience. Apply to Box No. 3209-V.

ELECTRICAL

ELECTRICAL ENGINEER, preferably unmarried discharged service man with two or three years' experience in plant layout, is required by a firm of contractors in Montreal for work in eastern Ontario in connection with the installation of services and equipment in a large new plant. Salary about $250 a month. Apply to Box No. 6187-V.

ELECTRICAL ENGINEER with fair knowledge of draughting is required by a firm in Montreal for work on design, assembly and testing of special instruments for industrial process control equipment. Candidates may be recent graduates and starting salary would be about $175 a month. Apply to Box No. 3201-V'

MECHANICAL

SEVERAL MECHANICAL ENGINEERS, preferably unmarried discharged service men with two or three years' experience in plant layout work, are required by a firm of contractors in Montreal for work in eastern Ontario in connection with the installation of services and equipment in a large new plant. Salary about $250 a month. Apply to Box No. 3187-V.

MECHANICAL ENGINEER preferably about 32 years old with about five years straight engineering experience and about five years general experience in factory or plant management, etc., and with suitable personality for selling and contacting is required by a firm in Montreal. Salary would be from $250 a month depending on experience. Apply to Box No. 3191-V.

MECHANICAL ENGINEER, age 25-35 with some experience, preferably bilingual, is required by a manufacturer in the Eastern Townships of Quebec, to work under the supervision of the plant manager with responsibility for executing production schedules, manufacturing operations, and for quality and cost control work. Apply to Box No. 3192-V.

MECHANICAL OR AERONAUTICAL ENGINEER with two or three years' experience is required by a firm in the Montreal area to act as stress analyst. Salary would be about $250 a month. Apply to Box No. 3202-V.

MECHANICAL ENGINEER with five to ten years' experience, preferably in pulp and paper work, is required to act as chief draughtsman for a company in New Brunswick. Salary is open according to qualifications. Apply to Box No. 3204-V.

MECHANICAL ENGINEER, young graduate, preferably ex-service man with draughting ability, is required for general mechanical work by a paper mill in eastern Quebec. Apply to Box No. 3205-V.

MECHANICAL ENGINEER from recent graduate up, about 25, preferably a veteran, is required for design and estimating in connection with steel plate work. This position would be in Toronto and salary would be from $150 to $250 a month depending on qualifications. Apply to Box No. 3207-V.

MECHANICAL ENGINEER is required as draughtsman for layouts and general mechanical engineering by a paper company in the Lake St. John area. Salary would be $225 to $250 a month depending on experience. Apply to Box No. 3208-V.

MECHANICAL ENGINEER is required by a firm engaged in the manufacture of building materials in Montreal to act as junior engineer and to start on draughting and layout work of new equipment. Candidates need not be graduate engineers but preference will be given to ex-service men. Salary will be about $175 a month. Apply to Box No. 3213-V.

METALLURGICAL

METALLURGICAL ENGINEER with B.Eng., or B.Sc., in chemical or metallurgical engineering and at least one year's experience in non-ferrous metallurgical chemical analysis is required by a company in Montreal. Preference will be given to ex-service man and salary would be about $250 a month. Apply to Box No. 3200-V.

MISCELLANEOUS

DRAUGHTSMAN with about ten years' experience in structural and steel plate work, preferably, but not necessarily a graduate engineer, is required by a large company in Montreal. Apply to Box No. 3193-V.

ARCHITECTURAL DRAUGHTSMAN with enough experience to develop new types of windows, doors, trusses, steel sections, etc., is required by a manufacturer in Montreal. Salary would be about $300 a month. Apply to Box No. 3212-V.

PLANT ENGINEER, either mechanical, civil or electrical graduate with two or three years' general experience, age 25-30, is required by a firm engaged in the manufacture of building materials to take charge of maintenance of a plant complete with equipment and machinery. Candidates may expect to do some travelling and may have headquarters in either Quebec, Ontario or Manitoba. Salary would be from $200 a month up according to experience. Apply to Box No. 3217-V.

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

CHEMICAL

CHEMICAL ENGINEER, 20-25 years is required to act as sales engineer for a chemical company in the Toronto district. Preference will be given to ex-service man. Salary $150. to $250., depending on qualifications. Apply to Box No. 3134-V.

CIVIL

TWO CIVIL ENGINEERS are required to act as a structural steel engineer and a structural steel designer. The former would be required to prepare cost estimates, do some designing and selling of structural steel work, give technical direction to the structural steel draughting, contact contractors, customers and other persons in the steel business. The structural steel designer under supervision of the structural steel engineer would be required to do detailed designing, including the layout and detailing of structural steel work. These positions would be in Toronto at salaries according to qualifications. Apply to Box No. 3060-V.

CIVIL ENGINEER is required by the building department of a large Ontario city to examine buildings for general safety and code requirements pursuant to the issuance of building permits. Preference will be given to qualified applicants who have been honourably discharged from the Armed Forces. Apply to Box No. 2943-V.

CIVIL ENGINEER, bilingual, ex-service man is wanted to act as instrument-man for survey work in the province of Quebec in connection with the Veterans Land Act. Salary about $200. a month. Apply to Box No. 3129-V.

CIVIL ENGINEER, age 30-35 with some experience is required to install bush roads for woods operations and to make surveys and profiles in northern Ontario. Apply to Box No. 3130-V.

CIVIL ENGINEER, age 27-35, with experience in reinforced concrete and steel is required to act as structural designer for a large company in Montreal. Salary would be about $250. a month. Apply to Box No. 3140-V.

CIVIL ENGINEER with experience in the design of hydro-electric power stations is required to act as designer on reinforced concrete structures in Winnipeg. Apply to Box No. 3155-V.

CIVIL ENGINEER recent graduate is required to act as lecturer and assistant in the engineering faculty of a university in Ontario. Work will involve lecturing to third and fourth year students on highway and railway course, also elementary surveying and assisting in laboratory. Preference will be given to returned service man. Apply to Box No. 3163-V.

ELECTRICAL

ELECTRICAL ENGINEER, graduate under 35 years of age, bilingual, is required to be trained as assistant to the supervising engineer of the electrical commission of a large city in the province of Quebec. Salary during training period will vary with qualifications between $2500. and $3000. a year. Apply to Box No. 2963-V.

ELECTRICAL ENGINEER with five years' aeronautical experience is required to be in charge of the electrical work in connection with modifications to aircraft. This position will be in the Montreal area and would be worth about $275. a month. Apply to Box No 3107-V.

ELECTRICAL ENGINEER with experience around mills or smelters, English-speaking, with a working knowledge of French, age 32-36, is required by a firm engaged in the manufacture of abrasives and refractories in the province of Quebec. Apply to Box No. 3122-V.

MECHANICAL

CHIEF MECHANICAL ENGINEER is required by a firm engaged in the manufacture of cranes, crushers, conveyors, pumps, etc., in the Toronto area. Work will consist of organizing and directing the activities of the engineering department, which would include draughting, development and design of mechanical products and the supervision of a chief draughtsman, development engineers, project engineers and designers. Apply to Box No. 3040-V.

MECHANICAL ENGINEER with experience in machine design and preferably a returned service man is required by a firm of manufacturers of insulating materials located in eastern Quebec. Apply to Box No. 3058-V.

MECHANICAL ENGINEER, having some familiarity with pulp and paper machinery and suitable personality is required to act as sales engineer for a small manufacturing company in northern New Brunswick. This is a permanent position with a good future for the right man. Candidates should be between 30 and 35 years old and can expect a salary of between $200 and $300 a month depending on experience. Apply to Box 3088-V.

MECHANICAL ENGINEER is required for investigation of maintenance and operation problems in connection with pumps, compressors, boilers, etc., for a firm of alkali manufacturers in southern Ontario. Candidates should be between 26 and 30 years of age. Apply to Box No. 3094-V.

MECHANICAL ENGINEER is required to act as superintending engineer for a pulp and paper company in Calcutta, India. The position demands, firstly, a man who has had some considerable experience in both pulp and paper mill work, particularly in the sulphate pulp mill industry. The company is embarking on an extensive programme covering the installation of various new equipment. The work will involve general maintenance of the entire plant, boiler house and steam turbo power generators. Three year contract including free housing accommodation, full passage expenses and a suggested salary of about $12,000. per annum. Apply to Box No. 3112-V.

MECHANICAL ENGINEER is required to act as assistant engineer to the superintending engineer of a pulp and paper company in Calcutta, India. The work will be in connection with all the practical maintenance of the plant and a salary of between $4,000. and $6,000. per year, under a three year contract, including free housing accommodation and full passage expenses, is offered. Apply to Box No. 3112-V.

MECHANICAL ENGINEER with experience in crude oil burning is required by a small company in Montreal for work in connection with the installation of oil-burners and heating equipment. Age not important but must have good experience. Salary about $250. a month. Apply to Box 3137-V.

MECHANICAL ENGINEER with good local contacts, age 25-30 is required to act as sales engineer for a small firm of manufacturers in the Montreal area. Preference will be given to returned service man who has conversational knowledge of French. Apply to Box No. 3141-V

MECHANICAL ENGINEER, recent graduate, preferably returned service man is required by a well-known company in Montreal for draughting and design work on structural and mechanical problems. Apply to Box No. 3146-V.

MECHANICAL ENGINEER experienced plant and production superintendent is required for a machine shop and grey iron foundry in the Ottawa district, to take full charge of operations and planning. Salary $300. to $375. a month depending on experience. Apply to Box No. 3159-V.

MECHANICAL DRAUGHTSMAN is required by a firm of manufacturing chemists in the Montreal area for temporary work in connection with design and layout of plant equipment of a new plant. Candidates need not be graduate engineers but should have some experience with industrial equipment. Apply to Box No. 3169-V.

MECHANICAL ENGINEER is required to act as designing engineer for a newsprint manufacturer in the St. Maurice Valley. Candidates should have some paper mill experience in mechanical and structural work. This position will last about one year but there will be good prospects for the right man. Preference will be given to an ex-service man and salary will be about $275 a month. Apply to Box No. 3173-V

MECHANICAL ENGINEER, recent graduate, is urgently required for the position of foreman in the mechanical department of a newsprint manufacturer in the St. Maurice Valley. Salary will be between $150 and $225 a month depending on qualifications. Preference will be given to ex-service men. Apply to Box No. 3174-V.

MECHANICAL ENGINEER with approximately ten years experience divided between design and machine shop is required to act as principal assistant to a mechanical engineer in a corporation in Toronto. Candidates should have general all around experience and particularly some manufacturing experience with heavy machinery. Salary would be from $300 a month according to qualifications. Apply to Box No. 3175-V.

SEVERAL MECHANICAL ENGINEERS, preferably recent graduates and discharged service men, are required by an engineering company in Montreal for draughting, testing and research work. Salary would be $185 to $220, depending on experience. Apply to Box No. 3183-V.

MECHANICAL ENGINEER is required to act as chief design engineer for a paper company in southern Ontario. Candidates should have had five or six years' experience preferably in pulp and paper mill work. Salary would be about $325 a month. Apply to Box No. 3184-V.

METALLURGICAL

METALLURGICAL ENGINEER, age 25-30 years is required to act as sales engineer for a chemical company in northern Quebec and Ontario. Preference will be given to an ex-service man. Candidates should have a conversational knowledge of the French language and should expect to do considerable travelling. Salary $160. to $250. a month depending on qualifications. Apply to Box No. 3134-V.

MISCELLANEOUS

ARCHITECT OR ARCHITECTURAL DRAUGHTSMAN with about three years' experience is required by a consulting engineer in the Montreal area. Salary would be about $250 a month. Apply to Box No. 3165-V.

TWO ENGINEERS, civil or mechanical graduates, age 22 to 30, preferably with conversational knowledge of French language are required, one for the sales staff and one for the engineering department of a firm in the Montreal area engaged in the manufacture of refractories. Preference will be given to discharged service men and the work will be in connection with boiler and furnace installations, etc. Salary $175 to $200 a month. Apply to Box No. 3166-V

ELECTRICAL, MECHANICAL OR CIVIL ENGINEERS are urgently required for appointments in the British Colonial Service. These positions will be in Malaya and Hong Kong, particularly. Consideration will ge given to applicants who have been discharged from the armed forces with no other experience and to applicants with varying degrees of experience, especially in railroad engineering. Application may be made to the office of High Commissioner for the United Kingdom, Earnscliffe, Ottawa, or to one of the university liaison officers at the university from which the candidate graduated.

DRAUGHTSMAN, under 35 years of age, not necessarily a graduate engineer, but accustomed to plotting from field surveys, with some experience in structural steel and reinforced concrete draughting, preferably a discharged overseas veteran, is required for a position in Montreal. Salary will be about $150 a month. Apply to Box No. 3180-V.

Situations Wanted

SENIOR REINFORCED CONCRETE DESIGNER and civil engineer. P.E. Ont., experienced field and office, various countries, seeks first class opening. Apply to Box No. 107-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., age 39, married, B.Sc. U.N.B., widespread experience in construction with experience in plant maintenance both in civilian and Air Force capacities. Interested in responsible position involving plant maintenance. Apply to Box No. 225-W.

GRADUATE ENGINEER, B.A., B.Sc., Montreal University (1935). Age 34, married, bilingual. Interested in development of new machinery, industrial promotion and management; resides in Montreal but willing to travel. Two years on construction and design of hydraulic machinery for food processing. Associated for the past seven years with large electro-metallurgical plant as supervisor on production and on various assignments such as time studies, technical and job-instructor training of personnel, manrating. Apply to Box No. 1818-W.

CIVIL ENGINEER, 30, married, nine years experience in general construction, sewer and water work. Interested in position with consultant or municipal engineer, or company doing structural design. Located in western Canada Available on short notice. Apply to Box No. 2459-W.

GRADUATE MECHANICAL ENGINEER, U. of Sask., S.E.I.C., 26, single, at present with R.C.E.M.E. Wishes to make contacts for position leading to sales engineer .Apply to Box No. 2557-W.

GRADUATE CIVIL ENGINEER, age 25, with three years' experience in surveying, building construction, and highway construction. Prefer western Canada. Recently discharged from army. Available immediately. Apply to Box No. 2560-W

ELECTRICAL ENGINEER, M.E.I.C., P.E.Q., available on one month's notice or less. Age 39 years. Experience as plant engineer of 400,000 KVA. hydro-electric generating station, operating engineer of 800,000 KVA. transformer and switching station and A.C. and D.C. conversion station handling approximately 90% of the output of the above station. Also one year's experience as electrical maintenance engineer of large industrial plant. Some experience in electrical construction and in cost and manufacturing methods engineering. Would prefer position in Ontario or the Maritimes. Apply to Box No. 2562-W.

GRADUATE CIVIL ENGINEER, age 24, presently in Vancouver, Experienced in layout of townsite and construction of buildings, ground service, and central steam-heating system. Familiar with soils investigation. Has 1½ years' experience as junior engineer on highway location, design and estimate. Apply to Box No. 2570-W.

MECHANICAL ENGINEER, M.E.I.C., age 36, married, B. Eng., N.S.T.C., Major, R.C.E., soon to be discharged. Experience: 7 years steel plant in rolling mills, machine shop, coke ovens, engineering department; 6 years in army, 4 years on construction and maintenance of fortifications, buildings, 2 years in complete charge, 1½ years overseas as technical officer. Experienced in handling men. Desires administrative position of responsibility in expanding and progressive industry. Location, preferably Ontario. Apply to Box No. 2571-W

MECHANICAL ENGINEER, Jr.E.I.C., McGill graduate, age 27, single. Five years' design and executive experience in manufacturing plants. Now available for position with progressive organization. Highest references from former employers. Apply to Box No. 2586-W.

CIVIL ENGINEER, graduate of UNB in 1941, age 27, with experience as instrumentman on highway construction, assistant engineer on town concrete street paving and concrete inspection, and one year as aircraft inspector for Department of National Defence. Expects early discharge from R.C.A.F. after nineteen months service overseas with bomber command as aeronautical engineer, and desires to make contacts for employment, preferably in Ontario. Apply to Box No. 2585-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 23, single, with degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy. Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

CIVIL ENGINEER, M.Sc., in hydraulics, and sanitary engineering, experienced in design and operation of waterworks distribution systems; has administrative ability; age 30, M.E.I.C. Wishes to obtain position in municipal, sanitary or water supply department. Apply to Box No. 2589-W.

GRADUATE ELECTRICAL ENGINEER, UBC '41, P.E. Ont., Associate A.I.E.E. Age 32, married, one child. Six years school teaching, five months thawing assistant engineer; first class honors degree, C.G.E. Test Course. Major, Technical Staff, R.C.E.M.E., four years active service. Radar trained. Active part in build-up of Canadian Army Telecommunications maintenance and repair organization and production of technical literature. Accustomed to planning, forecasting, general organizing and supervision. Not a specialist. Available in B.C. after discharge February '46. Apply to Box No. 2588-W.

WANTED City Engineer

The Corporation of the City of Vancouver, B.C., invites applications for the position of CITY ENGINEER at a salary of $7,200.00 per annum, rising by annual increments of $240.00 to $8,400.00 per annum.

Applicants must be qualified civil engineers, registered to practise professional engineering in British Columbia, with extensive experience in the design, construction, maintenance and operation of municipal engineering works and the development of town planning, transit and civic improvement schemes. Proven administrative and executive ability must be possessed by applicant.

Applications, stating age, full particulars of experience and qualifications and date when duties could be assumed, accompanied by copies of three recent testimonials, should be endorsed "City Engineer" and addressed to the City Clerk, City Hall, Vancouver, B.C., not later than 21st January, 1946.

Civil and Hydraulic Engineer

Required, with comprehensive background of experience and good executive ability to supervise the designing of reinforced concrete and structural steel structures, hydraulic structures and equipment. Give complete resumé education, experience and state salary required. Location Toronto. Apply to Box No. 3196-V.

Specification Writer

Required by Toronto engineering firm; must be university graduate, experienced and able to write clear and technically sound specifications suitable for contract work. Give full particulars education, experience, references and salary required. Apply to Box No. 3195-V.

Development Engineer

Large paper company has opportunity at Main Office for BILINGUAL Mechanical engineer, age 26-33. Work involves development of mechanical equipment for woodlands operations and standardization of maintenance methods for large numbers of trucks, tractors, gasoline and diesel engines. Some draughting experience necessary. Must be able to get along well with men. Veteran of R.C.E.M.E. or R.C.E. preferred. Salary $300 monthly. Do not apply unless your services are available under regulation P.C. 2796, Part 3, administered by the Wartime Bureau of Technical Personnel. Apply to Box No. 3024-V.

ENGINEERS WANTED

An engineering firm located in Toronto requires the following men experienced in design of hydro-electric developments:

Squad Chief, Checker and five Draughtsmen on reinforced concrete design.

Squad Chief, Checker and three Draughtsmen on structural steel design.

Squad Chief, Checker and three Draughtsmen on mechanical design.

Applicants should state age, education, experience and salary expected.

Do not apply unless your services are available under regulations P.C. 2796, part 3, administered by the Wartime Bureau of Technical. Apply to Box No. 3194-V.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

CANADIAN LICENSEES

G. W. Wigle, president of Hamilton Bridge Co. Ltd., recently announced that the company has been licensed by the Sanford-Day Iron Works Inc., Knoxville, Tenn., to manufacture and sell "Sanford-Day" automatic drop-bottom cars, drop-bottom trailers, patented types of wheels and axles and patented methods of opening and closing the doors of these cars and trailers. All of this equipment is designed and adapted for use in the production of minerals in underground and stripping mining operations and for other industrial uses.

GROUND BEARINGS

Completely reconditioned ball bearings, fully guaranteed to give the same service as new bearings and a saving of 30% in bearing costs, are now available in Canada. Although new in Canada, the process of reconditioning worn ball bearings has been in use in the United States for almost a third of a century. Ground bearings are simply worn bearings on which the raceways have been wet-ground, oversize balls installed and new retainers fitted.

Ahlberg Bearings Canada Limited, affiliated with the Ahlberg Bearing Company of Chicago, has set up temporary offices in Montreal where orders are now being filled. A large, modern plant at 4000 Namur Street, Montreal, is now under construction and will be in operation by March. The factory will be equipped with the latest machinery, capable of handling all types and sizes of ball bearings from 1-inch bore up.

C.G.E. TRANSFER

T. J. Halme has been transferred to the industrial control section, industrial division, apparatus department, Canadian General Electric Co. Ltd. He will specialize in industrial electronics, applications and products.

Mr. Halme has served with the contract service department at Toronto and Winnipeg district offices and most recently with the engineering service department at head office.

T. J. Halme

L. E. Messinger

APPOINTED PRESIDENT

L. E. Messinger, well-known throughout the electrical industry, has recently been appointed president of the Selenium Corporation of Canada. He is also president of Canadian Line Materials Limited, as well as several other companies.

LINK-BELT PROMOTIONS

A. W. Williams, for many years sales engineer, Link-Belt Limited, Toronto, has been appointed district manager at Montreal. He has been with the company since 1916.

P. G. Welford, formerly sales engineer at Toronto, has been appointed sales manager at Toronto. He joined the company in 1929.

NATIONAL DISTRIBUTORS

The appointment of Rogers Majestic Limited, Toronto, as Canadian and Newfoundland representatives for the Amperex Electronic Corporation, Brooklyn, N.Y., has recently been announced by S. G. Paterson, manager of the telecommunications division of Rogers Majestic.

C.G.E. APPOINTMENTS

W. H. Prevey has been appointed application engineer, supply department, Canadian General Electric Co. Ltd.

Mr. Prevey will provide engineering information and will make application studies on utility and industrial electric distribution systems. He joined the company in 1936 and after completing the test and engineering course, was transferred to the distribution equipment division of the supply department at head office. During the war, he was associated with aircraft instruments and equipment and was on loan for a time to the Aircraft Production Branch, Department of Munitions and Supply.

W. E. Weaver has been appointed manager of the Royce Avenue Works, C.G.E., Toronto.

Since 1936, Mr. Weaver has been manager of the industrial division, supply department. Prior to this time, he was associated with industrial heating and carboloy and later with fractional horsepower motors and arc welding.

MARITIME DISTRIBUTORS

Moffats Limited have announced the appointment of Electrics Limited, Halifax, N.S., as distributor for the Maritime provinces. With warehouses in St. John and Moncton, they will distribute the complete Moffat line including: Crosley radios, Crosley shelvador refrigerators, Moffat ranges and appliances.

NEW WAREHOUSE

A new oxygen and acetylene warehouse located at 11013-105th Avenue, Edmonton, Alta., has been announced by Dominion Oxygen Co. Ltd., a unit of Union Carbide & Carbon Corporation.

Dominion Oxygen, which at present serves Canadian industries from oxygen-producing plants at Sault Ste. Marie, Welland, Toronto, Montreal, and Quebec, recently announced plans for the erection of an oxy-producing plant and sales office at Vancouver, B.C. An affiliate company, Prest-O-Lite Company of Canada Limited, has acetylene-generating or charging plants located at Shawinigan Falls, Merritton, Montreal, and Winnipeg.

SALES REPRESENTATIVE

Williams & Wilson Limited, with offices in Montreal, Toronto and Windsor, have been appointed exclusive sales representative throughout Canada, east of Manitoba, for the F. J. Stokes Machine Company of Philadelphia, Pa.

C.G.E. PROMOTION

A. E. Byrne has been appointed manager of the newly-formed chemical division, supply department, Canadian General Electric Co. Ltd. Since 1940, he has been in charge of glyptals, plastics and insulating materials.

Mr. Byrne, who joined the company in 1937, recently served as secretary of the Plastics Advisory Committee, Department of Munitions & Supply, and is a past chairman of the Canadian Section of the Society of the Plastics Industry.

A. E. Byrne

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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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

Searchlight antenna used with AN/TRC-6 microwave pulse modulated radio relay system. This relay system, developed especially for the U.S. Signal Corps by the Bell Telephone Laboratories, is a combined radio transmitter and radio receiver with multiplex facilities for providing eight two-way message channels between two points over an unobstructed line-of-sight transmission path. (*See page 72.*)

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THE FUTURE OF RADIO COMMUNICATIONS IN CANADA

A. B. HUNT, M.E.I.C.
Manager, Electronics Division, Northern Electric Company Ltd., Montreal

Paper presented at the Sixtieth Annual General and Professional Meeting of The Engineering Institute of Canada, at Montreal, on February 8th, 1946.

INTRODUCTION

War, with all its horror and devastation, was brought upon us by the aggressor nations who had for many years directed their development and research towards the advancement of the science of war. A great deal of credit is due our scientists, physicists and engineers who, in spite of the tremendous lag in our scientific thinking for war, were able, not only to overcome this handicap, but to surpass in practically every technical field the development of our enemies during the short space of time that we were engaged in war.

During this period, the combined resources of all allied countries were pooled with one incentive: to outwit the brains of our common enemies. With this wealth of knowledge working for one purpose, there is no doubt that many years of normal research and development were crowded into the space of a few years of war. Radio and radar research took on one of the leading roles during this race for supremacy.

We now find ourselves loosed from the demands of our fighting services, and with the slackening of security restrictions on many of the war developments, we can well afford to review these scientific advances and consider their practical application to the service of mankind in a world free from war. It will be many years before we realize the full commercial value of many of these scientific discoveries, and it is hoped that with the continued co-operation of private, industrial, national, and even international research, these advances will be only the starting point of many great developments which can be produced during times of peace. Even though we can see only dimly into the future, there are many applications which have already become apparent, and many others which are a challenge to research engineers to produce something for the usefulness of mankind instead of for the production of deadly weapons for the destruction of human life and property.

War developments in radio communications have brought about outstanding improvements in the existing art and technique which have expanded the useful radio frequency spectrum very close to that of visible light and the spectacular accomplishments of research in the radar field will have far-reaching effect on the future of many types of radio communications and aids to navigation.

The technical ramifications of all branches of radio and radar research during these years, or even recent months, are so ponderous that it is impossible to comprehend their full effect on future development and the broadening scope of this form of communication on the economy of the nation. It is therefore proposed to deal only with the broad aspect of the many improvements and changes which we may expect in the radio field and the general effect they will have on the various civilian services which will look to radio more than ever before as a means of communication.

It is also proposed to deal briefly with a few types of navigation aids which have been developed through our expanded knowledge of radio and radar techniques. These devices, although not strictly coming under the subject of this paper, are so closely allied that it is impossible to deal adequately with the broad field of radio communication without referring to the spectacular advances in radio aids to navigation which were the forerunner of many communication developments.

CANADIAN RADIO TECHNICAL PLANNING BOARD

A review of the reports of the Canadian Radio Technical Planning Board, which is composed of many outstanding engineers in Canada, gives us some idea of the expanded field of application of radio. The express purpose of this board is to formulate sound engineering principles and to organize technical facts which will assist in the development, in accordance with the public interest, of the Canadian radio industry and radio services of the nation, and to advise Government, industry and the people of its findings and recommendations.

The Engineering Institute is a sponsoring member of this Board and has representation on all of its panels and working committees.

The reports of the Board show requirements for services unthought of before the war, not that the need did not exist previously but, due to the lack of useful frequency space according to our pre-war knowledge, their demands had to give place to those involving the protection of human life and property and those of common service to the greatest proportion of the population. Even the demands of these services were far from adequately fulfilled in the days before the war.

The greatly expanded frequency spectrum, as we know it today, will still be inadequate to supply the complete demands of all services. The exhaustive studies now being made by the Planning Board in regard to frequency assignment should, however, aid materially in the orderly allocation of new frequencies so as to reduce to a minimum confusion and interference between services in the future.

RADIO-TELEGRAPH AND TELETYPE

The development of radio communications[7] started with Marconi's low-frequency trans-Atlantic experiments in 1901. The low-frequency or long-wave range below 100 kilocycles was intensely developed during the first two decades of the present century. The large expansion in communication did not occur, however, until it was discovered during the 1920's that long-distance transmission could be carried on by short waves, that is, by frequencies in the range 3 to 30 megacycles.

Commercial radio communication by Morse code has been standard since Marconi's early developments. The dot-dash system has never been entirely superseded by voice and, in fact, its use has been greatly expanded during the war years by the development of a new system of high-speed automatic code transmission and reception.

The frequency shift[1] method of transmitting telegraph signals is analogous to frequency modulation broadcasting except that it does not introduce the undesirable characteristic of increasing band width. Instead of keying a carrier on and off to designate the mark and space of the telegraph signals, the transmitter maintains radiation at full power, but the carrier is shifted back and forth between two distinct frequencies to designate mark and space. The same beneficial reduction in signal-to-noise ratio is derived in transmitting telegraphy in this manner as is derived from frequency modulation.

The development of high-speed automatic senders and tape recording equipment for both telegraph and teletype paralleled the frequency shift transmission development. Due to these outstanding improvements, towards the end of the war Press Wireless was able to maintain telegraph communication between Europe and the United States with 400-watt mobile transmitters, and handled press traffic at a rate of 500 words per minute.

These developments are entirely commercial and may be used extensively in Canada in future years. One may question the need for these high-speed circuits in many parts of Canada where traffic volumes are relatively low. They can be justified, however, in many cases, particularly in the auroral zones, where transmission may be blacked out for hours at a time with an occasional break-through at which time a larger volume of stored-up traffic may be cleared.

Trans-oceanic Telephony

The first trans-Atlantic radio telephone circuit② for public service was established in 1927. It used a low-frequency carrier of 60 kc. The following year a short-wave telephone circuit was established and by the beginning of 1939 there were in service throughout the world about 170 important long-distance short-wave telephone circuits, of which five were in regular use between this continent and Europe.

Recent developments by the Bell Telephone Laboratories in the short-wave field for trans-oceanic service have introduced single-sideband transmission and the multiple-unit steerable antenna known as "MUSA". The single-sideband transmission has doubled the frequency channel utilization factor as the transmission band width is cut in half and there is a very marked improvement in the signal-to-noise ratio. The MUSA reduces selective fading by combining signals arriving over different paths or by eliminating all signals except those arriving over one path.

With cessation of hostilities, there was an immediate commercial demand for this equipment. Many countries of continental Europe have already purchased this system to establish direct radio telephone circuits with this side of the Atlantic. Some of these equipments have already been delivered and will be in operation within the next few months.

It is impossible to predict the part Canada will play in the expansion of trans-oceanic radio communication, but it is just another one of the many broadening radio fields which are opening up unlimited opportunities for Canadian engineers.

Point-to-point Communications and Relay Systems

Prior to the war, radio as used by the telephone companies was restricted to a few special applications where it was found to be definitely impractical to use land lines or submarine cables. This limitation was principally due to the lack of available frequencies; in fact, it can be generally stated that radio frequency channels would not be assigned for any type of service where alternative wire circuit could be made available.

One of the largest pre-war radio-telephone networks was operated by the British Columbia Telephone Company for point-to-point communications and ship-to-shore radio service which tied in directly through their long distance toll switchboard in Vancouver to regular telephone subscribers.

A radio circuit from Saint John, N.B., to Digby, N.S., operated jointly by the New Brunswick Telephone Company and the Maritime Telegraph and Telephone Company was put into service in July 1941 across the Bay of Fundy, a distance of approximately 40 miles. This was a typical application for radio as it saved approximately 130 miles of wire line by transmitting by radio from Saint John to Digby and continuing from there by wire for approximately 150 miles to Halifax, as compared with a 280-mile wire circuit from Saint John to Halifax via Moncton and Truro. This radio circuit meets standard long-distance toll requirements and forms part of the trans-Canada telephone circuit. Telephone carrier was applied to this radio circuit in March 1945, increasing its capacity from one to three channels.

During the war, the Canadian Government installed several extensive radio telephone relay systems to supplement telephone communication systems for coastal defence on both the Atlantic and Pacific coasts. The first of these systems, engineered during 1942 for protection along the Gulf of St. Lawrence, utilized standard 1,000-watt 40-50 megacycle FM broadcast transmitters which were chosen because of their availability to meet the urgent requirements of the fighting services. This

Fig. 1—1000-watt FM broadcasting transmitter used during the war emergency for communication across the St. Lawrence river. High quality wide-band transmission characteristics of FM permitted use of telephone carrier to increase capacity of single radio channel to include two telephone voice circuits and four telegraph circuits.

Fig. 2—Experimental antenna station, Lachine, Que., used to check characteristics of VHF antenna structures for telephone relay station used on East Coast defence system.

installation, the first of its kind in Canada, required extensive development work, principally in regard to the design and construction of antennas, to withstand the severe weather conditions encountered at high altitudes along the coast where some of the equipment had to be located.

Towers were designed to withstand wind velocities of 150 miles per hour with structures loaded with three inches of ice. This ruled out conventional antenna designs using insulators and regular co-axial transmission line feeds. It was necessary to establish a large experimental antenna station a few miles west of Montreal where designs were engineered and their transmission characteristics thoroughly checked during the winter of 1942-1943 so that they could be installed without delay in the spring as soon as roads could be built into the inaccessible sites on the rugged south shore of the St. Lawrence. One of the sites was approximately 30 miles from the nearest highway and over 4,000 feet above sea level.

This circuit consisted of two terminal stations and one intermediate relay station and was originally designed to operate as an isolated radio link, but was later tied in with wire line to the telephone exchange at Halifax and, at that time, telephone carrier was superimposed on the radio circuit to give a total of two voice and four telegraph circuits. This addition of carrier was possible due to the high quality wideband FM radio transmitter that had been originally used for this installation.

The second large radio telephone network installed by the Government was on the West Coast. This installation also used commercial FM broadcast equipment in the same frequency range but of somewhat lower power output. Climatic conditions being much less severe on the West Coast, more or less conventional antenna systems were employed, although many difficult and almost insurmountable problems were encountered due to the inaccessible and rugged nature of the country.

Due to the rapid advancement of the art, higher frequencies in the neighbourhood of 100 megacycles were used for the next large system engineered and installed for war purposes during the fall of 1943 and the spring of 1944. This installation was located on the East Coast, supplying much needed communication to Newfoundland. Weather conditions were again a severe problem to cope with, but design work was greatly simplified due to the smaller antennas required for these higher frequencies; 250-watt transmitters were also found adequate for the system. Voice frequency carrier was not employed on these circuits but instead, four separate radio channels were installed. This compared favourably from a cost standpoint with the first installation referred to, due to smaller antenna structures and lower power of the transmitters used at these high frequencies.

The reliability of very high frequency systems of this type has been thoroughly established during their wartime operation and, provided frequency assignments can be made available, there is little doubt that extensive use will be found for radio to replace or supplement existing wire lines. Relay systems at these or higher frequencies will soon become an integral part of many long distance telephone circuits. They will also find extensive use in extending telephone service to rural communities where normal land lines are too expensive to install or maintain.

Pulse Modulation

In considering the future plans for radio telephony, this paper would be very incomplete if it did not include a reference to pulse modulation. The merits of this method of transmission applicable to multi-channel telephony were first considered in 1937, but the advancement of radar or pulse technique during recent years can be given full credit for bringing this system into actual operating use during the last year of the war.

The method consists essentially of transmitting intelligency by pulses of constant amplitude and duration, the instantaneous amplitude of the voice being translated into a variation of time intervals of successive pulses, the rate of this variation corresponding to the instantaneous frequency of the signal.

The AN/TRC-6 eight-channel microwave radio system(3), designed by the Bell Telephone Laboratories and used during the last year of the war by the American forces, makes use of "pulse modulation". In such a system, the radio transmitter emits short spurts or

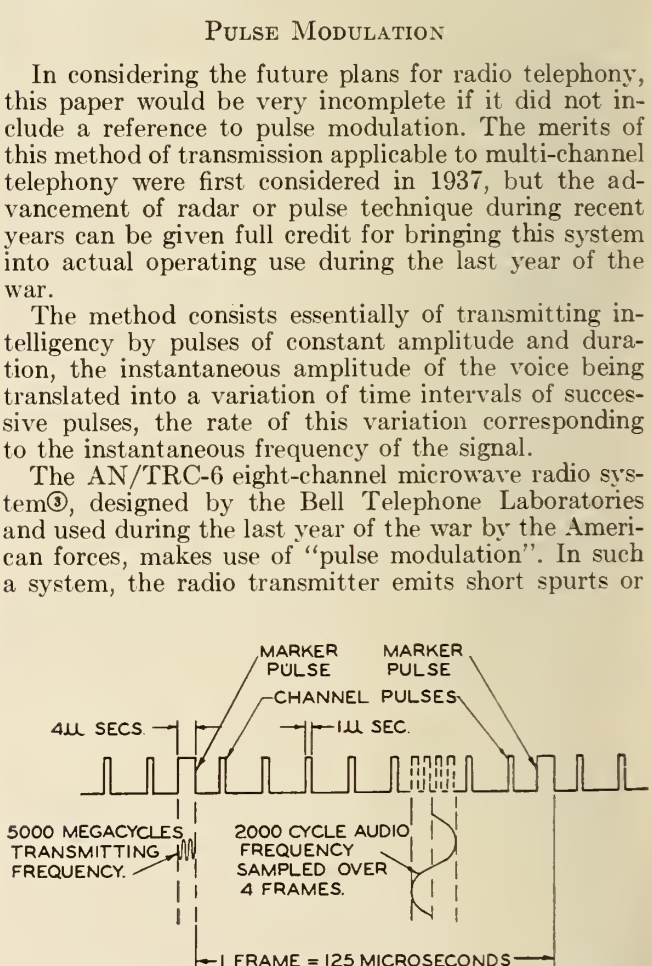

Fig. 3—Diagrammatic sketch of pulse transmission of AN/TRC-6 microwave relay transmitter with audio modulation on channel No. 6.

pulses of radio-frequency power, individual bursts lasting for intervals of time as short as about one-millionth of a second. These short microwave pulses are substantially constant in both amplitude and frequency. Eight one-microsecond pulses, one for each channel, are transmitted in sequence 8,000 times a second, that is, each audio channel is sampled or scanned approximately every 125 microseconds.

The intelligence of each channel is conveyed by varying the time position of the one-microsecond channel pulses. The phrase "pulse-position-modulation" (PPM) has been applied to this method. Eight channels share the operating time of the radio transmitter and receiver, each using them in turn. Such a sharing process utilizes a multiplexing principle that, at least for telegraph, dates back to 1853, and for many years has been known as "time division". Pulse transmission therefore not only provides for position modulating the pulses but also permits multiplexing the channels by time division. Simultaneous two-way communication is provided by using different radio frequencies for the two directions of transmission. Directional separation is thus obtained by frequency separation or "frequency division", while channel separation is obtained by time division. No detectable distortion of the re-created signals in the final receiver is inherent in this method of transmission, nor is the system limited to only eight channels.

Fig. 4—Searchlight antenna used with AN/TRC-6 microwave pulse modulated radio relay system.

Because of the line-of-sight path over which the system operates, the distance between sets is limited by the curvature of the earth, but by using intermediate sets as radio relays, communication may readily be extended to hundreds and even thousands of miles.

A highly directive and sharply focused microwave beam with a frequency of nearly five billion cycles per second is used to carry the intelligence of the eight messages. The antenna beam pattern is comparable in sharpness to that of a searchlight, and the five-billion-cycle radio frequency of the relay system corresponds to a wavelength that is less than one-half the length of an ordinary lead pencil.

This very high radio frequency gives communication channels virtually free from static and most man-made interference. As a result of the sharply beamed transmission, the correspondingly highly directive reception and the absence of static and other external noise sources, a small amount of transmitter power is adequate for communication over optical paths of considerable distance. A peak power of two watts serves for jumps as great as 100 miles. Because of the sharp beam pattern of the transmitting and receiving antenna systems, because transmission must be over an unobstructed optical path, and because of the method of modulation employed, a substantial number of sets using the same frequencies may be operated in close proximity at a single location.

The practical application of this system of radio communication has been thoroughly established by war usage. A trial installation for commercial telephony is now under way between Los Angeles and Cataline Island. A similar trial installation is contemplated for Canada. It seems probable that AN/TRC-6 equipment is the forerunner of future line-of-sight microwave relay systems operating in the billion-cycle range which will provide stabilized broad-band communication facilities of high quality and dependability. These advantages are enhanced by sharply beamed transmission and reception, pulse transmission, and time division multiplex. Such systems can be transportable or fixed as required. The passage of time and the results of additional development which can be expected to follow at a rapid tempo will contribute towards establishing their economic status and advantageous fields of application.

Aircraft Radio

Prior to the war, practically all commercial air lines carried complete two-way radio communication facilities for the transmission of information and instructions between the pilot in the air, and the ground control at various airports. The pilot was also guided in his flight path by low frequency radio range beacons, and was given warning of his approach to specific ground features by radio marker beacons.

Radio is undoubtedly one of the major factors contributing to the successful use of aircraft during the war. The radio communication equipment, with no reference to the multiplicity of radar, installed in every Canadian-built Lancaster bomber included three radio transmitters and three radio receivers, one of the latter being used as a radio compass. Two TA-12 transmitters, each with four pre-set station frequencies, were used for long distance communication between the plane and ground. The companion RA-10 receiver was used for long distance reception from the ground. A combined transmitter-receiver, TR-1196, known as a command set, was used for short distance communication within the squadron. The MN-26 Compass, which also forms part of the navigation radio equipment is a high quality radio receiver with a rotatable loop antenna which, when directed towards a specific radio station to which the receiver is tuned, gives the pilot or navigator a direct azimuth reading of the radio station relative to the direction in which the plane is heading. In addition to these radio transmitters and receivers, there are numerous remote indicators and controls, as well as a complete intercommunication system within the plane having eleven outlets or station boxes where the crew can receive information that comes over the radio, or they can be used to pass instructions between members of the crew.

Returning again to commercial air transport, it will be realized that aircraft in flight are totally dependent upon radio for transmission of essential flight information relating to *en route* and terminal weather conditions and trends, changes in routing and the nature of other traffic on the airway. A safe and efficient operation cannot be conducted unless this information is continually available. The tremendous expansion in air transport operations now being planned will be accompanied by a commensurate increase in the complexity of the airways traffic control problem. To assure safety in flight, it is therefore reasonable to assume that within the next few years, all aircraft, scheduled and unscheduled, will be required by government edict to carry two-way radio communication facilities.

Fig. 6—Radio control pedestal designed for TCA for the DC-4M DeLuxe airliners being built by Canadair in Montreal.

There is no doubt that the advancement in radio will keep pace with the fast-moving air industry. This will bring into use many new radio devices and will necessitate a large expansion in the number of radio frequency channels for airways services. Fortunately, the accelerated war development has already made this a reality. Existing services will be greatly expanded and augmented in the post-war years. New and broader frequency assignments have already been given to the aeronautical services in the high frequency spectrum. In addition to communication frequencies, provision is also being made for airway and airport traffic control, distance and collision indicators and meteorological observations by radio which are already accepted aids to air navigation. It is feasible to expect that pilots will be directed in specific traffic lanes and their flight safely controlled by radio or radar beams just as railways are today controlled by the block system. Instrument landing, which is already installed at some airports, will permit pilots to land in absolute safety where visibility above the landing strip, due to weather, may be only a matter of feet instead of hundreds of feet.

The science of radar has already made possible the development of accurate instruments for the reading of distance. The distance indicator④ developed by the National Research Council is an airborne equipment which shows the pilot of an aircraft his distance from one or more selected ground points. This information is presented continuously on a meter on the cockpit panel calibrated in two ranges, 0-100 miles and 0-25 miles. The long range scale is intended for airways navigation and the short range scale for airport control and approach procedures. The conservative working range of the system is 100 miles at an altitude of 4,000 ft.

The complementary ground equipment is installed at selected points, which may be sites of the present range stations, or at airports, depending upon the particular application. Monitoring equipment is provided in the airport control towers to ensure a continuous check on the performance of the ground stations.

One of the most promising peacetime applications for radar appears to be in the meteorological field for the detection and observation of storm areas. Extensive experimental work⑤ has been carried on during the past year using radar equipment, known to the army as M.E.W. It has been conclusively established that this same equipment which used to scan the sky for enemy aircraft, can also see snow, rain and even heavily saturated clouds. The location of these storm areas and the direction of movement can be readily determined from the electronic picture on the cathode ray screen of the radar equipment, and the necessary information can thus be given to the pilots through the usual meteorological service.

Fig. 5—Wireless operator's table, Lancaster bomber, showing TA-12 transmitters with associated antenna loading units, MR9 remote control for R-10 receiver, MN-28 remote control for MN-26 compass receiver, and 3616-B transmitter control.

Marine Radio

Ships having sailed the seas as long as history can relate are not as vitally dependent on radio for communication as aircraft, but nevertheless no modern ship today is without radio and, in fact, by recent government legislation, certain classes of vessels sailing in specified zones in Canadian waters must now be equipped with this modern means of communication.

The use of very high frequencies which has extended the horizon of many communication services will have only limited application for marine communication. Due to the "line of sight" characteristics of frequencies above 30 megacycles, their use will probably be restricted to direction finding and to coastal vessels and inland shipping on small lakes where land stations can be installed on high ground near the water's edge and thus the height of the station will offset to some extent the curvature of the earth. For example, if the shore station is 1,000 feet above the water level, the line of sight path will extend out from shore approximately 40 miles, whereas with two stations located on separate boats, at sea level the tops of 50 ft. masts would drop out of line of sight when the boats are approximately 18 miles apart. These distances are of very little value to commercial shipping so that generally speaking their communication frequencies will probably remain in the old pre-war channels below 30 megacycles, where we can rely on obtaining one or more reflections from the Heaviside layer to greatly extend the useful range of the transmitted signal.

Although we do not expect any spectacular changes in marine radio communication, there appear to be many improvements in navigational aids as well as a direct application for the use of radar. The distance indicator, referred to under Aeronautical Aids to Navigation, has a direct application for ships approaching harbour or another vessel equipped to give a return signal. It may also be used to obtain distance readings from lighthouses or buoys. These return signals will be identified so the captain will have no difficulty in recognizing the correct landmark.

Type 268 naval radar equipment[4] was designed by the National Research Council to be used in small ships of the Motor Torpedo Boat or Fairmile class for the detection of surface targets.

The equipment consists of a single rack or cabinet which contains the transmitting and receiving apparatus, a motor-driven continuously rotating antenna, mounted on the mast, and two remote indicator units or displays. The equipment is usually mounted in a small cabin within the ship, and a single operator ob-

Fig. 7—Airborne distance indicator designed by National Research Laboratories.

Fig. 8—Microwave search antenna used with 268 naval radar equipment.

tains range and bearing information from the main display unit mounted in the main rack or cabinet. Of the two remote display units, one is usually mounted on the bridge, and the second mounted within the chart room.

The main purpose of the equipment during the war was to detect the target and direct the ship's course onto it, for attack. It was also found useful in navigating small vessels during darkness or fog, particularly when in a group with other ships or when close to shore.

Equipment of this type will have a broad application as a peacetime navigational aid. With the rugged shore lines of some approaching narrows clearly traced on the electronic screen in front of the captain, he can with complete safety, even in a dense fog, guide his vessel past the perilous rocks and continue on his course without delay.

Train Radio

The broadening of the radio frequency frontier towards the visible spectrum has made possible the development of mobile train radio service. Following extensive field studies, the Federal Communications Commission in the United States has, within the last few months, allocated the band 158-162 mc. for railroad use, in end-to-end, train-to-train, and wayside-to-train service; and on a non-interference basis, for yard and terminal communication. The bands 44-72 mc. and 186-216 mc. are also available on a sharing basis with television, for yard and terminal radio systems. This action by F.C.C. is significant and of vital importance, and cannot be overlooked in considering the potentialities of VHF train radio. It is to be expected that Canada will consider similar action in assigning frequencies for this type of service.

The opening up of the VHF band for this service has resulted in many advantages; they can be briefly summarized as follows:

(1) The first and most important consideration is the desirable propagation characteristic of 160 megacycle radiation. Due to the absence of ionispheric reflections, it is possible to control the range as

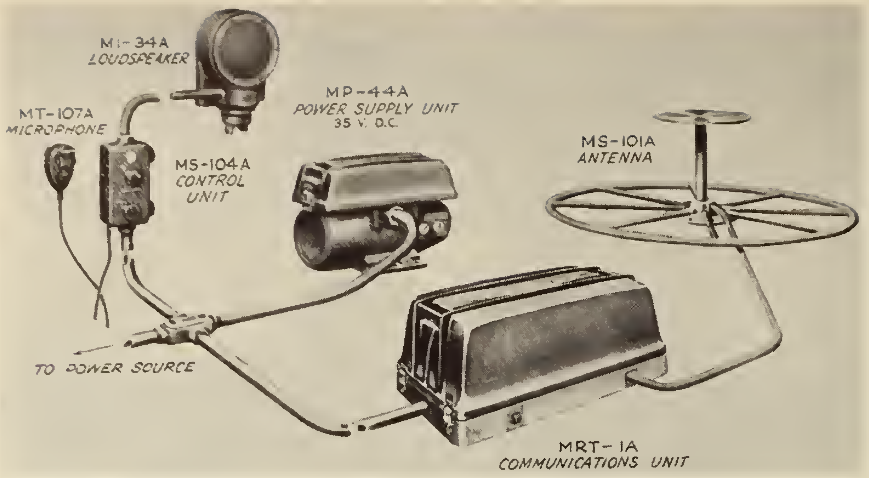

Fig. 9—160-megacycle mobile train radio equipment.

the requirements of railroad application might dictate. Then, too, the earth and objects upon it act as more and more efficient reflectors as we proceed upward in the spectrum to 160 megacycles. This results in perfectly usable signal levels entirely beyond the line of sight and , on the basis of recent tests, it appears that solid communication on 160 megacycles can be maintained in long tunnels.

(2) The short wavelengths employed, slightly less than two meters, permit the erection of small but highly efficient antennas having directional or non-directional characteristics as desired. This makes it possible to erect antennas on locomotives and cabooses well within the railroad's clearance pattern. This is one of the major reasons why tests at lower frequencies in the past have been somewhat unsatisfactory.

(3) A third and most important feature concerns electrical interference. It was originally feared that the electrical noise level in huge Diesel-electric locomotives and in industrial areas would be severe. Recent operating tests have indicated that at frequencies of 160 megacycles, noise from sparking commutators, high tension lines and other such sources was almost non-existent. It is safe to say that atmospheric noise is almost entirely absent and that any man-made noise encountered is of the impulse type and easily rendered innocuous by the use of radio noise limiters.

(4) Due essentially to the three preceding factors, it is not necessary to employ high power to provide a consistent noise-free communication circuit. Low power can do an excellent job. This means smaller equipment operating at lower temperatures, lower power input, lower tube cost and lower overall cost. It also makes practicable the employment of pack sets and handy talkies.

(5) 160 megacycles also represent a "happy combination" of things. The frequency is high enough to secure the advantages of controlled range, small antennas, low noise level and lower power, yet the frequency is low enough to permit routine manufacturing and maintenance techniques and use of standard components. This means that thoroughly reliable equipment is available today.

The MRT-1A communication unit is one of the latest post-war designs of a combined mobile transmitter-receiver for railway use. The case is of moulded, reinforced aluminum construction with a rubber gasket between upper and lower halves to give a water-and-air-tight housing. The overall dimensions are 27 in. long. 14 in. wide and 10 in. high, and the complete unit weighs 55 lb. This equipment operates in the 108-162 mc. range, the lower end of the band being available for aviation radio. It is frequency modulated and has a transmitter output of approximately 12 watts.

The associated antenna is of novel design; relatively short in any event due to the high frequency, but made still shorter to meet the space limitations of the railroads by the top loading disc, and carries its own ground plane in the form of a cartwheel.

Police, Fire and Forestry Radio

Police, fire and forestry as emergency services for the protection of life and property have been able to obtain a limited use of radio in the past. The commercial development of frequency modulation (FM) in the 30-40 megacycle band for mobile service during 1939 greatly expanded the usefulness of mobile communication and especially for large networks required by the provincial police.

The following proposed Provincial Police system illustrates the advantages that can be obtained from FM. All main fixed stations would operate on the same frequency so that they could communicate with adjacent stations and any car within their range.

The transmitters in the mobile units would be on a second frequency used to communicate back to the main stations, which would have a second receiver tuned to the mobile transmitting frequency. This dual frequency arrangement permits the main stations to have priority for inter-station and station-to-car communication without interference from the mobile units. On the other hand, a mobile unit would be always free to call its main station on the second frequency and, depending upon the urgency of the case, the main station could decide whether or not to interrupt the conversation in progress in order to communicate with the car which has put in the call.

This arrangement provides for two-way communication from main station to car and car to main station. If three-way communication is required, that is, the addition of car-to-car communication, a second crystal can be added to the mobile transmitter using the main station frequency. This, however, would make it possible for the cars so equipped to interfere with trunk calls.

A large number of main stations operating on the same frequency, thus giving great flexibility with a minimum of equipment, is only possible because of the capture effect of FM. It has been found entirely feasible to operate stations not immediately adjacent simultaneously without creating any disturbance to the cars listening to their own stations. If the same case were applied to amplitude modulation (AM) the weaker signal would be heard mixed up with the desired station and would set up a heterodyne squeal or spoil the wanted signals entirely. In engineering terms, using FM, the ratio between desired and undesired signals has to be only 2 to 1 for rejection of the weaker station on the same frequency, whereas in AM, the stronger signal must be at least 20 times louder in order to blanket out the interference.

This engineering fact has proven to be the solution to the problem of congestion that exists on police frequencies due to the large number of cities, towns and even provinces desiring to operate radio facilities on the limited number of frequency channels available.

This characteristic will also be of considerable advantage to forestry radio as it will permit large networks to operate on the same frequency and give great flexibility in the movement of equipment from one location to another as it is needed to take care of emergencies.

Up until the present time, radio for fire departments has usually been used in co-operation with the municipal police systems. With the development of pack sets and walkie-talkies, there is little doubt that this service will be extended to supply communication at the actual scene of the fire. With this equipment, the various fire-fighting crews will be able to keep in touch with each other and at the same time they can be directed in their operations by the chief or some other officer who can see the progress of the fire from a place of advantage. It will also be of invaluable assistance in directing help to firemen who are in danger of being trapped or cut off from exit.

General Mobile Radio

General mobile radio includes a broad field and, although not a standardized term, is intended to designate all services designed to extend communications to motor vehicles in the cities and on the highways. Telephone service to these moving vehicles, of course, can be given only by radio. The service, up until the present time, has been extremely restricted, due to the limitations of usable frequency channels. The broadening of the frequency spectrum in recent years has therefore stimulated a great deal of interest on the part of prospective users who realize the tremendous advantages which are likely to accrue from this type of service.

This vehicular telephone service is of two types. First, urban service for vehicles operating primarily in cities and towns and, secondly, highway service for vehicles operating on or in the vicinity of the principal inter-city highways. Urban service, particularly in the large cities, should be available for use by all operators of motor vehicles, including public utilities, doctors' cars, ambulances, surface traction lines, taxicabs, busses and all types of delivery trucks. This service should be available also to tugs, ferry boats, barges and other vessels. Highway service should be provided to inter-city transports, busses, highway maintenance vehicles, utilities and others, including vessels operating in nearby waterways. The facilities also may be used for communication with railway trains and possibly aircraft.

Such service may be provided either on a common carrier basis by the telephone companies, or through a plurality of private services. Private service may be justified for certain large operating companies who can utilize at a reasonable capacity the frequency channels assigned to them, and can also justify the economy of establishing separate central office fixed station transmitting and receiving equipment. On the other hand, there are many advantages in the establishment of a co-ordinated common carrier system of public mobile communication, serving a wide variety of needs. Such a system will permit highly efficient use of radio channels with resulting conservation of frequencies and economy of operation. Through interconnection with the general telephone exchange and toll system, the communication needs of the smaller user will be served as effectively as those of the larger user. Centralized operation and co-ordination will also minimize interference possibilities.

One of the most important new applications for mobile radio service is for communication to line maintenance and emergency service trucks of all types. This service will eliminate a great deal of waiting time on the part of service trucks which are now held at headquarters for emergency calls. When radio-equipped, these trucks may be employed on regular routine maintenance and yet will be available for immediate dispatch to the source of trouble in the same familiar way that we now see a police car directed to the source of a civilian disturbance.

The Bell Telephone Company of Canada already have installed, on an experimental basis, common carrier mobile radio service in both Montreal and Toronto. The final installations at these locations will include one or more high-power fixed-station transmitters and a network of fixed receivers located at a number of points throughout the city to receive the weaker return signal from the low-power mobile transmitters. The fixed station equipment will be connected through the regular telephone trunk lines to the exchange switchboards. Any telephone subscriber may therefore originate a call through the exchange and be connected by radio to any radio-equipped vehicle. Selective ringing is used so that even though the radio circuit will be a party line for a number of mobile subscribers, only the designated subscriber will receive the ringing call. The radio-equipped vehicle may originate a call to any other telephone subscriber through the exchange operator.

Power Line Carrier

Power line carrier, operating in the low frequency band below 200 kc.. has been used extensively by the electric power companies for communication between power stations and to service trucks equipped with portable radio equipment working in close proximity to the power lines.

This system has many of the inherent advantages of both wired lines and space radio. The radio waves, being guided by the wire lines, give reliable transmission up to approximately 150 miles with relatively low power in the order of 50 watts. At the same time, having the characteristics of radio, the signal will carry through space for a limited distance in the event of line damage.

In recent years the use of these radio communication systems has been extended for relay control and telemetering. This is accomplished by dividing a portion of the audio frequency channel into a number of narrow band channels for the transmission of a single frequency tone or pulse. By interrupting the continuous tone or by varying the length of the pulse, relays or meters can be operated at remote locations.

This system is very economical in the use of radio frequency channels and as it is practically instantaneous in response as a means of control, it gives considerable promise for widespread use in the future.

Radio Broadcasting

Standard broadcasting is one of the oldest and, as its name implies, one of the most standardized forms of radio communication. Little technical change can therefore be expected, but on the other hand, many Canadian stations have recently been authorized by the Government to increase their power output rating to the limits permitted under the terms of the Havana Agreement. This has brought about a large expansion

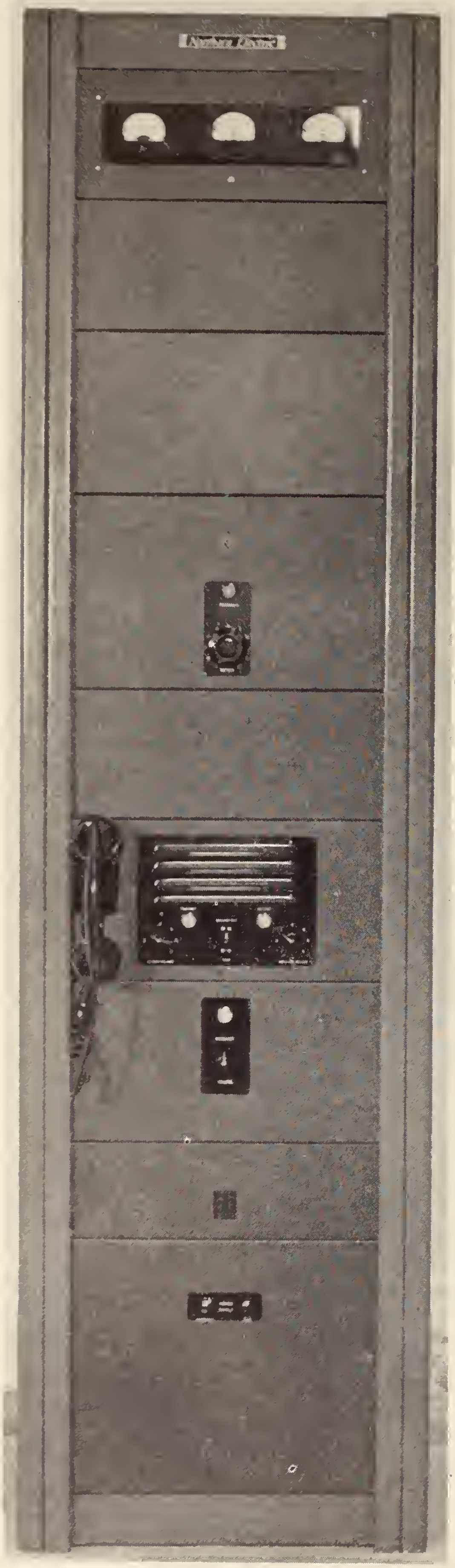

Fig. 10—Power line carrier terminal.

in the construction of new high power stations from coast to coast. This has been accompanied by extensive use of two, three and even four tower antenna directional arrays required to prevent excessive interference with co-channel and adjacent channel stations.

Considerable publicity has been given to the advantages of frequency modulation as compared with amplitude modulation for broadcast purposes. These advantages include the possibility of better signal-to-noise ratio, absence of fading due to the use of very high frequencies, lack of interference due to the capture effect, and improved quality due to the wider frequency band available. FM, however, is not likely to entirely supersede AM, as the standard broadcast has the advantage, in rural areas, of greater coverage as it is not limited to line-of-sight transmission. The field for FM broadcasting appears to be in cities and larger towns, whereas AM can be expected to remain in favour for high power stations giving combined urban and rural coverage.

In the United States, frequency modulation had made a beginning before the war with approximately half a million FM receivers in use as compared with about sixty million AM receivers. This was one of the objections brought forward against changing the frequency allocation from the 42-50 mc. band up to the 88-108 mc. band. A limited amount of experimentation is being done in Canada on the old frequency band due to the availability of equipment for these frequencies, but for practical purposes this country is in the fortunate position of not being faced with any conversion programme or obsolescence due to the adaptation of the 100 mc. band for FM.

The Department of Transport is actively engaged in planning for FM broadcasting and it is expected that the regulations governing its use and the engineering standards to be followed will be forthcoming early this year. A conservative estimate of the ultimate number of FM broadcast stations in Canada would be in the order of 200 as compared with about 2,000 in the United States. There are at the present time approximately 100 applications for Canadian stations so that there is little doubt that a broad expansion will be forthcoming in this field of radio communication. This will expand Canadian production facilities for both transmitting equipment and radio receiving sets for the home. The latter will undoubtedly appear on the market as combined AM and FM receivers before the end of this year.

Canada's future position in the field of international broadcasting has been very firmly established by the inauguration of the Canadian Broadcasting Corporation's International Shortwave Service[6] about a year ago at Sackville, New Brunswick. This installation is an outstanding tribute to Canadian engineers and especially those directly associated with the design and construction of the system. By the application of the latest developments in the art of radio communication, Canada is able to supply a service which is technically second to none, as compared to similar services originating from this side of the Atlantic. These services are gradually being extended and we can be assured that "Canada's Voice" will have an ever broadening influence in world affairs.

Facsimile and Television

It has been stated that television is the ultimate in communication. A very brief analysis of the technical facts reveals only too clearly the magnitude of the transmission problems of sight as compared to audio intelligence, which up until recent years has been the common concept of communication.

Frequency band width has become almost a commodity to the communication engineer. He assigns about 100 cycles to a printing telegraph machine that prints 60 words per minute. A 3,000-cycle band width is considered a reasonable engineering standard for commercial telephony. The range of the normal human ear is about 15,000 cycles and perfect transmission of music requires that band width. For the transmission of high quality colour television, the standards have been established at the astronomical figure of 20,000,000 cycles although for commercial black and white transmission, the limit will not exceed 6,000,000 cycles.

Stating this in another way, twenty printing telegraph channels with adequate separation cost in frequencies about as much as an ordinary telephone channel, but for one television channel we must pay the price, in frequencies, of 1,000 telephone or 20,000 printing telegraph channels.

The necessity for this broad communication band can be realized when it is understood that the television camera dissects each picture into approximately 175,000 separate pieces, accurately arranged in horizontal rows with hundreds of pieces to each row. They are then transmitted one piece at a time, row by row, to the receiving set. There they are laid down in the same order, so swiftly that the eye sees a complete picture all at once. To show clear images and unblurred action, television must reproduce 30 complete pictures every second, giving a total of 5,250,000 separate dots or picture elements. With colour television, the number of picture elements to be transmitted each second must be approximately three times this number.

In the United States at the end of 1944 there were nine active television stations and over 80 applications for new stations. At the end of 1945, the number of applications had increased to 125. During November of last year, F. M. Folson, Executive Vice-President in charge of television for RCA, predicted sales of 300 to 400 thousand television receivers during 1946 and 600 to 700 thousand during 1947. This compares with a total of approximately 7,000 receivers in use in the United States prior to the war.

The Canadian picture, of course, is not quite so optimistic. Studio programmes using live talent will be extremely expensive and can probably be supported in only a few of our large cities. It has been stated that a television programme requires ten technicians for every one used on a radio broadcast programme. The importation of programme material will necessitate the installation of co-axial cables or radio relay circuits from the American network centres. It will probably be several years before these facilities will be available. A further problem confronting Canada is the need of specially designed equipment for our 25-cycle power areas and the difficulty of synchronizing telecasts between the 25 and 60 cycle districts.

These many problems, however, are only a challenge to our Canadian engineering talent and Canadian industrial enterprise. From a review of our past achievements, there is no reason to doubt that these obstacles will be overcome and that the future of television in Canada is assured.

Conclusion

I realize only too well as I approach the conclusion of this article that I have attempted a difficult if not impossible task in trying to deal with the broad field of radio communication within the limits of a single paper. Any one of the phases of this art gives adequate scope for a complete study in itself. I am conscious of many omissions, but hope that I have covered most of the highlights and have left no doubt in your minds as to the broad expansion that lies ahead of us in the field of radio communication.

This expansion, however, cannot be realized immediately and we, as engineers, should guard against the stimulation of undue optimism on the part of the public for the early release of new products and services. If these are not thoroughly engineered and field-tested before being offered for commercial use, it is bound to have a serious reaction on the whole radio industry and may jeopardize its growth for many years to come. We all realize that even during the war when the lives of hundreds of thousands were at stake, progress in new developments was subject to many limitations. Advancement had to be made one step at a time. With commercial and economical considerations now playing an important role in civilian developments, progress is bound to be relatively slow. It is interesting to note that Major Armstrong's original developments on FM broadcasting date back to 1933, but it was not until six years later that they were applied commercially to mobile radio and we are only beginning to realize the benefits of FM broadcasting itself.

We can reasonably expect, as a direct result of war research, that there will be a greatly accelerated period of development in commercial radio communication during the next five or ten years. Radio communication throughout most of the VHF band from 30 to 300 mc. is already becoming a commercial reality. This expansion will soon give service to many types of users who were previously without means of communication. Many new radio aids to navigation are already past the experimental stage and within the next few years will be a major contribution towards safer and more efficient operation of both aircraft and marine transportation. In the ultra-high frequency and microwave ranges, research has produced many new equipments for war use but only a very limited number of them have been applied even experimentally to commercial communication. This latter stage, unlike the developments covering equipment used below 300 mc., involves entirely new components and techniques. Consequently, commercial developments are only in their infancy, and it will undoubtedly be many years before we realize the full advantages which can be gained by the use of these extremely high frequencies.

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THE SOLUTION OF THREE-TERM SIMULTANEOUS LINEAR EQUATIONS BY THE USE OF SUBMATRICES

I. F. MORRISON, M.E.I.C.

Professor of Applied Mechanics, University of Alberta, Edmonton, Alta.

Introduction

In the analysis of indeterminate structures one often encounters large sets of simultaneous equations. If influence lines are to be plotted, it is advantageous to solve these equations in general form. The loading terms can then be varied according to the successive positions of the unit load. Also they can be written in algebraic form from which the equations of the influence lines can be immediately set down. This paper deals with a method of solution based on the division of the matrix of the coefficients of the set of equations into submatrices. It is particularly adapted to sets of three-term equations because some of the submatrices are null and, therefore, do not appear in the process of solution. A common source of equations of this sort is the three-moment equation.[1] A formal solution has been worked out and a simple step by step process by means of which the reciprocal matrix is to be obtained is set forth. It is illustrated by application to a simple numerical case.

§*1.*

A set of three-term simultaneous linear equations with n unknowns may be briefly indicated by

$$a_{ij}x_i = z_i \qquad i-1.......n. \qquad a_{ij}=a_{ji}$$

$$j-1.......n. \qquad a_{ii} \neq 0$$

$$\text{at least one } z_i \neq 0$$

The summation of the terms on the left is implied and there are not more than three terms in any one equation.

The formal solution of these equations is

$$x_i = b_{ij}z_i, \text{ in which } b_{ij} \text{ is such that,}$$

$$b_{ij}.a_{ij} = I_n \qquad I_n \text{ is the unit matrix of order } n.$$

It has been shown in a recent paper[2] that some advantage may be gained in the solution of large sets of linear equations by considering the matrix of the coefficients to be partitioned into four submatrices in terms of which the reciprocal of the main matrix can be found. This method will here be extended and applied to a set of three-term equations.

For purposes of illustration, a set of three-term equations containing six unknowns will be chosen and, instead of four submatrices, the set will be partitioned into nine submatrices as shown in the scheme below, thereby extending the process given in Duncan's paper.

$$\left(\begin{array}{cc|cc|cc}
a_{11} & a_{12} & & & & \\
a_{21} & a_{22} & a_{23} & & & \\
\hline
 & a_{32} & a_{33} & a_{34} & & \\
 & & a_{43} & a_{44} & a_{45} & \\
\hline
 & & & a_{54} & a_{55} & a_{56} \\
 & & & & a_{65} & a_{66}
\end{array}\right) \qquad \begin{array}{l} a_{ij} = a_{ji} \\ \\ a_{ii} \neq 0 \end{array}$$

Let:

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \qquad B = \begin{pmatrix} 0 & 0 \\ a_{23} & 0 \end{pmatrix}$$

$$C = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \qquad D = \begin{pmatrix} 0 & a_{32} \\ 0 & 0 \end{pmatrix}$$

$$E = \begin{pmatrix} a_{32} & a_{34} \\ a_{43} & a_{44} \end{pmatrix} \qquad F = \begin{pmatrix} 0 & 0 \\ a_{45} & 0 \end{pmatrix}$$

$$G = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \qquad H = \begin{pmatrix} 0 & a_{54} \\ 0 & 0 \end{pmatrix}$$

$$I = \begin{pmatrix} a_{55} & a_{56} \\ a_{65} & a_{66} \end{pmatrix}$$

We may now rewrite the set of equations as

$$\begin{aligned} Ax + By + Cz &= l \\ Dx + Ey + Fz &= m \\ Gx + Hy + Iz &= n \end{aligned} \qquad 1.1$$

In these equations, $C = G = 0$ and A, E and I are not singular because $a_{ii} \neq 0$.

Solving the first and third, we have

$$\begin{aligned} x &= A^{-1}\,l - A^{-1}\,By \\ z &= I^{-1}\,n - I^{-1}\,Hy \end{aligned} \qquad 1.2$$

Substituting in the second equation of 1.1,

$$Ey = m - DA^{-1}l + DA^{-1}\,By - FI^{-1}\,n + FI^{-1}\,Hy$$

from which

$$y = U^{-1}\,(m - DA^{-1}l - FI^{-1}\,n),$$

in which

$$U \equiv (E - DA^{-1}\,B - FI^{-1}\,H). \qquad 1.3$$

We now replace y in equations 1.2 and write out the formal solutions which give

$$\begin{aligned} x &= (A^{-1} + A^{-1}\,BU^{-1}\,DA^{-1})\,l \\ &\quad - A^{-1}\,BU^{-1}\,m + A^{-1}\,BU^{-1}\,FI^{-1}\,n \\ y &= \;- U^{-1}\,DA^{-1}\,l + U^{-1}\,m - U^{-1}\,FI^{-1}\,n \\ z &= + I^{-1}\,HU^{-1}\,DA^{-1}\,l - I^{-1}\,HU^{-1}\,m \\ &\quad + (I^{-1} + I^{-1}\,HU^{-1}\,FI^{-1})\,n \end{aligned}$$

The reciprocal matrix is therefore

$$\begin{pmatrix} (A^{-1}+A^{-1}BU^{-1}DA^{-1}) & -A^{-1}BU^{-1} & +A^{-1}BU^{-1}FI^{-1} \\ -U^{-1}\,DA^{-1} & +U^{-1} & -U^{-1}FI^{-1} \\ +I^{-1}\,HU^{-1}\,DA^{-1} & -I^{-1}HU^{-1} & +(I^{-1}+I^{-1}HU^{-1}FI^{-1}) \end{pmatrix}$$

[1]See "A Note on a New Form of the Three-moment Equation", by I. F. Morrison, *Engineering Journal*, March 1944, p. 143.

[2]Some devices for the solution of Large Sets of Simultaneous Linear Equations by Prof. W. J. Duncan, *Phil. Mag.* Vol. 35 page 660.

It will be noted here that A, I and U must be non-singular in order to have reciprocals.

N.B. To multiply two matrices A and B, multiply the terms of each row i of A by those of each column j of B taken in pairs, starting at the left of the row and the top of the column, and add the results. This gives the ij term in the product.

§2.

In order to develop the process further, we proceed to develop U in detail.

We have:

$$(1)\quad DA^{-1} = \frac{1}{a}\begin{pmatrix} -a_{12}\,a_{23} & +a_{11}\,a_{23} \\ 0 & 0 \end{pmatrix}$$

$$(2)\quad A^{-1}B = \frac{1}{a}\begin{pmatrix} -a_{12}\,a_{23} & 0 \\ +a_{11}\,a_{23} & 0 \end{pmatrix}$$

$$DA^{-1}B = \frac{1}{a}\begin{pmatrix} +a_{11}\,a^2_{23} & 0 \\ 0 & 0 \end{pmatrix} \qquad 2.1$$

and also

$$(3)\quad FI^{-1} = \frac{1}{i}\begin{pmatrix} 0 & 0 \\ +a_{45}\,a_{66} & -\,a_{45}\,a_{56} \end{pmatrix}$$

$$(4)\quad I^{-1}H = \frac{1}{i}\begin{pmatrix} 0 & +\,a_{45}\,a_{66} \\ 0 & -\,a_{45}\,a_{56} \end{pmatrix}$$

$$FI^{-1}H = \frac{1}{i}\begin{pmatrix} 0 & 0 \\ 0 & +\,a^2_{45}a_{66} \end{pmatrix},$$

in which a and i are the determinants of A and I respectively. From equations 2.1 and 1.3 we have.

$$(5)\qquad U = \begin{pmatrix} \left(a_{33}-\dfrac{a_{11}a^2_{23}}{a}\right) & a_{34} \\ a_{34} & \left(a_{44}-\dfrac{a_{66}a^2_{45}}{i}\right) \end{pmatrix}$$

which obviously is non-singular provided

$$a_{33} \neq \frac{a_{11}\,a^2_{23}}{a},\ \text{or}\ a_{44} \neq \frac{a_{66}\,a^2_{45}}{i}\ \text{and}\ a_{34} \neq 0.$$

The remaining steps now can be worked out.

(6)	U^{-1}	from	(5)
(7)	$A^{-1}BU^{-1}$	from	(2) x (6)
(8)	$I^{-1}HU^{-1}$	from	(4) x (6)
(9)	$A^{-1}BU^{-1}DA^{-1}$	from	(7) x (1)
(10)	$A^{-1}BU^{-1}FI^{-1}$	from	(7) x (3)
(11)	$I^{-1}HU^{-1}DA^{-1}$	from	(8) x (1)
(12)	$I^{-1}HU^{-1}FI^{-1}$	from	(8) x (3)
(13)	$U^{-1}DA^{-1}$	from	(6) x (1)
(14)	$U^{-1}FI^{-1}$	from	(6) x (3)
(15)	A^{-1} + (9)		
(16)	I^{-1} + (12)		

In skeleton form the reciprocal matrix is:

$$b_{ij} = \begin{vmatrix} (15) & -\ (7) & (10) \\ -\ (13) & (6) & -\ (14) \\ (11) & -\ (8) & (16) \end{vmatrix}$$

§3.

Illustrative Example.

As an illustration of the above process let the matrix be set down as the coefficients of the moments at the supports of a seven span continuous girder of constant I.

$$a_{ij} = \begin{pmatrix} +20 & +4 & & & & \\ +4 & +18 & +5 & & & \\ & +5 & +22 & +6 & & \\ & & +6 & +26 & +7 & \\ & & & +7 & +20 & +3 \\ & & & & +3 & +14 \end{pmatrix}$$

In this case:

$$A = \begin{pmatrix} +20 & +4 \\ +4 & +18 \end{pmatrix} \quad B = \begin{pmatrix} 0 & 0 \\ +5 & 0 \end{pmatrix} \quad a = +344$$

$$D = \begin{pmatrix} 0 & +5 \\ 0 & 0 \end{pmatrix} \quad E = \begin{pmatrix} +22 & +6 \\ +6 & +26 \end{pmatrix} \quad F = \begin{pmatrix} 0 & 0 \\ +7 & 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 & +7 \\ 0 & 0 \end{pmatrix} \quad I = \begin{pmatrix} +20 & +3 \\ +3 & +14 \end{pmatrix} \quad i = +271$$

$$A^{-1} = \frac{1}{344}\begin{pmatrix} 18 & -4 \\ -4 & 20 \end{pmatrix}$$

$$I^{-1} = \frac{1}{271}\begin{pmatrix} +14 & -3 \\ -3 & +20 \end{pmatrix}$$

$$(1)\quad DA^{-1} = \frac{1}{344}\begin{pmatrix} -20 & +100 \\ 0 & 0 \end{pmatrix}$$

$$(2)\quad A^{-1}B = \frac{1}{344}\begin{pmatrix} -20 & 0 \\ +100 & 0 \end{pmatrix}$$

$$(3)\quad FI^{-1} = \frac{1}{271}\begin{pmatrix} 0 & 0 \\ +98 & -21 \end{pmatrix}$$

$$(4)\quad I^{-1}H = \frac{1}{271}\begin{pmatrix} 0 & +98 \\ 0 & -21 \end{pmatrix}$$

$$(5)\quad U = \begin{pmatrix} +20.547 & +6 \\ +6 & +23.468 \end{pmatrix}$$

$$(6)\quad U^{-1} = \frac{1}{446.20}\begin{pmatrix} +23.468 & -6 \\ -6 & +20.547 \end{pmatrix}$$

$$(7)\quad A^{-1}BU^{-1} = \frac{1}{153{,}493}\begin{pmatrix} -469.36 & +120 \\ +2346.8 & -600 \end{pmatrix}$$

$$(8)\quad I^{-1}HU^{-1} = \frac{1}{120{,}920}\begin{pmatrix} -588 & +2013.6 \\ +126 & -431.5 \end{pmatrix}$$

$$(9)\quad A^{-1}BU^{-1}DA^{-1} = \frac{1}{153{,}493}\begin{pmatrix} +9{,}387 & -46{,}936 \\ -46{,}936 & +234{,}680 \end{pmatrix}\cdot\frac{1}{344}$$

$$(10)\quad A^{-1}BU^{1-}FI^{-1} = \frac{1}{153{,}493}\begin{pmatrix} +11{,}760 & -2{,}520 \\ -58{,}800 & +12{,}600 \end{pmatrix}\cdot\frac{1}{271}$$

(11) $I^{-1} HU^{-1} DA^{-1} =$

$$\frac{1}{120{,}920}\begin{vmatrix} +11{,}760 & -58{,}800 \\ -2{,}520 & +12{,}600 \end{vmatrix} \cdot \frac{1}{344}$$

(12) $I^{-1} HU^{-1} FI^{-1} =$

$$\frac{1}{120{,}920}\begin{vmatrix} 197{,}333 & -42{,}287 \\ -\ 42{,}287 & 9{,}062 \end{vmatrix} \cdot \frac{1}{271}$$

(13) $U^{-1} DA^{-1} =$

$$\frac{1}{153{,}493}\begin{vmatrix} -469.36 & +2{,}346.8 \\ +120 & -600 \end{vmatrix}$$

(14) $U^{-1} FI^{-1} =$

$$\frac{1}{120{,}920}\begin{vmatrix} -588 & +126 \\ +2013.6 & -431.5 \end{vmatrix}$$

(15) $A^{-1} + (9) =$

$$\frac{1}{344}\begin{vmatrix} +18.06116 & -4.30579 \\ -4.30579 & +21.52893 \end{vmatrix}$$

(16) $I^{-1} + (12) =$

$$\frac{1}{271}\begin{vmatrix} +15.63193 & -3.34971 \\ -3.34971 & +20.07494 \end{vmatrix}$$

The reciprocal matrix may now be written down by inspection. It is, after the necessary reduction to decimal fractions:—

$$b_{ij} = \begin{vmatrix} +\ .05250 & -\ .01252 & +\ .00306 & -\ .00078 & +\ .00028 & -\ .00001 \\ -\ .01252 & +\ .06258 & -\ .01529 & +\ .00391 & -\ .00141 & +\ .00030 \\ +\ .00306 & -\ .01529 & +\ .05260 & -\ .01345 & +\ .00486 & -\ .00104 \\ -\ .00078 & +\ .00391 & -\ .01345 & +\ .04605 & -\ .01665 & +\ .00357 \\ +\ .00028 & -\ .00141 & +\ .00486 & -\ .01665 & +\ .05768 & -\ .01236 \\ -\ .00001 & +\ .00030 & -\ .00104 & +\ .00357 & -\ .01236 & +\ .07408 \end{vmatrix}$$

§4.

Remarks.

In order to check the final result, the original matrix may be multiplied by the reciprocal matrix. It would seem sufficient, in addition to the obvious symmetry of the reciprocal matrix, to multiply each row by the corresponding column. The result should, of course, in each case be +1.

If n be odd, for the number of unknowns, the method may still be applied. In this case it is best to partition the matrix into nine submatrices such that $E = a_{33}$, the last row and the last column having been omitted. Thus, the symmetry is maintained and moreover U^{-1} reduces to a scalar multiplier, which, since it appears in all forms of the reciprocal matrix, may be factored. In fact U becomes,

$$U = (a_{33} - \frac{a^2_{23}\, a_{11}}{a} - \frac{a^2_{34} a_{55}}{i})$$

The reciprocal matrix is symmetric as will be seen from the numerical example. Thus, (13) is the transverse of (7), (11) of (10), and (14) of (8). Recognition of this fact reduces the amount of computation by three items, and the skeleton of the reciprocal matrix can be written.

$$\begin{vmatrix} (15) & -\ (7) & (10) \\ -\ (7) & (6) & -\ (8) \\ (10) & -\ (8) & (16) \end{vmatrix}$$

Some advantage by the way of a final check, however, may be had by leaving items (13), (11) and (14) in. The proof of these relationships is simple but will not be given here.

The process outlined above can be applied to the case for n equal nine except that the submatrices will then be of higher order and the working out will require more numerical computation.

APPENDIX NOTE ON MATRICES

Definition

A matrix is a system of mn quantities arranged in a rectangular array of m rows and n columns. It is not a determinant. If $m = n$, then the matrix is said to be a square matrix of rank n. A typical element is indicated by

$$a_{ij} \quad i\ .\ .\ 1 \text{ to } m.$$
$$\qquad j\ .\ .\ 1 \text{ to } n.$$

Properties:

Two matrices, A and B or a_{ij} and b_{ij} are equal if, and only if, all of the corresponding elements are equal i.e. $a_{ij} = b_{ij}$.

A zero matrix has all of its elements equal to zero.

The unit matrix is a square matrix such that $a_{ij} = 1$ $i = j$ and $a_{ij} = 0$ $i \neq j$.

The determinant of a matrix is formed from a square matrix and is written $|a_{ij}|$, or a, to distinguish it from the matrix. A matrix is said to be singular or non-singular according as the determinant does or does not vanish.

The coefactor A_{ij} of the element a_{ij} in the determinant $|a_{ij}|$ is used to form the adjoint of the matrix A.

$A_{ij} = (-1)^{i+j} M_{ij}$, in which M_{ij} is the minor of the ij term of the determinant.

$$\text{Thus: Adj. } A = \begin{vmatrix} A_{11} & A_{21} \ .\ . \\ A_{12} & A_{22} \ .\ . \end{vmatrix}$$

The transposed order should be carefully noted. The inverse A^{-1} of a square matrix is obtained by dividing Adj. A by $|a_{ij}|$.

$$\text{Thus: } A^{-1} = \frac{\text{Adj. } A}{|a_{ij}|}$$

$$\text{If } A = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} \text{ then } A^{-1} = \frac{1}{a}\begin{vmatrix} +a_{22} & -\ a_{21} \\ -a_{12} & +\ a_{11} \end{vmatrix}$$

Algebra of matrices

1. The sum of two matrices is defined as a matrix formed by adding each of the corresponding elements.

$$\text{Thus: } \begin{vmatrix} a_{11}\, a_{12} \\ a_{21}\, a_{22} \end{vmatrix} \pm \begin{vmatrix} b_{11}\, b_{12} \\ b_{21}\, b_{22} \end{vmatrix} = \begin{vmatrix} a_{11} \pm b_{11} & a_{12} \pm b_{12} \\ a_{21} \pm b_{21} & a_{22} + b_{22} \end{vmatrix}$$

In general $A_{ij} \pm b_{ij} = C_{ij}$ by the same rule.

2. The product of two matrices is defined as the matrix obtained by multiplying the elements of each row of the first matrix by the elements of each column of the second matrix and adding. This is entered in the product matrix in the position corresponding to the intersection of the row and the column used.

Thus: $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \cdot \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix}$

$$= \begin{pmatrix} a_{11}\, b_{11} + a_{12}\, b_{21} & a_{11}\, b_{12} + a_{12}\, b_{22} \\ a_{21}\, b_{11} + a_{22}\, b_{21} & a_{21}\, b_{12} + a_{22}\, b_{22} \end{pmatrix}$$

In general $a_{ij} \cdot b_{ij} = c_i$

This may also be written: $c_{ik} = \sum_{j=1}^{n} a_{ij} \cdot b_{jk}$ which is in better form.

3. The associative and distributive laws of ordinary scaler algebra hold for matrix algebra. But, the order of the factors in multiplication is important because $A.B \neq B.A$. i.e. the commutative law does not hold.

4. Division by a non-singular matrix A is defined as multiplication by A^{-1}.

Thus: $B/A = A^{-1} \cdot B$

The product $A^{-1} \cdot A = A \cdot A^{-1} = I$, in which I is the unit matrix.

However, $(A.B)^{-1} = B^{-1} \cdot A^{-1}$

The order is important.

N.B. The I used in the paper is not the unit matrix. As the unit matrix does not occur in the paper there should be no confusion. The above note is merely intended to assist those not already familar with matrix algebra in reading the paper.

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IRRIGATION

G. P. F. BOESE, M.E.I.C.

Chief Engineer, Department of Natural Resources, Canadian Pacific Railway Company, Calgary, Alta.

1. Irrigation is so comprehensive a subject that it can be only briefly outlined in a general way in a short article. It is a subject on which a great many volumes have been published and which may be found in public and private libraries almost everywhere. It is older than civilization and as up-to-date as modern science can make it. Fundamentally the principles of irrigation are the same the world over, but irrigation practice and methods vary widely, depending on climate, soil, crops, markets, standards of living, costs and other economic considerations, and in the older areas by traditions handed down from ancient times.

2. Some idea of the extent of irrigation development in different parts of the world may be seen from the following figures, which stand for millions of acres actually served by irrigation works;

India, 53; China, 50; United States, 27; Russia, 8; Egypt, 7½; Japan, 7½; France, 6; Mexico, 4; Italy, 4; Chile, 3; Java, 2½; Spain, 2; Siam, 2.

The figures for India were obtained in 1942; for the United States in 1939; for China (estimated) in 1923, and for the other countries in 1926. Not included are a number of countries where irrigation is carried on to a considerable extent but on a smaller scale. The areas that can eventually be irrigated are considerably greater than the above figures.

In the United States, California leads with about 5¼ million acres, Colorado is next with about 3½ million, followed in order of size of area irrigated by Montana, Wyoming, Utah, Oregon and Texas, with from 2 to 1 million acres. Arizona, Washington, Nebraska and New Mexico have less than 1 million but over 500,000 acres under irrigation.

In Canada, about 500,000 acres are under irrigation in Alberta and there are a number of small projects in British Columbia and Saskatchewan. In Australia, irrigation development has made considerable progress since about 1924.

Irrigation in the United States and Canada is practically all confined to Western States and Provinces.

3. The amount of water needed to produce maximum crops of all kinds has been determined in practically all areas where irrigation is practised, but warmth and sunshine are also needed and the soil must contain sufficient chemical plant food and decayed organic matter or humus. Where the normal rainfall is insufficient, irrigation must be resorted to if abundant crops are to be produced.

4. Various other considerations besides climatic and soil conditions have bearing on the feasibility of irrigation development. Water must be available in quantity and accessibility; the cost of the project should be within economic limits; markets and transportation facilities should be accessible, and water users should have the ability to pay some proportion of capital costs as well as maintenance charges.

5. The amount of water to be supplied by irrigation is determined by experiment and from studies of the meteorological records of the locality, which will indicate to what extent precipitation is deficient and to what extent temperature, sunshine and evaporation will affect crop growth. The quantity of water required is variable for different crops, but an irrigation system is designed for the average crop requirements of some particular area and also to supply domestic and stock water needs. Irrigation water is not supplied for human consumption, although indirectly, through wells and after treatment, such use is frequently made of it.

6. Water for irrigation is supplied by gravity, pumping or sprinkler systems and by various primitive devices coming down from antiquity. By gravity, which is by far the most general method used, the water is carried in open ditches, pipes, flumes and chutes by the force of gravity. Pumping is resorted to where water can be economically lifted to points higher than the source of supply, and from the higher levels it is carried by gravity to the land to be irrigated. Sprinkler systems are principally used to water orchards, lawns, gardens and golf courses, the water being carried under pressure in pipes. The sprinkler method occupies only a comparatively small place in the general field of irrigation. Various other contrivances are used for lifting water

to higher levels such as the vertical water wheel, operated by the current of the stream itself, and the hydraulic ram, which is automatic and uses a comparatively large quantity of water under a low head to raise a small quantity to a considerably higher level. Neither of the latter have much use in irrigation.

7. To determine what water is available for use on an irrigation project necessitates a study of stream flow records covering as many years as possible. Measurements of the flow of most of the more important streams in the United States and Canada have been made over a considerable period of years and are available in Government publications. For streams, on which such records have not been kept, it is possible to estimate the probable discharge by a study of precipitation records for the water shed area.

8. The source of supply is generally from rivers fed by mountain streams, which carry heavy spring run-off with high flood discharge for short periods and possibly small flow during the greater part of the year. The area that can be irrigated depends on the quantity of water available, after prior rights on the stream have been satisfied, and unless storage is provided the period of minimum flow will govern as to the amount of water that can be supplied by direct diversion. The area that can be irrigated is however limited to the water supply and not the land area, the area of fertile land being considerably in excess of what can be irrigated.

9. If topographical features lend themselves, and if otherwise feasible and not precluded by cost, water may be impounded by the diversion dam at the intake, or in reservoirs away from the stream. Generally, however, the former is tied in whith power development and the latter will depend on what suitable reservoir sites are available.

10. Laws and customs governing diversion and use of water for irrigation are in force in all countries where irrigation is practised. Such laws are peculiar to each country and differ in accordance with customs and views, but general principles in regard to the design of irrigation works and their operation will to a large extent be similarly employed. In the United States and Canada, the Governments control the diversion of water from all streams, granting licenses to divert such quantities as are available after riparian and prior rights have been taken care of. The Government investigates every proposal as to its feasibility and need and has the power to refuse or allow as the case may be.

11. The first step towards the construction of an irrigation project is a field survey to determine the actual area to be irrigated, the location of canals to feed it and determination of water requirements. This survey is made by transit and level parties running alignment and profiles for the canals and laterals, tieing-in all road crossings, water courses, railways, buildings and other features which are affected by the general scheme. Correct levels must be carried from some known datum and bench marks established.

12. Plans and profiles are then prepared to show the areas to be irrigated, the location of canals and laterals, canal right-of-way and all structures necessary for the control and regulation of the water. These plans and also plans of highway and railway crossings are subject to approval by the administration of public affairs in most countries.

13. Estimates of materials required and work to be done are made up in detail, together with cost estimates.

14. Construction is generally carried out under contract. Tenders are called for and the work is done by the successful bidder in accordance with the plans and specifications of the Irrigation District. The contractor must have the equipment, experience and financial ability to successfully carry out the terms of the contract.

15. The structures for an irrigation project vary from large concrete dams and headgates to small wooden outlet structures and measuring devices. Take for example an irrigation project having its intake on a river which is fed from mountain streams and subject to high floods in the run-off period and low flow during the greater part of the year. To divert sufficient water for irrigation during the season a dam is constructed across the river, which will allow flood water to flow down the river and low flow to be held up high enough to provide maximum flow through the headgates into the main canal. The size of such diversion works will depend on maximum flood and capacity of diversion canal. There is considerable variation as to type, but such dams are generally built of concrete.

16. The main canal carries the water to branch canals and laterals, which reduce in size proportional to the lessening water requirements further down the system. The principal control structures on the project consist of diversion gates, where canals and laterals branch off; spillway gates, where water is released in priming or after rain storms; outlet structures, where farmers ditches take off or direct diversion is made; drops, flumes, chutes and siphons, where the fall is concentrated or valleys and depressions are crossed; hold-up and check structures to enable maximum diversion at certain points; weirs and other devices for the measurement of water; bridges and culverts at highways and railways, and numerous other structures including earth dams and levees to impound water in reservoirs and flooded areas.

17. Canals are located along the highest ground possible, so as to command the greatest possible area which can be economically irrigated; but within the boundaries of the district, the lower lands may have to be reached by drop lines, flumes and chutes as well as open ditch.

18. The ideal location for an irrigation ditch is on a contour grade with balancing cut and fill, and the best velocity to be obtained is that which can be maintained without erosion of the ditch section. The latter will vary from as low as one cu. ft. per second in fine sand to as high as 15 ft. per second, or more, in rock. On the other hand, if the velocity is too low, silt deposits and aquatic weed growth will tend to choke up the ditch.

19. Operation and maintenance of the project commences when construction has been completed and consists mainly of the control and regulation of the volume of water carried in the canals and its distribution to the farmers; also in keeping the canals and structures in good order. On the larger projects, these functions are carried out by an operating staff consisting of ditchriders, or patrolmen, and work crews under an administrative staff. The size of the operating organization depends on the size of the project. Buildings and equipment used by the operating staff represent a relatively large investment. Transportation of men and materials, within the project is chiefly done by motor cars and trucks and ditchwork by modern excavating machinery under its own motive power.

The running and measurement of water, repair and renewal of structures, betterment work and other matters are mostly of an engineering nature and most of the administrative staff on the larger projects have engineering qualifications.

20. The water is applied directly to the land by the farmer, who may run it in furrows to overflowing, or in

(*Continued on page 106*)

REPORT OF THE COUNCIL FOR THE YEAR 1945

Together with Committee and Branch Reports

It is a pleasant experience to record, year after year, a steady improvement in Institute affairs and a steady increase in activities. A glance back over the reports for the past ten years shows the progression clearly. A great deal of this has been due to the general conditions of the country, but credit must go also to the succeeding presidents, councils and committees, who have worked so intelligently and so diligently on behalf of the organization.

The year 1945 maintained the acceleration. Both membership and activities were enlarged materially. The reports of branches generally show a good year, and the increase in the number of branches is significant and gratifying. Although throughout the war the Institute carried on certain special activities, its sudden ending did not lessen the total amount of activity.

The War is Over

This report is different in at least one important respect from reports since 1939. It records the cessation of hostilities in Europe and Japan. The awfulness of that struggle being disclosed now to all the world both nauseates and infuriates all decent people, and leaves the non-combatant with a greater appreciation than ever of the services rendered to civilization by the man in uniform.

Engineers everywhere made outstanding contributions to the winning of the war, and within the ranks of Institute membership were great numbers who shared in these achievements. The Institute is proud of them all and is happy to stand with the membership of sister societies everywhere in grateful acknowledgement of their accomplishments and their sacrifices. They have brought great honour to their profession, and the shining record of their achievements will be an inspiration for generations.

Rehabilitation

With the cessation of hostilities came increased obligations to the Institute, and new opportunities to serve the profession. The rehabilitation service made possible by the voluntary contributions of members is reported in full elsewhere in these pages, but in these general remarks it can be pointed out that the members in the services have spoken well of it, which in the last analysis, is the only approbation that means anything. This service must be continued in 1946 because the job is far from finished.

Membership

Once again the membership reaches a new level. The increase is larger than any recorded previously with the added value that it has a higher proportion of new corporate members. The net increase in 1944 was 643, of which 372 were Students and 168 were corporate members. In 1945 the net increase is 653, of which 160 were Students and 471 corporate members. Another source of satisfaction is that the figure for transfer to Member is greater than ever, being 197 as compared to 60 in 1944.

Council Meetings

There were eleven meetings of council, five of them being away from Headquarters. The average attendance of councillors throughout the year was fourteen. For the first time, the five provincial professional organizations with which the Institute has agreements were represented on Council.

Annual Meeting

No review of the year's activities would be complete without reference to the annual meeting at Winnipeg in February 1945. From every point of view this was an outstanding event. The members of the branch earned the gratitude of members from all parts of Canada, and it is expected that before many years have passed there will be a demand from many quarters to return to the "Gateway to the West".

Committees

The work of committees is recounted formally in the report by the various chairmen, but from such reports it is never possible to judge the amount of work done and things accomplished. One of the great strengths of the Institute is the willingness of leading members of the profession to accept duties on committees. Through such groups is accomplished the best work that is done on behalf of the profession. There is need for more committees and now that the war is over there should be opportunity to develop several subjects, deserving and requiring study by technical committees, which have been held back pending the completion of war assignments by those most competent to make the studies.

Engineers' Council for Professional Development

The Engineers' Council for Professional Development continues to be an active and important interest. At its annual meeting the Institute was represented on all committees and throughout the year was active in all branches of the work. E.C.P.D. has some new projects before it that will give it a busy and useful 1946. The accrediting of technical institutes is not the least of these.

By-Law Changes

Proposals to change several by-laws were presented by different committees, and approved by Council. These include changes in examination procedure, transfers, and fees. All will be presented to the annual meeting on February 7th and if approved there, will go out to ballot early in the year. These changes are a logical corollary to the expansion of the Institute and if accepted by the membership will permit of a continuing acceleration of activities and usefulness. The work of the Board of Examiners, the Membership Committee, and the Finance Committee in preparing these proposals has been a valued contribution to the year's work.

New Branches

In October, with due ceremony, a branch was opened at Sarnia, Ontario, known as the Sarnia Branch. At the December 15th meeting of Council, authorization for the granting of a charter was given to a group of members at Trail, B.C., for a branch to be known as the Kootenay Branch.

There are prospects of other new branches and it would not be surprising if the near future were to see further additions to the list.

Mulberry

The Institute, in association with the Hudson's Bay Company, undertook an unusual activity—the showing of the War Office model of the prefabricated harbour known as "Mulberry". The purposes back of this endeavour were to show Canadians something of what the British people had done in the war, and to demonstrate the importance of the engineer in this life and death struggle.

The model is being exhibited in the main centres right across Canada. Attendance is exceeding expectations, and the purposes back of the endeavour are being fulfilled. It will take a full year to complete the exhibition circuit.

Roll of the Institute

The membership of all classifications now totals 7,370, which again is a record. New names added for the year 1945 amounted to 816, but deaths, resignations and removals reduce the net figure to a gain of 653.

During the year, 791 candidates were elected to various grades of membership. These were classified as follows: Members, 343; Juniors, 62; Students, 383; Affiliates, 3. The elections for the previous year totalled 760. Twenty-five reinstatements were effected, and sixteen life memberships were granted.

Transfers from one grade to another were as follows: Junior to Member, 108; Student to Member, 89; Student to Junior, 86, a total of 283.

The names of those elected or transferred are published in the *Journal* each month immediately following their election.

Removal from the Roll

There have been removed from the roll during the year for non-payment of fees and by resignation, 38 Members; 9 Juniors; 46 Students, and 3 Affiliates, a total of 96.

Deceased Members

During the year 1945 the deaths of sixty-seven members of the Institute have been reported as follows:

Members

Acres, Henry Girdlestone
Arkley, Lorne McKenzie
Ashbridge, Wellington Thomas
Bennett, Charles Samuel
Bennett, Harry Frederick
Blaylock, Selwyn Gwillym
Bond, Frank Lorn Campbell
Bone, Peter Turner
Bowman, Frederick Allison
Brown, George Laing
Brown, Harry Cleophas
Browne, George Alleyn
Burchell, Herbert Charles
Carpenter, Edward Emery
Collet, Aimé
Cranbrook, James Huntington
Dodge, George Blanchard
Fitzgerald, George G.
Gilchrist, James Macdonald
Gnaedinger, Frederick Theodore
Goodrich, Chauncey M.
Hazen, Hugh T.
Huestis, Harry Ernest
Kelsch, Raymond Stirling
Lea, Richard Smith
Lovelace, Edgar Sydney Montgomery
Meldrum, William
Mellor, Alfred Ayre
Morley, Edward Henry
Morrison, Duncan Seward
McCulloch, Andrew
Macdougall, George D.
McKenzie, James Edgar
MacLeod, George Roderick
Norrie, James Paul
Pottle, Walter Reginald
Roche, Robert Selwyn
Rostron, John Robert
Ryckman, John Hamilton
Sargent, Charles Daniel
Seabury, George Tilley
Smith, Arthur
Strong, Robert Ambrose
Taylor, Alfred James Towle
Thorne, Carl Busch
Tyrrell, James Williams
Walker, Andrew
Westman, Adolf Alfred Julius
Westman, LeRoy Egerton
Wilcox, Percy Lawrence
Williams, David G.

Juniors

Corbett, Bruce Sherwood (killed in action)
Johnson, Robert (killed in action)
Madeley, William Arthur
Watson, John Crittenden (missing and presumed dead)

Students

Brandt, René Edmond
Dowd, Elbert Watson (died of wounds received in action)
Hilton, Thomas Bradford (missing and presumed dead)
Krisiuk, Joseph
Mollard, Lloyd Bemister (missing and presumed dead)
McDunnough, William Ralph (killed in action)
Prideaux, Norman Llewellyn (killed in action)
Ramsay, Robert D.
Reynolds, Donald Doane (killed in action)
Reynolds, George G. (killed in action)

Affiliates

Mills, Alfred Arthur
Surveyer, Joseph Bernard Edouard Fabre

Total Membership

The membership of the Institute as at December 31st, 1945, totals 7,370. The corresponding number for the year 1944 was 6,717.

	1944	1945
Honorary Members	17	17
Members	3,988	4,453
Juniors	773	803
Students	1,843	2,003
Affiliates	96	94
	6,717	7,370

Respectfully submitted on behalf of the Council,

E. P. Fetherstonhaugh, M.E.I.C., *President*

L. Austin Wright, M.E.I.C., *General Secretary*

COMMITTEE ON PROFESSIONAL INTERESTS

The Institute's Committee on Professional Interests begs to submit herewith its report upon its activities for the year just completed.

There has been again ample evidence of the satisfactory operation of the co-operative agreements between the Institute and the five (5) provincial professional associations, viz. Saskatchewan, Alberta, New Brunswick, Nova Scotia and Quebec. It has been gratifying to note that right acrss Canada there has been an accelerated movement displayed by engineers to become members of both the Institute and their provincial professional association, and in commenting on this movement your committee feels that it cannot do better than repeat the recent words of President Fetherstonhaugh—

> "In looking into the future, one might hope to see an increasing tendency towards common membership in the Institute and the licensing bodies, a fuller recognition of the fields of activity of each,

and of the fields in which joint action and interest are desirable. As these conditions are more closely approached, the tendency should be for the Institute and the licensing bodies to work side by side in the interest of the profession, with harmony and unity of purpose, and with the closest possible co-operation in all matters of common interest."

The co-operative agreement between the Corporation of Professional Engineers of the Province of Quebec and the Institute was formally executed on January 20th last (E.I.C. *Journal*, March 1945) and the results are fully gratifying. Joint committee meetings have been held at frequent intervals and evidence is accumulating that matters of mutual interest are being worked out in a spirit of friendly and useful co-operation.

Due to continued war conditions throughout most of the year, little progress was made towards agreements with British engineering institutions, though contacts were maintained, and with the re-establishment of normal conditions it is hoped and expected that negotiations will be resumed. A proposal to participate in a suggested new international organization of engineering institutions was discussed, but from correspondence received from British institutions it was indicated that they were more interested in consolidating with existing organizations than in spending their resources and energies in setting up a new one. Accordingly, the matter was noted, and tabled by the Council at the September meeting. To the end of promoting this co-operation between existing societies, the British institutions have proposed an Empire conference in 1946. The Council of the Institute has accepted the invitation, and is now awaiting details.

This committee reported a year ago that it had been unable to recommend to Council that the Institute participate in a new organization known as the Canadian Council of Engineers and Scientists. Council unanimously approved of the decision and instructed the committee to evolve for consideration of Council a set of principles which would set out the policy and programme of the Institute with regard to co-operation among the members in Canada of Canadian, British and American engineering societies. A number of meetings were held by the committee and a considerable volume of correspondence was exchanged with engineers across the country, from which emerged a "Statement of Principles and Policy of the Institute on Relations with Sister Societies". This was published in full in the June 1945 *Journal*, and in the same issue appeared a statement by the committee giving the reasons leading up to its conclusions. The report to Council covering this statement was presented in May and was unanimously adopted. The door to co-operation with engineering societies was left wide open, however, and this committee concluded its statement as follows:

> "The decision of Council not to support the new organization does not in any way alter the Institute's well-established policy of promoting and participating in co-operation whenever it will react to the benefit of the profession or the public. Co-operative projects will find the Institute always ready to carry its share of the burden, and to work closely with its sister societies."

Several visits were made to branches. Your chairman, Vice-Chairman J. E. Armstrong, Mr. J. A. Vance, and the general secretary, met the Toronto Branch executive, when many matters of mutual interest were discussed (E. I. C. *Journal* June 1945). Two visits to the Halifax Branch were made by your chairman, one a joint meeting with the provincial professional association, and one visit to the Saint John Branch, where the Institute branch executive and provincial professional association had a joint meeting. The outstanding result was a definitely formed opinion as to the urgent need of a field secretary, or some officer of the Institute who could give attention to branch affairs. This was reported to Council. The inauguration of the Sarnia Branch was attended by your chairman, Vice-Chairman Armstrong, and Mr. J. A. Vance.

Your committee is pleased to report that following visits to Toronto, and as a result of discussion with officers and members of the A.S.M.E., in that district, several small revisions to the co-operative agreement between the Institute and The American Society of Mechanical Engineers were agreed upon, and upon submission to Council in December 1945 were adopted. Your committee delegated Messrs. R. S. Eadie, G. L. Wiggs, and Louis Trudel to present these at the annual meeting of the A.S.M.E. in New York, and at this meeting the amendments were approved. Members of the Institute, we are sure, will recognize this as a great forward step in international co-operation for the benefit of the profession, and it will be with gratification that pursuant to By-Law 78 we shall welcome to Council a representative of that great American society, The American Society of Mechanical Engineers.

As indicated above, the co-operative movement has been making headway, and it is with the keenest satisfaction that this committee notes that many branches have instituted joint meetings with sister societies in their respective districts. This cannot fail to be of immense benefit to the profession, and this committee's work is materially assisted by branch officers and members keeping this objective of co-operation continually before them.

Respectfully submitted,

J. B. Stirling, M.E.I.C., *Chairman.*

LEGISLATION COMMITTEE

During the course of the year, your committee's principal concern has been the decision rendered by a judge of the Superior Court against the defendant in the case of the Province of Quebec Association of Architects against Brian R. Perry, for having made plans of an industrial building.

In a spirit of co-operation with the Corporation of Professional Engineers of Quebec toward safeguarding the welfare of the profession, your committee offered its support and stated the Institute's interest in the above case and in the proposed application for revision of the Province of Quebec Engineers' Act. The offer gladly accepted by the Corporation resulted in the appointment of a Joint Committee of the Institute and the Corporation that was charged to do everything possible to see that engineers were not denied the age-old right to design industrial buildings.

After reviewing the case and having obtained the greatly valued advice of an eminent legal Counsellor, the Joint Committee decided that appeal against the decision of the Superior Court should be entered in the Court of King's Bench and that this proceeding should not interfere with the Corporation's application for amendments to the Engineers' Act.

The appeal has been lodged in the King's Court. All the documents have been submitted. Steps have also been initiated to apply to the Quebec Legislature for amendments to the Professional Engineers' Act which is to be considered as a public bill.

Respectfully submitted,

P. E. Poitras, *Chairman.*

COMMITTEE ON REHABILITATION

It has been possible, through the medium of the *Journal*, to keep the membership informed of the work of the Committee on Rehabilitation. Several monthly progress reports have been presented and a complete statement of all the activities was published in the October issue. Therefore, this report attempts only to summarize the information published earlier, and to revise the significant figures to the end of the year.

Activities

1. *Questionnaires:* A rehabilitation questionnaire was drawn up and mailed to all members on active service in March 1945. Twelve hundred and fifty copies were sent out and it has thereby been possible to establish contact with about seven hundred and fifty of the addressees.

2. *Pamphlets:* In answer to the many requests for information concerning the Post-Discharge Re-establishments Order as applied to veterans requiring further education, a pamphlet entitled "The Engineers Return to Civil Life" was prepared and distributed. About four hundred copies were sent also to representatives of the three services to be used by their personnel counsellors as required.

3. *Opportunities:* The majority of completed questionnaires indicated the need for information on the current employment situation. The employment page of the *Journal* was therefore expanded from one to three pages, to contain all vacancies obtainable, and about four hundred preprints of this sheet are being mailed each month to members on active service, with these objects in mind:

(a) To present a general overall picture

(b) To reach members who might otherwise not see the *Journal.*

(c) To give service men an opportunity to make contact while still away.

(d) To enable all service men waiting for discharge to apply for interesting openings, about two weeks before the *Journal* reaches the general public.

4. *Interviews:* As members become available for peacetime occupations, whether from service with the armed forces or from war plants, they are streaming into Headquarters, seeking new opportunities. The numbers being interviewed appear in Table I, and will be further mentioned later.

5. *Employers:* There are naturally two aspects to rehabilitation and employment work, the first dealing with finding vacancies for employees, the second dealing with the attempt to find suitable candidates for positions with employers. The first aspect is perhaps the motive for the work that is being done, but the second is of more immediate importance in that only by giving satisfaction to employers is the service possible. Therefore, it has been necessary, sometimes, to interview non-members and to keep some of their records available. In Table II the present situation is outlined, and it will be noted that there are 40 per cent fewer openings now than at October first.

The *Journal* has carried over four hundred advertisements of the requirements of more than two hundred employers. The number of answers received is given in Table I, and it may be seen that, in one way or another, a total of well over three thousand applications have been directed to about three hundred employers, or an average of ten to each vacancy.

Results

Table I

Classification	Members		Non-Members		Total
	Armed Forces	Civilians	Armed Forces	Civilians	
Applications to positions adv'd. forwarded to employers	278	391	56	239	964
Records sent and men directed to employers	888	783	394	352	2,417
Total	1,166	1,174	460	591	3,381
Men interviewed	267	218	164	93	742
Known placements	46	39	26	12	123

Table II

Employment vacancies:	No. of Companies	No. of men Required
Vacancies listed at April 1, 1945..	34	46
Vacancies received since April 1, 1945........................	291	503
Total handled........	325	549
Vacancies listed at December 31, 1945......................	102	151
Total closed during nine months..	223	398
Placements made (confirmed)....	99	123

Observations and Recommendations

1. *Interviews:* An average of one hundred and forty men are being interviewed each month. As this is about the limit that can be properly handled by the present permanent staff, and as the number of members becoming available is increasing, it is necessary to recommend that in future the service be restricted almost entirely to members.

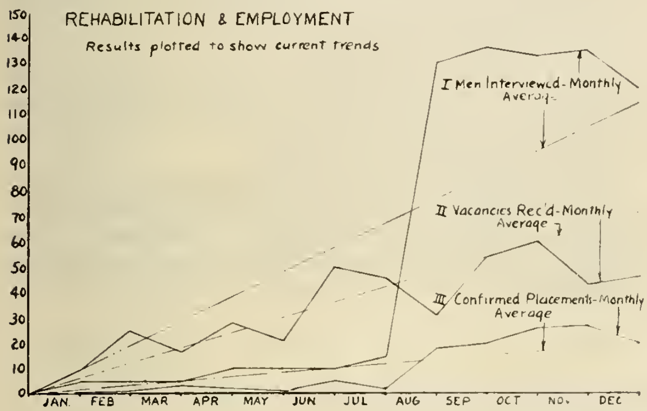
2. *Employers:* The decrease in the number of openings available also makes an effective service to members impossible if applications from non-members are also considered. A list of employers of engineers throughout Canada has been prepared and between two and three thousand copies of a letter asking for advice of possible vacancies were mailed early in January. It is felt that a favourable reply from even one or two per cent of these will more than justify the effort.

3. *Placements:* The total number of confirmed placements is not staggering, but it must be remembered that it is only during the last five months of the year that results have become apparent. This means that confirmation of satisfactory placements is being received at the rate of about one a day. It is felt that if all the facts were known, the service is probably responsible for approximately twice this number.

It is also interesting to note that of the one hundred ex-service members who have now become re-established in peacetime occupations after receiving assistance from the Committee, forty-seven are direct placements, forty-three have obtained positions other than those of which they learned directly from this

Department, and ten have already returned to their old jobs, satisfied at having first thoroughly examined the field.

4. *Membership:* Many of the non-members who have been interviewed have expressed their intention of applying for admission to the Institute. Applications have been received to date from about forty ex-service men who have received some assistance from the Committee.



5. *General Trend:* The graph that has been drawn to give pictorial representation to the above facts indicates certain interesting tendencies and ratios. As the work of the Committee only began to show results about the first of August, the actual curves show decided peaks at this time. Mean lines have been drawn in to show the effect of the work of the Committee distributed over the year. From these the following observations are possible:

(a) It appears to be necessary to interview about six men before one placement is obtained.

(b) Two confirmed placements result for every seven vacancies.

(c) For the last two months, the number of employment opportunities occurring has been well below average, and definite steps will have to be taken to overcome this.

(d) The number of men becoming available is indicated by the interview curve, and the "saturation" level of the existing facilities for interviewing has been reached and is being maintained. It is interesting to note that prior to August there were more vacancies than applicants, and that the position is now quite the reverse.

6. *Estimated Future Requirements:* To date answers have been received from about seven hundred and fifty of the men approached, leaving about five hundred still to be reached. Of those heard from, four hundred and sixty or sixty per cent required assistance. One hundred have been re-established, more or less satisfactorily, leaving three hundred and fifty to assist. It is therefore probable that the number who will need help in the future is

$$350 \text{ plus } 60\% \text{ of } 500 = 650$$

As past experience shows that about half of these will have to be direct placements (See paragraph 3 above), it will require 325 x 3.5 or about eleven hundred vacancies to do this, and at the rate of twenty-five placements per month this will take something over a year to accomplish.

Respectfully submitted,

Howard Kennedy, M.E.I.C., *Chairman.*

PUBLICATION COMMITTEE

Your committee, last year, pointed out that due to a curtailment in the allotment of paper for the *Journal* it would be necessary to temporarily eliminate several features which appeared monthly. Fortunately, during this year, our paper allotment has been increased, and as a result, it has been possible to reinstate a number of these items.

During the last few months of the year it has also been possible to increase the number of technical papers published with the result that the editorial content of the *Journal* has been expanded to about its pre-war size.

After considerable negotiation, a new contract was entered into for the printing of the *Journal* during the year. This has very considerably increased the cost of publication. It is expected that this increase will in time be balanced by increased receipts from our advertising contracts but this will take time. During this year the net profit from the publication of the *Journal* has been very greatly decreased.

It has been possible to obtain and publish a number of papers dealing with some of the activities of the Canadian and British engineering units on active service. These papers are long overdue but were unobtainable previously because of censorship regulations. It is hoped that it may be possible to obtain more papers of the same type so that finally an accurate record of, at least, the major achievements of our army engineers may be published. The work of the Canadian and British army engineers has not received the publicity it deserved and as a result their achievements have been lost sight of due to the great amount of publicity, allowed by the American censors, on the work of their army and navy engineers.

Your Committee has continued their study of several proposals for added features for the *Journal* during the year. Some of these proposals have reached the stage where if adequate editorial staff were available they could be introduced. However, the present staff is badly overloaded and it will be necessary to obtain more editorial assistance before further expansion can take place.

Respectfully submitted,

R. S. Eadie, M.E.I.C., *Chairman.*

BOARD OF EXAMINERS AND EDUCATION

Your Board of Examiners submits the following report of its activities for the current year.

The Board has not conducted any examinations whatever. At your request it studied the Institute's system of admission by examination with a view to suggesting alterations in procedure which might seem desirable.

As a result of these studies, your Board recommended on September 20th, 1945, that the Institute should revise its examination system and accept the examinations of the various provincial professional associations. This report was accepted by your body at its meeting on October 6th, and we understand its recommendations are in process of being implemented.

We wish to thank the general secretary and headquarters staff for courtesies extended to us and work done on our behalf.

Respectfully submitted,

R. DeL. French, M.E.I.C., *Chairman.*

TREASURER'S REPORT

The audited statements of Assets and Liabilities and of Revenue and Expenditure for the year ended December 31, 1945, are submitted herewith.

It will be noted that the accounts for the year show a deficit of $3,411.10 as compared with a surplus of $3,022.46 for the previous year, the latter after the transfer of a sum of $5,000.00 to Contingent Reserve.

Income from membership fees, excluding voluntary assessments in respect of Rehabilitation Fund, show an increase of $4,699.29 or 10 per cent as compared with the previous year. The increase in revenue from publications is $1,322.78 or 3.4 per cent.

Expenditure, exclusive of that chargeable to publications and to Rehabilitation Fund, shows an increase of $7,949.21 or 18 per cent. Expenditure in respect of publications shows an increase of $10,608.06 or 38.4 per cent.

The principal cause of the reduction in surplus is obviously attributable to the increase in the cost of publication of the *Journal*, this following the expiry of a contract for the printing of the same made in 1939. On account of unexpired contracts, increases in the rates for advertising are not yet fully reflected in the way of increased revenue. In short, the very substantial profit previously arising out of the *Journal* has for the year under consideration been largely eliminated.

If the surplus of Assets over Liabilities, built up over the course of years, is to be maintained, it is evident that the profit from the publication of the *Journal* must be restored, presumably by increasing the income from advertising, or that there must be an increase in membership fees or, alternately, some curtailment in the activities of the Institute that will be reflected in a reduction in operating expenses.

It is confidently anticipated that the year 1946 will witness an increase in the advertising revenue of the *Journal* and that the discharge of personnel from Canada's armed services, added to the normal increase in membership, will be reflected in increased revenue

COMPARATIVE STATEMENT OF REVENUE AND EXPENDITURE

FOR THE YEAR ENDED 31ST DECEMBER, 1945

Revenue	1945	1944
MEMBERSHIP FEES:		
Arrears	$ 3,934.24	$ 4,032.47
Current	36,064.87	31,450.03
Advance	1,279.40	814.25
Entrance	2,951.28	3,233.75
	$44,229.79	$39,530.50
PUBLICATIONS:		
Journal Subscriptions	$10,841.05	$ 9,800.48
Journal Sales	71.93	152.38
Journal Advertising	29,229.30	28,866.64
	$40,142.28	$38,819.50
INCOME FROM INVESTMENTS	$ 1,188.87	$ 980.36
REFUND OF HALL EXPENSE	450.00	400.00
SUNDRY REVENUE AND PROFIT ON SALE OF SECURITIES	899.16	56.03
TOTAL REVENUE FOR YEAR	$86,910.10	$79,786.39

Expenditure	1945	1944
BUILDING EXPENSE:		
Property and Water Taxes	$ 1,496.83	$ 1,324.74
Fuel	533.91	568.76
Insurance	173.91	189.08
Light, Gas and Power	460.39	347.81
Caretaker's Wages and Services	1,231.50	1,218.00
House Expense and Repairs	1,249.86	515.03
	$ 5,146.40	$ 4,163.42
PUBLICATIONS:		
Journal Salaries and Expense	$37,159.63	$25,498.75
Sundry Printing	1,055.33	2,108.15
	$38,214.96	$27,606.90
OFFICE EXPENSE:		
Salaries	$21,375.02	$17,844.92
Telegrams, Postage and Excise Stamps	2,270.94	1,518.92
Telephones	852.00	720.42
Office Supplies and Stationery	3,310.64	2,281.21
Audit and Legal Fees	378.24	390.00
Messenger and Express	235.67	136.60
Miscellaneous Expense	442.26	648.56
Depreciation—Furniture and Fixtures	401.67	342.95
	$29,266.44	$23,883.58
GENERAL EXPENSE:		
Annual and Professional Meetings	$ 1,763.09	$ 1,642.56
Meetings of Council	814.27	746.61
Travelling	1,842.27	1,841.12
Branch Stationery	102.56	188.26
Prizes	356.24	334.53
Library Salary and Expense	2,474.43	2,151.48
Interest, Discount and Exchange	35.34	69.55
Committee Expenses	639.08	1,836.27
Cost of Membership in other Organizations	1,271.28	100.00
Sundry Expense	498.97	359.04
	$ 9,797.53	$ 9,269.42
REBATES TO BRANCHES	$ 7,895.87	$ 6,840.61
TRANSFER TO CONTINGENT RESERVE	—	5,000.00
TOTAL EXPENDITURES	$90,321.20	$76,763.93
SURPLUS OR *Deficit* FOR YEAR	*3,411.10*	3,022.46
	$86,910.10	$79,786.39

from membership dues. Under the circumstances on the basis of the activities of 1945, the deficit for that year need not necessarily be considered in the light of a recurring item. Insofar as the *Journal* is concerned, it must be considered as the result of the expiry of a long-term contract for printing that, having regard to the general increase in costs, has been extraordinarily favourable to the Institute. If we are to meet the demand for increased activity it is obvious that an increase in the membership fees will be necessary.

R. E. Chadwick, M.E.I.C., *Treasurer.*

Rehabilitation Fund

Total amount received by voluntary assessment....		$ 7,207.71
Expenditures:		
Salaries........................	$3,998.10	
Sundry Travelling Expenses........	86.56	
Sundry Printing, Multigraphing, etc.	481.32	
		4,565.98
Balance as at 31st December, 1945............		$2,641.73

FINANCE COMMITTEE

As foreseen in the 1943 and 1944 reports of the Finance Committee, increases in costs and expenditures have now taken place which have resulted in a deficit instead of a surplus in the operations for 1945.

Principal among these has been the cost of printing the *Journal.* The contract made with the printers in 1939 has protected the Institute from increases in cost of labour and material that have developed, but it became necessary to rewrite it during the past year. The new contract rates are 30 per cent higher, which in the course of a year will cost the Institute between six and seven thousand dollars additional.

To offset this increase, advertising rates have been increased but, because of existing contracts, it will take a year for these to become fully effective. In the meantime, the balance sheet makes a less favourable showing.

Increase in committee expenses, additions to the staff, and a general increase in the cost of all supplies have contributed to offsetting the increase in fee income

COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES

As at 31st December, 1945

Assets

		1945	1944
Current:			
Cash on hand and in bank.........		$ 2,357.71	$ 1,621.99
Accounts Receivable, less Reserve...		6,959.53	6,602.90
Arrears of Fees—Estimated.........		2,500.00	2,500.00
Army Technical Development Board		—	72.44
		$11,817.24	$10,797.33
Investments—at Cost:			
Property of Special Funds..............	$15,615.50		14,591.18
Property of Engineering Institute...........	33,376.87		
		48,992.37	32,064.66
(Market Value as at 31st December, 1945—Estimated, $51,000.00)			
Sundry Advances..................		250.00	250.00
Deposit with Postmaster...........		100.00	100.00
Prepaid Insurance.................		150.00	275.00
Gold Medal.......................		45.00	45.00
Library—At Cost less Depreciation...		1,448.13	1,448.13
Furniture and Fixtures:			
At Cost...............	$17,192.79		
Less: Depreciation.....	13,577.69		
		3,615.10	3,086.58
Land and Buildings—Cost less Depreciation........................		36,000.00	36,000.00
		$102,417.84	$98,657.88

Liabilities

		1945	1944
Current:			
Bank Loan—Secured.............		—	$ 5,000.00
Bank Overdraft..................		$ 1,524.69	—
Accounts Payable................		9,750.36	3,039.15
Rebates to Branches..............		499.98	230.87
Unexpended Balance of Rehabilitation Fund.....................		2,641.73	—
		$14,416.76	$ 8,270.02
Special Funds:			
As per Statement attached.........		15,615.50	14,591.18
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, 1944........	$63,796.68		
Less: Excess of Expenditure over Revenue for year as per Statement attached............	3,411.10		
		60,385.58	63,796.68
		$102,417.84	$98,657.88

Audit Certificate

We have audited the books and vouchers of The Engineering Institute of Canada for the year ended 31st December, 1945, 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 1945, as attached, are properly drawn up so as to exhibit a true and correct view of the Institute's affairs as at 31st December, 1945, 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, 16th January, 1946.

which follows an expansion in membership. A broad increase in all activities has also added to expenditures.

On the whole, the situation is not discouraging, but it indicates clearly the need for increasing annual fees. The activities have outgrown the income. The Institute has reached a new level in its development and certain readjustments now become necessary in order to meet new responsibilities and new opportunities. Approval of the proposals for increased fees will provide the solution.

Respectfully submitted,

J. E. Armstrong, M.E.I.C., *Chairman.*

LIBRARY AND HOUSE COMMITTEE

The committee would like to point out that the increased activities and increased membership of the Institute are taxing headquarters to capacity. The general office is now filled completely and the auditorium has overflowed at a number of the recent weekly meetings of the Montreal Branch.

To alleviate the office conditions your committee has had new lighting installed and the ceiling treated acoustically. The main office was also redecorated—the first time since 1928. The ladies' dressing room was also enlarged and redecorated. These changes have improved the conditions materially.

Some thought has been given to enlarging our quarters, and we recommend that your new Library and House Committee continue this study.

Library

The statistics customarily reported to indicate the extent to which the members use the library are as follows:

Library		
Volumes in library	12,690 volumes	
Shelving in library	2,475 feet	
Pamphlet files	42 drawers	
Days open—1945	276½ days	
Accessions	1945	1944
Books for review	56	67
Books presented	84	20
Proceedings and Transactions	23	23
Reports and Bulletins (including Standards & Tentative Standards)	353	257
Pamphlets	170	—
Reviews		
Book reviews	4	3
Book notes prepared by E.I.C. Library	32	0
Reference Work Done		
By phone	1,616	1,268
By letter	1,730	1,070
In person	661	379
Total	4,007	2,717
Loans, Photostats, Bibliographies		
Books and periodicals loaned	1,480	936
Books and periodicals borrowed	20	41
Photostats—Orders	34	24
Prints	314	189
Bibliographies—prepared	54	24
pages	117	30

The use of the library has been increased by all grades of membership. As shown by the comparative figures above, this increase is considerable. It is interesting to note, on looking back over the figures for the past few years, a somewhat proportionate rise each year since 1942.

It has become more and more evident of late that a complete revision of the library methods and materials must be effected if the library is to serve the membership adequately and efficiently. With this idea in mind, the librarian was sent to New York to study the organization, administration, services and collection of the Engineering Societies Library. As a result, a programme of reorganization has been drawn up and the work started.

The revision of the library stacks and files is almost completed. It had been hoped that this part of the reorganization of the library would be finished by the end of the year. However, lack of staff, the redecoration of the offices and the greatly increased use made of the library have made this impossible. It should be completed early in 1946. The revision of the records and catalogue and the weeding of the collection of obsolete material will begin as soon as the earlier work is completed.

The Committee wishes to remind all members that, on the deposit of a five-dollar cheque with the library, two books may be borrowed for a period of two weeks, and renewed, at the discretion of the librarian, for a further two-week period. The deposit will be returned when the books arrive back at Headquarters.

The library facilities are available to out-of-town members on the same basis as they are to members in Montreal, the only difference being that out-of-town members are asked to pay all postage charges.

Your committee has much pleasure in commending the work of the staff. Every member has given loyal support to all the multitudinous details of Institute affairs.

Respectfully submitted,

E. V. Gage, M.E.I.C., *Chairman.*

COMMITTEE ON THE ENGINEER IN THE ACTIVE SERVICES

Although 1944 saw the attainment of the objective of separating the engineers from the Ordnance Corps, and the creation of the Royal Canadian Electrical and Mechanical Engineers, it did not see the realization of the committee's hopes for proper recognition of the profession by the Army. Nor did 1945.

There is still a lot of work to be done before non-professional senior administrative officers see the need of putting engineers in engineering appointments. On paper the situation can be made to look not too bad, but in practice it is not too good. The war is over now but the situation becomes more than ever acute for the engineer who wants to remain in the service permanently.

During the year, the committee received appeals from many engineers in the service who asked for assistance in correcting situations involving their professional work and their status. In one instance at least, when a large number were involved, the Institute's interjection was influential in obtaining a satisfactory adjustment.

The committee recommends that some further study be given to the peace-time plans and policy of the R.C.E.M.E. towards engineers, and to the matter of professional allowance for the professional services of engineers, comparable to that made to the medical profession.

Respectfully submitted,

D. S. Ellis, M.E.I.C., *Chairman.*

COMMITTEE ON EMPLOYMENT CONDITIONS

Due to the importance of, and the interest in, the subject of Collective Bargaining, the activities of your Committee on Employment Conditions have been fully reported for 1945 in the various issues of *The Engineering Journal*. It therefore seems appropriate at this time merely to summarize briefly what has taken place during the past year.

On January 9th, the Committee of Three presented a Brief on Collective Bargaining, proposing a new order-in-council, to the Wartime Labour Relations Board at a public hearing at Ottawa on behalf of twenty organizations of engineers and scientists.

The proposal for a new order was opposed by the Canadian Congress of Labour, the Trades and Labour Congress and the Association of Technical Employees. The Canadian Catholic Federation of Labour was not unfavourable to it. The Canadian Manufacturers Association favoured excluding engineers from collective bargaining rights. The National Conference of Canadian Universities recorded its conviction that any application of P.C. 1003 "to include members of university staffs would violate the principles by which universities as free associations of scholars are founded". The Ontario Association and Federation supported the proposal.

The complete text of the brief presented to the W.L.R.B. and of the draft order-in-council presented to the Government with a copy to the board was published in the January and February issues of the *Journal* respectively. The report of your committee for 1944 was also published in the February *Journal*.

Following representations to the W.L.R.B. on January 9th the Minister of Labour, Mr. Mitchell, in a letter dated February 12th ruled that—

"The Board recommends that the present regulations be continued for a further period of six months and thereafter until otherwise determined, the Board meanwhile subdividing bargaining units so that employees engaged in a professional capacity may elect or appoint (as the case may be) bargaining representatives on their own behalf in a proper case".

The full text of the Minister's letter and the cost of collective bargaining negotiations distributed among the co-operating societies will be found in the March number of the *Journal*.

On June 12th, the Committee of Fourteen met at Ottawa and by a motion duly presented and carried by a majority vote transferred its responsibility for collective bargaining to the newly created Canadian Council of Professional Engineers and Scientists, of which the Institute is not a member. Earlier in the meeting the Institute attempted to preserve the Committee of Fourteen and its sub-committee of three, so that the joint effort which up to then had been so successful, might be continued, but its motion was defeated.

Later your committee proposed a further joint meeting stressing the importance of a common recommendation in replying to the Minister's letter of February 12th before the expiry of the six months period mentioned therein. As this suggestion was not accepted by the new council, your committee replied to the Minister's letter on August 11th requesting "that arrangements set forth in your letter be continued and that the Institute be given an opportunity of being heard when any changes in P.C. 1003 affecting professional employees are being considered". A report on recent events was published in the October *Journal*.

There has been no change in the legal position since February 12th. Engineers coming within the jurisdiction of P.C. 1003 may bargain for and on their own behalf if they so desire. They cannot be out-voted by labour. It is not known what changes may take place as a result of the Dominion-Provincial conference. Your committee will continue to watch developments and act in accordance with the best interests of the profession.

As chairman of your committee, I wish to express my sincere thanks to its members, Messrs. P. N. Gross, G. N. Martin, A. D. Ross, J. D. Sylvester and I. R. Tait for their deep sense of responsibility, invaluable advice and loyal support at all times, to Mr. L. Austin Wright for his untiring efforts and able assistance and to Mr. Louis Trudel and the Headquarters' staff for their efficient service.

Respectfully submitted,

R. E. Heartz, m.e.i.c., *Chairman.*

MEMBERSHIP COMMITTEE

During the past year your Membership Committee continued its study of the by-laws relating to classification requirements and methods of transfer.

As a result of decision made by Council at its Winnipeg Meeting in February 1945, the Committee's preliminary report was published in the *Journal* with a request for comments from the members. Replies received showed a keen interest in the subject and opinions submitted were carefully considered in a further report to Council which included recommended changes and additions to our by-laws.

It is hoped a decision will be reached by Council on all points still under consideration and that the subject will be ready for final disposition by the members at the next annual meeting.

Your Committee wishes to express its appreciation of the hearty co-operation received and the keen interest shown in this important phase of E.I.C. work.

Respectfully submitted,

John G. Hall, m.e.i.c., *Chairman.*

NOMINATING COMMITTEE

Chairman: C. G. R. Armstrong

Branch:	*Representative*
Border Cities	T. H. Jenkins
Calgary	D. P. Goodall
Cape Breton	J. H. Fraser
Edmonton	E. Nelson
Halifax	P. A. Lovett
Hamilton	Alex. Love
Kingston	S. D. Lash
Lakehead	W. L. Bird
Lethbridge	J. M. Campbell
London	R. S. Charles
Moncton	A. R. Bennett
Montreal	J. Benoit
Niagara Peninsula	C. G. Cline
Ottawa	G. H. Ferguson
Peterborough	H. R. Sills
Quebec	J. O. Martineau
Saguenay	W. J. Thomson
Saint John	F. A. Patriquen
St. Maurice Valley	H. J. Ward
Sarnia	J. W. MacDonald
Saskatchewan	I. M. Fraser
Sault Ste. Marie	R. A. Campbell
Toronto	J. G. Hall
Vancouver	T. V. Berry
Victoria	S. H. Frame
Winnipeg	T. H. Kirby

PAPERS COMMITTEE

While the papers presented before the branches furnish a large and important part of the branches' interests and programme and one feels that it should be possible to be of considerable assistance in this connection, such does not appear to be the case, particularly with reference to the more distant branches. The Committee has in reality only been able to supplement to a limited extent the work done in this direction by the general secretary and Headquarters staff.

However, it has been possible to assist in the securing of some desirable papers, and there are immediately available the following papers to branches within reasonable distance.

"Engineering Problems Facing the Canadian Army in N. W. Europe",
by—Brigadier G. Walsh,
Room 4074, Army Building, Ottawa.

"The Wartime Production of Precision Optics in Canada",
By—D. C. R. Miller, M.E.I.C.,
108 Wychwood Park, Toronto.

"The Electric Cables Made During the War for the Royal Canadian Navy",
by—Northern Electric Company Limited,
Montreal.

It is noted with gratification that all the branches have secured papers that cover the wide range of engineering interests represented by the Institute's membership.

The most important and time consuming undertaking of the Committee has been in connection with the "Mulberry Exhibit", which has been in Canada since September last and will complete its itinerary in Halifax about next midsummer. The expenses in connection with this project were fortunately assumed by the Hudson's Bay Company, but the Institute has cooperated with them in arranging for special meetings of the local Institute members and in those centres where the H. B. Co. is not represented, almost the entire responsibility for accommodation, programme, etc., has been taken by the local branch. The special meetings of the Institute members at which Col. V. C. Steer-Webster, O.B.E., who is directing the exhibit, has spoken have been very satisfactory and quite worth while from an engineering point of view. Your chairman has been greatly assisted in this work by the chairman of the International Relations Committee, M. J. McHenry and the general secretary.

Respectfully submitted,

C. E. Sisson, M.E.I.C., *Chairman.*

COMMITTEE ON INDUSTRIAL RELATIONS

Since the last annual meeting, the Committee on Industrial Relations has held five meetings; on 6th February, 16th March, 18th May, 26th September and 2nd November.

During the year, two papers were published in the *Journal* which were prepared at the request of the Committee, namely:

The Engineer in Administration, by Dean C. R. Young, Faculty of Applied Science and Engineering, University of Toronto.

Union Security Clauses in Canadian Collective Labour Agreements, by Professor J. C. Cameron, Head, Department of Industrial Relations, Queen's University, Kingston.

The problem of retraining and rehabilitating ex-service people has received attention from the committee and at one meeting Colonel W. Line, Director of Personnel Selection, Department of National Defence, attended and spoke to the members in regard to the Army's work of reorienting men to civilian life prior to their discharge. Other phases of this matter have also received attention.

The Committee has continued to keep in touch with matters concerning the position of professional engineers under collective bargaining and particularly regarding the effect of various proposed arrangements on general industrial relations within industry.

The Committee is also giving study to questions of the status of foremen in management and the present agitation in the United States for unionization of foremen. It hopes to be able to submit a paper on this subject for publication in the *Journal* in the near future.

The Committee has interested itself in the question of employee counselling, in particular the non-directive counselling of the type developed at the Hawthorne Works of the Western Electric Company. Mr. A. W. Entwistle, Employment Supervisor of the Bell Telephone Company of Canada, attended a meeting of the Committee and gave a very interesting account to the members of the general background of this type of counselling and its present application in the Bell Telephone Company organization.

Respectfully submitted,

Wills Maclachlan, M.E.I.C., *Chairman.*

COMMITTEE ON THE ENGINEER IN THE CIVIL SERVICE

It seems that the work of this committee is never ending. The progress to report is minute. A new group of positions was established in the Public Works Department for post-war reconstruction, with salaries substantially higher than for similar positions in the permanent staff. However, even with the increase the positions have been unattractive and the committee is informed that not many engineers have been secured.

In the Department of Reconstruction some new salaries were offered, but for the type of work required it appears that they too will be inadequate.

The committee is informed that a reclassification is possible whereby engineers who have been stuck in certain classifications for years without any salary increase may get a new deal. Apparently a war bonus supplement has been authorized temporarily until the reclassification survey is completed. It seems odd that men doing extra work because of the war should have to wait until the war is over before getting a war bonus, but if the additional money is there in adequate amounts, we will not quarrel with the name they give it.

Within the last few days the Ottawa press reports a move to increase remuneration for the scientists in the National Research Council. It is implied that this is an effort to stop exodus of highly trained men from the Research Council to better paid positions in industry. It was reported as a move to remedy some "gross injustices" in this department.

The committee recommends strongly that the efforts be continued. It begins to look as if the mass were moving slightly. Perhaps we have accomplished something in a field that looked hopeless. Continued efforts along with other agencies may yet bring to an end a situation that has brought no credit to the government officials responsible for it.

Respectfully submitted,

N. B. MacRostie, M.E.I.C., *Chairman.*

COMMITTEE ON THE TRAINING AND WELFARE OF THE YOUNG ENGINEER

The membership of the Institute does not need to be reminded of the death of Harry Bennett, M.E.I.C., nor of the great services he rendered to young engineers and to the Institute generally, as chairman of this committee, an office which he held since its formation in 1939. The future work of the committee will be built upon the foundation so well laid by Mr. Bennett, and he must be given full credit for any achievements.

In August 1945, the undersigned was appointed chairman in succession to Mr. Bennett. The first duty was to examine the work carried out previously, a task that required several weeks.

This disclosed that the activities of the committee have three phases:

(a) Guidance to high-school boys who are considering taking a university course leading to engineering.

(b) Guidance to the engineering undergraduate.

(c) Guidance to the recently graduated engineer.

(a) Guidance to high-school boys is now carried out with the Canadian Institute of Mining and Metallurgy and the Canadian Institute of Chemistry, a joint committee having been set up of which the chairman of the Institute's Young Engineer Committee is ex-officio chairman. There is a committee of counsellors in twenty-four of the twenty-six branches of the Institute, on which the C.I.M.M. and C.I.C. are represented. Much useful work is being done by these counsellors, but it is apparent that in some districts much more advantage is being taken of this than in others. In order to increase the use of this service early this year, the Deputy Ministers of Education in all provinces were notified of the names of the chairmen of the local counsellors' committees, and have also been informed of the wide distribution of the booklet "The Profession of Engineering in Canada" prepared by Mr. Bennett. Additional steps are being taken, which, it is hoped, will result in more schools availing themselves of the information and advice which can thus be given to boys who contemplate entering the profession.

(b) At present little is being done under the head of guidance to the engineering undergraduate, nor do I think that your committee can do much that is not already being done by the university faculties and the student engineering societies.

(c) It is the opinion of your committee that guidance and help to the young engineer after graduation and before he becomes established was the chief object of the committee when it was originally set up, and I cannot find that much has been accomplished here. A weakness is that none of the members of the committee are themselves recent graduates, and thus we are not in touch with the very men we are trying to help. With a view to correcting this, I have added to the committee Mr. J. W. Brooks, of London, Ont., who is the Institute's representative on the Junior Committee for Professional Training of the E.C.P.D. I have also asked each branch of the Institute to send me the name of a young engineer with whom this committee can correspond and who will give us his opinion as to what we can do for him and his generation.

I have recently written all branches suggesting two things which older engineers could do for their younger professional brethren, but it is too early to report on how these suggestions have been received.

In conclusion, I wish to say that the committee will welcome suggestions for action which may increase its usefulness.

Respectfully submitted,

L. F. Grant, M.E.I.C., *Chairman.*

CANADIAN STANDARDS ASSOCIATION

The Canadian Standards Association, incorporated in 1919 and still better known to most of us as the Canadian Engineering Standards Association, has continued throughout 1945 the pursuit of its policy of broadening its interests, and extending its services. During the past twenty-six years the CSA (CESA) has furnished many types of standard recommendations in many branches of industry, and is constantly revising and improving these standards so that they may represent the best possible and most up-to-date practice in their various fields. In the governing and administrative committees as well as in the numerous working committees of the Association, the E.I.C. has always been directly concerned, and many of its members have contributed time and effort to the vast amount of detailed and technical work involved. During the last year some twenty different committees have been engaged in the revision of the Canadian Electrical Code Part I, a truly major undertaking, preparatory to the general issue of a fifth edition. Fifteen committees have been busy with specifications dealing with the Control of Radio Interference under Part IV of the same Code. Also under the Code, Part II, much activity has been devoted to the modernisation of Approval Specifications in the Electrical field.

In the Welding Section, committees are dealing with revisions and extensions to the specifications for electrodes, processes, qualifications of operators, etc. A new safety code for the protection of head and eyes is under way, as also is a proposed standard designed to eliminate many of the hazards in hospital operating rooms. The Approvals Division has had a very busy year, having issued some 1073 approval reports on equipment tested in their Laboratory, having made over 2500 routine inspections of electrical devices, machines and installations, having made about 3000 further inspections on wire and cable, and 2185 tests on conductors, conduit and tubing. In addition 740 new applications for testing and approval were received for consideration.

The lifting of Government restrictions on the manufacture of certain types of oil-burning equipment has resulted in a flood of applications for test and approval, so that the Fire Hazards Listing Service has had an increasingly busy year, and may grow in importance as a means of guidance and protection to the public and to industry. Other committees are feeling the urge to activity now that war controls and limitations are becoming things of the past, and a vast new field of international and united nations standardisation is opening up in which the CSA is vitally interested and with which it is closely identified.

Your representative has for many years been elected to serve on the Executive Committee of the Association, besides serving as chairman of various Technical Sectional and Working Committees.

Respectfully submitted,

P. L. Pratley, M.E.I.C.,
E. I. C. Representative on C.S.A.

CANADIAN CHAMBER OF COMMERCE

The Canadian Chamber is a federation of 182 Boards of Trade and Chambers of Commerce located in every province of the Dominion.

The Chamber provides a national medium through which business can meet its own and the country's problems with united strength. The activities of the Chamber are directed by a National Board of directors representing all fields of business activities. The Engineering Institute is represented on this Board for 1946, by Dr. J. B. Challies, who is the Chairman of the Executive Committee and by Colonel R. D. Harkness, its Vice-Chairman. The writer is a member of this Board, as the representative of the Engineering Institute, and is also Chairman of the Reconstruction Committee of the Chamber.

The Chamber's aims are described as follows:

1. To stimulate and maintain a vigorous national unity;
2. To determine the views of business on legislative and economic questions affecting the financial, commercial, agricultural, social and industrial interests of the Dominion and to interpret those views to Parliament and to the Departments of Government;
3. To keep local business organizations and business men informed about national developments affecting them by supplying dependable current information;
4. To promote the efficiency and extend the usefulness of individual Boards of Trade and Chambers of Commerce in Canada;
5. To create a better understanding of the problems of business on the part of the public;
6. To promote high standards of business practice;
7. To encourage freedom of enterprise and preserve individual liberty.

These activities are helped by the various divisions of the Chamber's permanent staff. There are also a number of special committees, the principal of which are the following:

Agriculture, Canada-United-States Committee, Economic Development, Foreign Trade, International Chamber of Commerce, National Labour Policy, Reconstruction, and Taxation and Public Finance.

During 1945, these committees have all been very active. Perhaps some of the most valuable work has been accomplished by the Economic Development Committee which has been carrying on a campaign of education on the functions and accomplishments of private enterprise.

The Committee on Finance and Taxation has made, from time to time, representations to the Government on such subjects as the Industrial Development Bank, the Royal Commission on Taxation of annuities and family corporations, the Royal Commission on Co-operatives and on the effect of wartime taxation on production costs.

The Committee on National Labour Policy has made suitable representations from time to time to the Government, particularly on wartime labour regulations and on other matters of importance affecting the relations between employers and employees.

The Reconstruction Committee directed the Kitchener-Waterloo survey to determine the possibility of employment after the war and this survey became a national pattern for community postwar planning and analysis. It also studied the various questions discussed in the White Paper published by the Department of Reconstruction, particularly on the question of public works, housing, price controls, etc.

I think that the Chamber is doing very useful work for business in general and more particularly for the defence of private enterprise. I consider that it is to the advantage of The Engineering Institute of Canada to have a representative on the Executive Committee of the Chamber and I wish to point out that it is an honour shared by only two other national associations.

Respectfully submitted,

Arthur Surveyer, M.E.I.C.,
E.I.C. Representative on the National Board of the Canadian Chamber of Commerce.

COMMITTEE ON PRAIRIE WATER PROBLEMS

Your Committee on Prairie Water Problems has been following closely developments as regards irrigation on the Prairie. Informal representations have been made from time to time as to the desirability and urgency of proceeding with the St. Mary and Milk rivers project. It has now been announced that this project will be one of those to be undertaken immediately by the Dominion Government as a part of its post-war programme.

Respectfully submitted,

G. A. Gaherty, M.E.I.C., *Chairman.*

KEEFER MEDAL COMMITTEE

Your committee has examined carefully the papers presented to the Institute during the prize year and is of the opinion that no award should be made of the Keefer Medal for the year 1945.

Respectfully submitted,

E. P. Muntz, M.E.I.C., *Chairman.*

ROSS MEDAL COMMITTEE

It is the recommendation of your committee that the Ross Medal for the year 1945 be awarded to S. T. Fisher, M.E.I.C., for his paper "Radio for Over-land Long-Distance Telephone Service", as published in the May 1945 issue of the *Journal.*

Respectfully submitted,

E. V. Leipoldt, M.E.I.C., *Chairman.*

PLUMMER MEDAL COMMITTEE

As Chairman of the Plummer Medal Committee, acting on behalf of Dr. Paul E. Gagnon, I would say that the Committee is of the opinion that neither of the two papers submitted qualify for the Plummer Medal. Either they do not come within the scope of the terms of reference or they do not show sufficient originality.

Respectfully submitted,

Harold J. Roast, M.E.I.C., *Chairman.*

LEONARD MEDAL COMMITTEE

Your committee is of the opinion that the Leonard Medal for 1945 should be awarded to E. Cecil Roper for his paper "The Raising of No. 7 Shaft at Britannia", as published in the February 1945, issue of *The Canadian Mining and Metallurgical Bulletin.*

Respectfully submitted,

F. V. Seibert, M.E.I.C., *Chairman.*

JULIAN C. SMITH MEDAL

Carrying out the instructions pertaining to the award of the Julian C. Smith Medal for 1945, the special committee consisting of Past-Presidents C. R. Young, deGaspé 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 1945 are being awarded to:

Alexander Joseph Grant, formerly Engineer-in-Charge, Department of Railways and Canals, Welland Ship Canal Office, St. Catharines, Ontario.

George Alexander Walkem, Managing Director, Vancouver Machinery Depot Limited, Vancouver, British Columbia.

Respectfully submitted,

E. P. Fetherstonhaugh, M.E.I.C., *Chairman.*

SIR JOHN KENNEDY MEDAL

The Sir John Kennedy Medal for 1945 has been awarded by the Council of the Institute to John Morrice Roger Fairbairn, D.Sc., M.E.I.C., formerly Chief Engineer, Canadian Pacific Railway Company, Montreal.

Respectfully submitted,

L. Austin Wright, M.E.I.C., *General Secretary.*

GZOWSKI MEDAL COMMITTEE

It is the recommendation of your committee that the Gzowski Medal for the year 1945 be awarded to John T. Dyment, M.E.I.C., for his paper "The Engineering Selection of an Airline Aeroplane", as published in the June 1945, issue of the *Journal.*

Respectfully submitted,

E. G. M. Cape, M.E.I.C., *Chairman.*

DUGGAN MEDAL AND PRIZE COMMITTEE

It is the recommendation of your committee that the Duggan Medal and Prize for 1945 should be awarded to H. L. Lexier, Jr. E.I.C., for his paper "Metallurgy and Machine Design", as published in the May 1945 issue of the *Journal.*

Respectfully submitted,

W. J. W. Reid, M.E.I.C., *Chairman.*

CANADIAN LUMBERMEN'S ASSOCIATION PRIZE

No papers in competition for the Canadian Lumbermen's Association Prize have been submitted to the committee. There is consequently nothing to report for the year 1945.

Respectfully submitted,

J. L. Lang, M.E.I.C., *Chairman.*

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 12th, 1946, and the following awards were made:

H. N. Ruttan Prize (Western Provinces) to Robert Peterson, Jr.E.I.C., for his paper "Soil Mechanics as Applied to P.F.R.A. Problems, with Special Reference to the Proposed St. Mary's Dam."

John Galbraith Prize (Province of Ontario), to F. J. McMulkin, Jr.E.I.C., for his paper "Welding and Fabrication of Canadian Light Armour".

Phelps Johnson Prize (Province of Quebec—English), to J. T. Madill, Jr.E.I.C., for his paper "Field Decay Characteristics of Large Hydro-Electric Generators".

Ernest Marceau Prize (Province of Quebec—French), to J. B. Nobert, S.E.I.C., for his paper "Etude d'installation d'usine de défibrage du bois par le procédé mécanique à la vapeur, à Pont Rouge".

Martin Murphy Prize (Maritime Provinces), to Fred W. Davidson, S.E.I.C., for his paper "Design of an Antenna for VE9AS".

Abstracts of Reports from Branches

Note—For Membership and Financial Statements see pages 102 and 103

BORDER CITIES BRANCH

The Executive Committee submits the following report for the year 1945:

We held thirteen meetings of the Executive Committee for the discussion of business.

There were ten regular branch meetings and one special meeting held this year. The ladies were invited to two of these and showed their appreciation by turning out in good numbers. One other meeting was of particular importance—the Inaugural Meeting held in Sarnia. At this particular meeting, this branch sponsored the former Sarnia members in becoming the first new branch to receive a charter from Headquarters for a long time.

The death of Mr. C. M. Goodrich, M.E.I.C., will be felt keenly by this Branch and the Institute in general for he has made many contributions to engineering.

Information relative to these meetings is as follows, attendance being shown in brackets:

Jan. 10—**Collective Bargaining and Accomplishments of the Association of Professional Engineers**, by Colonel T. Medland, Public Relations Officer of the Association of Professional Engineers. (54.)

Jan. 19—**Development and Testing of the Canadian Universal Trestle as used with the Bailey Bridge**, by R. C. Manning, Chief Engineer of the Canadian Institute of Steel Construction. Illustrated. (46.)

Feb. 16—**The Amplidyne**, by J. L. McKeever of the Peterborough plant of the Canadian General Electric Company. (60.)

Mar. 16—**Some Phases of Arc Welding** by W. D. Wolcott, Inspection Engineer of the Hydro-Electric Power Commission of Ontario. Illustrated. (34.)

Apr. 19—**Industrial Process Ventilation**, by W. N. Witheridge, Director and Chief Engineer of the Bureau of Industrial Hygiene, Detroit Department of Health. Illustrated. (33.)

May 18—**The Romance of Coal**—Technicolor sound films presented by R. Allaster, Western Sales Manager of the Pittsburg Coal Company.
Bridging San Francisco Bay—Sound film presented by T. Bronsom, Windsor representative of the United States Steel Export Company. (38.)

June 6—President's visit and Ladies Night. Dean E. P. Fetherstonhaugh spoke on **Engineering Education** with several other guest speakers. (98.)

Oct. 5—Joint Meeting with Detroit Branch of the A.S.M.E. General A.G.L. McNaughton spoke on **Canadian Engineering in the War.** (375.)

Oct. 6—Inaugural Meeting at Sarnia. (about 70.)

Nov. 16—**Some Employee Relations Aspects of Management Engineering**, by E. R. Complin, Manager of Industrial Relations of C.I.L. (40.)

Dec. 7—Annual Meeting and Election of Officers. **Fluid Drive in Industry**, by Glen V. Edmonson, Staff Engineer of the American Blower Corporation, Detroit. Illustrated (42.)

CALGARY BRANCH

The following report of activities is submitted by the Calgary Executive for the Branch Year 1945, the attendance at meetings being shown in brackets:

The Executive met eight times during the branch year.

Dec. 14—Annual Ladies Night was held at the Glencoe Club. Entertainment consisted of moving pictures. Refreshments were served. (79.)

Jan. 11—Joint Meeting with University of Alberta Alumni, Calgary Branch. Prof. R. M. Hardy, on **The Engineer and Society.** (38.)

Feb. 1—E. Kelly, on **Rural Electrification** (60.)

Feb. 15—G. W. Govier on **Straw Paper.** (55.)

Mar. 1—F/O Gidman on **Rehabilitation of the Members of the R.C.A.F.** (34.)

Mar. 10—Annual Meeting. Followed by dinner with bridge and dancing sponsored by Engineers Wives' Club. (56).

Oct. 15—A. G. Turnbull on **Recent Developments in Electrical Control.** (52.)

Nov. 1—D. F. Hamelin, on **Water Supply Investigation.** (70.)

Nov. 15—D. W. Clapperton, on **Full Employment in a Free Society.** (26.)

Nov. 21—L. Austin Wright, General Secretary, on **Institute Affairs.** (53.)

CAPE BRETON BRANCH

The Branch held the following meetings during the year:—

Jan. 15—Movie night and dinner meeting. Alaska Highway film courtesy William Stairs Son & Morrow. Bell Telephone film courtesy Northern Electric Company.

Feb. 8—**Lifeline of the Nation.** Dinner meeting with above film supplied by headquarters.

Mar. 5—**Ball and Roller Bearings,** by H. Little, R & M Bearings (Canada) Limited, with two films showing manufacture of New Departure Bearings. Dinner meeting.

Apr. 11—Annual General Dinner Meeting, at which the Branch was host to President E. P. Fetherstonhaugh, General Secretary L. Austin Wright, and G. L. Dickson, who addressed the meeting on E. I. C. affairs.

Oct. 25—**A Factual Analysis of the Tennessee Valley Authority,** by H. Massue, Statistical Engineer of the Shawinigan Water & Power Company, Limited. Dinner meeting.

EDMONTON BRANCH

The Edmonton Branch Executive met in March, April, May, September, October, twice in November and once in December in 1945, with an average attenfance of 8.

The general meetings of the Branch, except for the January meeting, opened with dinner at the Macdonald Hotel and featured the following programmes. The figure in brackets is the attendance.

Jan. 18—**A Trip Through the Andes,** with film, by Dr. N. McLeod, Engineer, the Asphalt Division of the Imperial Oil Company. This was a joint meeting held at University of Alberta with the Refresher School on Soil Mechanics and Concrete Testing. (150.)

Feb. 13—**The 12,500 K.W. Steam Electric Station of the Nova Scotia Light and Power Company Limited,** with slides by J. W. MacDonald of the Nova Scotia Light and Power Company. (42.)

Mar. 13—**Permanently Frozen Ground,** with slides and demonstrations by Prof. R. M. Hardy and E. D'Appolonia, Department of Civil Engineering, University of Alberta. (38.)

Apr. 24—**Annual Meeting of the Branch.** After reports from the officers and committees of the Branch, and the election and installation of the new executive, a moving picture entitled "From the Ground Up", being the manufacture of explosives in Canada, was shown. (32.)

Oct. 22—**German Oil Industry in the War,** by Dr. E. H. Boomer, Professor of Chemical Engineering at the University of Alberta, and one of Canada's two Oil Investigators for the Department of Munitions and Supply, with the Technical Intelligence Corps under General Eisenhower. (50.)

Nov. 20—**Annual Western Visit** of the general secretary of the E.I.C. Dr. L. Austin Wright showed the sound film **A Harbour Goes to France,** and discussed E.I.C. activities. (65.)

Dec. 10—**Rural Electrification in Alberta,** by F. T. Gale, Electrical Engineer of the Calgary Power Company, Calgary, Alberta. (36.)

Special meetings to which the Edmonton Branch had invitations were as follows:

A meeting of the Alberta Association of Architects, April 20th to hear Miss Jacqueline Tyrrwhitt, an authority from England on Town Planning.

The sessions for Technical Papers at the Western Annual Meeting of the Canadian Institute of Mining and Metallurgy in Edmonton, October 15th, 16th and 17th.

A meeting of the Chemical Institute of Canada, December 11th, when Mr. J. M. Dymond, Director of the Wartime Bureau of Technical Personnel spoke on "The Potential Employment of Technical Personnel".

HALIFAX BRANCH

During the past year, there have been held seven executive meetings in addition to the six following monthly gatherings:

Jan. 18—Combined Annual Banquet. (227.)
Feb. 22—**Steep Rock Lake Pumping,** by Mr. E. D. Brown. (76.)
Mar. 22—**Improving Personnel Relations in Industry,** by Mr. F. G. Hildebrand. (82.)
Apr. 13—Presidential Dinner. **Educational Trends in Engineering,** by Dean E. P. Fetherstonhaugh. (123.)
Oct. 23—**Factual Analysis of the Tennessee Valley Authority,** by H. Massue. (94.)
Nov. 22—**Research in Connection with Canada's Housing Problem,** by J. L. Gray. (114.)

HAMILTON BRANCH

During the year, the Branch held the following meetings with the attendance figures as given in brackets:

Jan. 11—The Annual Meeting and Dinner was held at the Scottish Rite Club, the guest speaker being Dean C. R. Young, Dean of the Faculty of Applied Science and Engineering, University of Toronto. His subject was **Trends in Engineering Education.** (66.)
Feb. 22—**Ball Bearings,** by H. Little, Vice-President and Sales Manager of R. & M. Bearings, Canada, Ltd. (48.)
Mar. 22—Students' Night—**The Design of a Tubular Conveyor Gallery,** by T. J. Boyle, At this meeting the film, **Life-Line of the Nation,** was shown through the courtesy of the American Association of Railroads. (42.)
Apr. 13—Annual Joint Meeting with the Toronto Section, A.I.E.E., and the Hamilton Sub-Section, A.I.E.E.—The subject was **Trends in Electric Power Generation,** by F. K. Fischer, Central Station Steam Engineer, Westinghouse Electric and Manufacturing Company, Philadelphia, Pa., U.S.A. (150.)
May 17—**Action Stations on the Front Line of Britain,** by L. L. Merrill. (130.)
June 8—**President's Visit**—A special dinner was held to honour the president, Dean E. P. Fetherstonhaugh, Dr. L. A. Wright, general secretary, and Major D. C. MacCallum. (65.)
June 9—Regional Meeting of Council at the Hamilton Golf and Country Club.
Aug. 23—Visit to the exhibit of the 47-ft. model of the **St. Lawrence Waterways Development** at the T. Eaton Company Ltd. (100.)
Sept. 25—Joint meeting with the Hamilton Sub-Section, A.I.E.E. —**Atomic Hydrogen Welding,** by P. H. Take, Canadian General Electric Co. Ltd., Toronto. (50.)
Oct. 15—**Steel Nesting Barges,** by W. B. Nicol, Chief Engineer, Hamilton Bridge Company Ltd., Hamilton. (65.)
Nov. 15—**Urban Transportation Problems,** by Charles E. DeLeuw, Consulting Engineer and Senior Partner of the firm of DeLeuw, Cotter & Company, Chicago, Illinois, U.S.A. (80.)
Dec. 8—The official opening in Hamilton of the **Mulberry Exhibition,** by His Worship Mayor Sam Lawrence. (500.)
Dec. 20—Joint meeting with the Hamilton Section of the Chemical Institute of Canada.—**Canada's Nitrogen Industry,** S. R. Frost, Department of Munitions and Supply, Montreal. (70.)

The Executive Committee of the Hamilton Branch held six meetings during the year with an average attendance of seven members.

KINGSTON BRANCH

During 1945, the following meetings were held by the Kingston Branch.

Jan. 10—**President's Visit**—de Gaspé Beaubien.
Feb. 1—**The Engineer in the Post-war World,** by Prof. R. F. Leggett.
Apr. 18—**Annual Meeting.**
Sept. 25—**Glued Laminated Timber Construction,** by Verne Ketchum.
Nov. 23—**The Work of the Association of Professional Engineers in Ontario,** by John Lang, and Col. T. Medland.
Dec. 4—**Industrial Training Schemes,** by Mr. D. E. Raymer.

LAKEHEAD BRANCH

The following meetings were held during the year:

Feb. 12—Fort William. **Modern Municipal Sanitation,** by E. M. Proctor, of James, Proctor and Redfern, Consulting Engineers, Toronto. Slides showing sewage treatment apparatus was shown after the meeting. (61.)
Mar. 7—Fort William. **Annual Dance,** held at the Royal Edward Hotel. (96.)
Apr. 18—Port Arthur. **Transportation in Wartime,** read by H. G. O'Leary from notes prepared by Mr. J. V. Dellabough, Transportation Engineer, Canadian National Railways, Winnipeg. Preceding this address the coloured sound motion picture film **Life line of the Nation** was shown. (31.)
May 3—Fort William. **Manufacture and Care of Ball Bearings,** by H. Little, Vice-President in charge of sales for R. & M. Bearings of Canada. Also two sound films were shown on "The Manufacture of Ball Bearings and Micro Instrument Bearings." (90.)
May 30—Port Arthur. **The Place of the Airplane in the Mining Industry,** by H. A. Oaks of Port Arthur. (30.)
June 27—Fort William. Annual Meeting and election of Officers. (32.)
Nov. 3—Cameron Falls, Ont. Branch visit to Cameron Falls and Alexander Landing power plants, H.E.P.C. of Ontario. Mr. Walter Looney, Superintendent of Thunder Bay System. (28.)
Dec. 7—Port Arthur. **Trends in Engineering Education,** by Dean E. P. Fetherstonhaugh, president of The Engineering Institute of Canada. Also Dr. L. Austin Wright, general secretary, spoke on Institute affairs.

LETHBRIDGE BRANCH

The following meetings were held by the Lethbridge Branch:

Jan. 26—A combined meeting of the Lethbridge Branch of the Engineering Institute and Association of Professional Engineers of Alberta was held in the Marquis Hotel. The speaker of the evening was Mr. George Spence and the subject was **A General Summary of Work Carried Out by the P.F.R.A.** The address was accompanied by very interesting slides. (45.)
Feb. 23—A general meeting was held in the small dining room of the Marquis Hotel with thirty present. The speaker at this meeting was Mr. D. D. Morris, General Manager of Nitrogen Products Limited. His address was entitled **Ammonia Plant at Calgary.**
Mar. 23—A general meeting was held in the Marquis Hotel with thirty present. The speaker for this meeting was Dr. J. A. Allan, Professor of Geology at the University of Alberta and his topic **Economic Aspects of the Yellowknife Area.**
Apr. 19—A corporate members meeting was held in the Department of Transport office with twelve members present. This meeting dealt mainly with the election of officers for the following year.
Apr. 27—A general meeting was held in the Marquis Hotel with forty present. The speaker for this meeting was Mr. Gard from the History Department of the University of Alberta and his subject was **Tall Tales in Alberta.** The film **Lifeline of a Nation** was shown at this meeting.
Oct. 26—A general meeting was held in the Marquis Hotel with thirty five members present. The guest speaker was Mr. H. W. Main, Chief Engineer of the Army Transport Service. The topic of his address was **Alaska.**

Nov. 22—A corporate members meeting was held in the small dining room of the Marquis Hotel on the occasion of Dr. L. Austin Wright's visit to this office. The speaker was Dr. L. Austin Wright and he spoke on topics of interest to this Branch and what Headquarters of The Engineering Institute of Canada propose doing.

Nov. 28—There was a combined meeting of the Lethbridge Branch of the Engineering Institute and the Association of Professional Engineers of Alberta. The guest speaker of the evening was Mr. C. G. Anderson, District Agriculturist and the topic **"Agriculture in Manchuria"**.

As well as general meetings, there were six executive meetings called to look after general administration of the Lethbridge Branch. The average attendance at these meetings was six.

LONDON BRANCH

During the year, the Branch held nine regular and special meetings.

Jan. 17—Annual meeting and election of Officers. **The University of Western Ontario and the War Effort,** by Dr. R. C. Dearle, Head of the Dept. of Physics at the University of Western Ontario.

Feb. 14—**Human Engineering,** by Dr. Herbert Moore, Ph. D., Clinical Psychologist of Stevenson & Kellogg, Management Engineers, Toronto.

Mar. 21—**Report on E.I.C. Annual Meeting in Winnipeg,** by J. A. Vance, Branch Councillor.

Apr. 25—**The Production of Electrical Current Indicating Instruments in Canada,** by A. L. Furanna, Instrument Division Engineer, Sparton of Canada, London.

June 5—President Dean E. P. Fetherstonhaugh and Mrs. Fetherstonhaugh were entertained by the Branch at the London Hunt Club.

Sept. 19—**A Review of Welding Processes,** by H. G. Stead, President and Chief Engineer of E. Leonard & Sons, Ltd., London.

Oct. 24—**Shipshaw,** by J. W. Brooks, Engineer, Hyatt Bros. Construction Co., London.

Nov. 15—London Branch was host at a luncheon meeting for its members and friends, newly returned from overseas.

Dec. 13—**The British Columbia Electric Railway Development,** by R. E. Heartz, Assistant Chief Engineer, Shawinigan Engineering Co. Ltd., Montreal.

MONTREAL BRANCH

The attendance this fall at meetings has been extremely high. This has been achieved to some extent, it is true, by the fact that several joint meetings have been held with other societies. This policy of holding joint meetings is undoubtedly a sound one but eventually it may not be possible to continue it due to the fact that the seating capacity of the hall at 2050 Mansfield is limited to a maximum of 200.

Following is the list of meetings held during the year 1945:

Jan. 11—**The Future of Aluminum,** by Dr. P. M. Haenni. (140.)

Jan. 18—Joint Meeting with A.I.E.E.—**The Amplidyne Machine,** by J. L. McKeever. (150.)

Jan. 25—Annual Meeting of the Branch (Refreshments) (110.)

Feb. 1—**The 12,500 KW Steam Electric Station of the Nova Scotia Light & Power Co. Ltd.,** by J. W. MacDonald and J. T. Farmer. (90.)

Feb. 8—**The Diesel Electric Power Plant in Industry and Transportation,** by Ira Sylvester. (125.)

Feb. 15—**Beet Sugar Manufacture,** by M. R. Allen. (115.)

Feb. 22—Annual Social Evening. (Refreshments). (400.)

Mar. 1—**The Automotive Industry in War,** by W. J. Davidson. (115.)

Mar. 8—**Train Communication,** by Dr. L. O. Grondahl. (100.)

Mar. 15—**Pollution Hazards in a Water Supply System,** by L. P. Cabana. (100.)

Mar. 22—**The Aircraft Industry,** by David Boyd. (130.)

Apr. 5—**Post War Problems of the Pulp and Paper Industry,** by R. E. Weldon. (90.)

Apr. 12—Joint Meeting with A.I.E.E.—**The Smith-Putnam Wind Turbine Project,** by Dr. John B. Wilbur. (150.)

Apr. 18—Joint Meeting with the Statistical Quality Control Association of Montreal.—**Progress of Quality Control in Great Britain during the War,** by Dr. John R. Womersley. (135.)

Apr. 26—**Factual Analysis of The Tennessee Valley Authority,** by H. Massue, (150.)

Sept. 27—Special Meeting—**Design and Use of Timber in Structures,** by Verne Ketchum. (240.)

Oct. 4—Opening Night—Films. (Refreshments). (325.)

Oct. 11—Visit to Mulberry Exhibit. (700.)

Oct. 13—Visit to Dorval Airport. (350.)

Oct. 18—Joint Meeting with A.I.E.E.—**A Modern Electric Boiler Installation at Arvida,** by F. L. Lawton and M. G. Saunders. (200.)

Oct. 25—**Central Steam Utilities as a Solution to the Urban Smoke and Heating Problem,** by R. L. Fitzgerald. (100.)

Nov. 1—**What is Good Management ,** by Wallace Clark. (225.)

Nov. 8—**Atomic Power,** by Dr. B. Weldon Sargent. (250.)

Nov. 15—Joint Meeting with I.R.E.—**Pulse Techniques,** by F/L R. W. Wilton, M.B.E. (150.)

Nov. 22—**Trends in Development of Airline Aircraft,** by John T. Dyment. (120.)

Nov. 29—**Application of the Cylindrical Shell for Concrete Roofs,** by Eric C. Molke. (130.)

Dec. 6—Joint Meeting with A.I.E.E.—**Gas Turbine Fundamentals,** by Dale D. Streid. (175.)

Dec. 13—**Patents,** by E. T. Henry. (125.)

Junior Section

Acting on the premise that the young engineer is a "social animal" like the rest of his fellow men, the Executive of the Junior Section took special pains this year in sponsoring evenings of a social character. That this policy met with full success is evidenced by the three film nights which attracted full house each time. Also, the crowning achievement of the season was the first annual dance of the Section. Some 200 couples attended the dance which was held in the ballroom of the Ritz-Carlton Hotel. The attendance of senior men to this function was particularly gratifying. Great credit is due to the Chairman of the Entertainment Committee, T. A. Monti, for his untiring efforts in organizing both the film nights and the dance.

Out of the eight sessions held by the Junior Section, three were devoted to papers, as shown below:

Jan. 29—Annual Meeting.—Reports and Film. (Refreshments).

Feb. 19—**Mechanical Impact,** by T. A. Monti.

Mar. 5—Film Night. (250.)

Apr. 9—**Planning and Construction of 10,000-ton Cargo Vessels,** by Edmond Pontbriand and Leo Scharry.

May 14—Film Night. (200.)

Oct. 22—Opening Night.—Mr. J. B. Stirling, Chairman of the Montreal Branch, addressed the members.—Film. (Refreshments).

Nov. 12—Film Night. (200.)

Nov. 23—Annual Dance. (400.)

MONCTON BRANCH

Eleven meetings of the Executive were held during the year. There were eight branch meetings held, at which technical subjects were discussed, and business transacted as follows:

Feb. 19—A meeting was held in the City Hall. H. W. Hole Manager, New Brunswick Gas & Oilfields, Ltd., gave an address on the **Formation and Development of the Stoney Creek Oil and Gas Field in Albert County, N.B.** At the conclusion of Mr. Hole's address, the film **Lifeline of the Nation** was shown.

Mar. 6—A joint meeting of Moncton Branch and the Engineering Society of Mount Allison, was held in the Science Building of the University, at Sackville. Two sound films dealing with the manufacture, care and handling of ball bearings were screened. H. Little, R. & M. Bearings, Canada, Limited, gave a commentary.

Mar. 7—A meeting was held in the City Hall. The films and commentary on ball bearings were presented.

Apr. 11—A meeting was held in the City Hall. Motion pictures were screened showing the Melocheville Construction, Surface Stripping at the East Malartic Gold Mine, and Soil-Cement Stabilization at Seven Islands Airport.

Apr. 20—A dinner meeting was held in the Brunswick Hotel in honour of the president of the Institute. The president addressed the meeting on the subject of **Engineering Education**, and the general Secretary, Dr. L. Austin Wright, spoke on conditions affecting the economic status of engineers.

May 22—A meeting was held for the purpose of nominating branch officers for the year 1945-46.

May 29—The Annual Meeting was held on this date.

Oct. 31—A meeting was held in the City Hall. Huet Massue, Statistical Engineer, Shawinigan Water and Power Co., Montreal, addressed the meeting on the subject **Factual Analysis of the Tennessee Valley Authority.**

NIAGARA PENINSULA BRANCH

The Branch Executive held six (6) executive meetings and one (1) electoral meeting during the year. The programme committee arranged for and conducted the following general professional meetings.

Jan. 25—Dinner meeting at the General Brock Hotel, Niagara Falls, Ontario, addressed by Mr. R. A. Abraham, of H. G. Acres and Company, on **The Engineer's Part in the History of Architecture.**

Mar. 1—**Smoker Meeting,** held at the Welland House, St. Catharines, Ontario. This was a joint meeting with the Association of Professional Engineers of the Province of Ontario, and was addressed by Lieut. Col. T. M. Medland, Director of Public Relations, Association of Professional Engineers of the Province of Ontario, who spoke on **The Association and Its Accomplishments.**

Apr. 5—Dinner meeting, held at the General Brock Hotel, Niagara Falls, Ontario. The guest speaker was Mr. A. E. K. Bunnell, Consultant to the Provincial Department of Planning and Development. His subject was **The Field of the Engineer in Community and Town Planning.**

Apr. 26—Dinner meeting, held at the Leonard Hotel, St. Catharines, Ontario, addressed by Mr. P. R. Sandwell, Development Engineer, Ontario Paper Company, on the subject **The Paper Industry in Australia.**

June 7—The branch annual dinner meeting was held at the Park Restaurant, Queen Victoria Park, Niagara Falls, Ontario. Dean E. P. Fetherstonhaugh, president; Dr. L. A. Wright, general secretary; and Major D. C. McCallum, director of rehabilitation and personnel services, all of The Engineering Institute of Canada, were guests of the Niagara Peninsula Branch, and addressed the meeting on professional and E.I.C. subjects.

June 20—A joint meeting with the Buffalo Branch of the American Society of Civil Engineers, held on board two United States Army "Self-Loading Dredges". The operation of these dredges was fully demonstrated by going on a short cruise and proceeding with loading and unloading operations.

Sept. 27—Dinner meeting, held at the Leonard Hotel, St. Catharines, Ontario. Mr. Morley Lazier delivered a very interesting talk on **Atomic Energy.**

Oct. 25—Dinner meeting at the Fox Head Hotel, Niagara Falls, Ontario, addressed by Mr. H. J. A. Chambers, on the subject **Steel in the Construction Industry.**

Nov. 22—**Annual Ladies Night,** dinner meeting held at the Leonard Hotel, St. Catharines, Ontario. Mr. George L. Long, Historian of the Bell Telephone Company of Canada, gave an address and demonstration on the subject **Your Voice as Others Hear It.**

OTTAWA BRANCH

The following meetings were held during the year:

Jan. 11—Annual evening meeting, Auditorium, National Research Council—Guest Speaker: De Gaspé Beaubien, C.B.E., President of The Engineering Institute of Canada.

Jan. 31—Evening meeting, Physical Metallurgical Research Laboratories of the Bureau of Mines—Demonstration of equipment.

Feb. 14—Luncheon meeting, Chateau Laurier—An illustrated talk entitled **The Heating of Dwellings,** by Huet Massue of the Shawinigan Water Power Company, Montreal.

Feb. 20—Joint evening meeting with the Ontario Section of the American Institute of Electrical Engineers—the Auditorium, National Research Council—**The Amplidyne Machine,** by J. L. McKeever, Canadian General Electric Co., Peterborough.

Mar. 8—Luncheon meeting, Chateau Laurier—a report on the Dominion Convention of the Institute by W. L. Saunders, councillor, Ottawa District.

Mar. 21—Luncheon meeting, Chateau Laurier, **The Development of Civil Aviation in Canada,** by J. A. Wilson, Director of Air Services, Dept. of Transport, Ottawa.

Apr. 6—Luncheon meeting, Chateau Laurier, **Rural Electrification**—an illustrated talk by Morris J. McHenry, Hydro-Electric Power Commission of Ontario, Toronto.

Apr. 19—Luncheon meeting, Chateau Laurier, **Some Experiences in Army Engineering Design**—an illustrated talk by R. E. Jamieson, Director General, Army Engineering Design Branch, Department of Munitions and Supply.

Apr. 20—Afternoon meeting in the Auditorium of the National Research Council—**River Control Structures in Australia,** by Mr. E. D. Shaw, State River & Water Supply Commission, Victoria, Australia.

May 24—Luncheon meeting, Chateau Laurier, held in honour of Major-General H. B. W. Hughes, C.B., D.S.O., O.B.E., Engineer-in-Chief, War Office, London, England.

Sept. 5—Evening inspection of the exhibit **Mulberry** as arranged by the Hudson's Bay Company, in collaboration with The Engineering Institute of Canada.

Sept. 13—Luncheon meeting at the Chateau Laurier in honour of E. P. Fetherstonhaugh, president of The Engineering Institute of Canada.

Sept. 26—Evening meeting in the Lecture Hall, Victoria Memorial Museum—an illustrated lecture on **Timber Structures,** by Mr. Verne Ketchum, New York.

Sept. 27—Members of the Ottawa Branch were invited to attend a general session of the Conference on **Unification of Engineering Standards,** Chateau Laurier—Speaker: Mr. Wm. Batt, Vice-Chairman of the American War Production Board and United States Representative on the combined Production and Resources Board.

Oct. 3—Evening meeting in the auditorium of the National Research Council, under the auspices of the Conference on the Unification of Engineering Standards—**Critical Instability in Structures,** by L. B. Tuckerman, National Bureau of Standards, Washington, U.S.A.

Oct. 4—Evening meeting in the Chateau Laurier under the auspices of the Conference on the Unification of Engineering Standards—**The Operation Pluto,** by Mr. James S. Blair, Stewarts & Lloyds, Ltd., Corby, England.

Nov. 27—A joint evening meeting with the American Institute of Electrical Engineers, auditorium, National Research Council—**Techniques of Radar and its Use in Peacetime,** by Mr. J. H. Rowlatt, Bell Telephone Co., Montreal.

No. 26-27—Inspection of an exhibition of radar and associated electronic developments arranged under the auspices of the Radio Branch of the National Research Council.

Dec. 7—A joint evening meeting held with the Ontario Section of the American Institute of Electrical Engineers—an illustrated lecture on **Gas Turbine Fundamentals,** by Mr. Dale D. Streid, General Electric Co., Lynn, Mass., U.S.A.

PETERBOROUGH BRANCH

The following meetings were held during 1945, with attendance shown in brackets.

Jan. 18—N. E. MacPherson, H.E.P.C. of Ontario, on **Rural Electrification.** (32.)

Feb. 15—Messrs. V. L. Richards, A. C. West, F. E. P. Griggs of Hanson & Van Winkle Co. Ltd., on **Electroplated Finishes.** (40.)

Mar. 1—A. C. Northover, Canadian General Electric Co. **The Design of a City.** (52.)

Mar. 15—Student and Junior Night. A. R. Hailey, on **Exciter Voltage Build-Down.** G. S. Wade and B. O. Baker, on **Some Problems in Gun Carriage Design.**

Branches	Border Cities	Calgary	Cape Breton	Edmonton	Halifax	Hamilton	Kingston	Lakehead	Lethbridge	London	Moncton
MEMBERSHIP											
Resident											
Hon. Members	..	..	..	..	..	..	2	..	..	..	..
Members	51	109	28	79	189	98	37	43	16	35	34
Juniors	10	22	2	13	16	20	14	4	1	6	3
Students	7	8	5	25	50	25	41	5	2	6	14
Affiliates	..	1	1	1	1	1	1	7	..	3	..
Total	68	140	36	118	256	144	95	59	19	50	51
Non-Resident											
Hon. Members	..	..	..	..	..	..	..	..	..	..	..
Members	11	14	23	9	76	20	6	15	17	12	21
Juniors	2	3	5	8	4	4	2	2	6	4	8
Students	3	4	12	3	24	6	3	3	10	3	7
Affiliates	1	..	1	..	..	1	..	..	..	..	..
Total	17	21	41	20	104	31	11	20	33	19	36
Grand Total December 31st, 1945	85	161	77	138	360	175	106	79	52	69	87
" December 31st, 1944	113	145	84	143	361	180	171	71	43	49	107
Branch Affiliates, December 31st, 1945	..	50	..	..	..	13	5	..	12	1	4
FINANCIAL STATEMENT											
Balance as of December 31st, 1944	401.54	217.76	672.41	109.97	285.70	207.85	62.58	209.48	220.24	179.42	160.37
Income											
Rebates from Institute Headquarters	220.15	73.73	55.95	41.60	128.51	251.68	143.97	144.38	33.30	95.70	45.53
Payments by Professional Assns.	..	266.01	85.25	217.07	432.00	..	..	..	61.80	..	98.00
Branch Affiliate Dues	..	187.50	..	..	..	36.00	5.00	..	36.00	5.00	20.00
Interest	13.16	42.33	4.45	..	1.08	42.03	0.28	2.05	1.74	3.00	3.38
Miscellaneous	469.03	94.21	95.00	13.25	65.75	760.95	3.38	353.60	31.00	116.50	64.75
Total Income	702.34	663.78	240.65	271.92	627.34	1,090.66	152.63	500.03	163.84	220.20	231.66
Disbursements											
Printing, Notices, Postage①	37.61	61.82	5.62	32.94	142.84	172.26	44.23	23.07	32.30	19.19	25.41
General Meeting Expense②	465.20	97.11	74.99	45.23	93.49	..	6.06	350.65	27.50	55.65	4.00
Special Meeting Expense③	..	149.80	206.87	9.70	115.07	266.24	37.97	89.61	42.00	121.25	122.10
Honorarium for Secretary	..	..	..	50.00	50.00	..	..	10.00	25.00	..	25.00
Stenographic Services	15.00	10.00	..	5.00	40.65	50.00	..	..	.. ..	..	10.00
Travelling Expenses④	..	38.50	18.11	..	18.25	148.85	27.22	..	..	..	6.64
Subscriptions to other organizations	..	..	..	..	..	..	..		..	..	..
Subscriptions to *The Journal*	..	24.15	..	..	..	4.15	..	..	..	2.00	8.00
Special Expenses	205.38	6.50	..	32.22	86.50	..	..	..	27.55	16.00	..
Miscellaneous	..	33.44	..	2.03	32.00	503.65	..	15.23	20.77	2.51	22.32
Total Disbursements	723.19	421.32	305.59	177.12	578.80	1,145.15	115.48	488.56	175.12	216.60	223.47
Surplus or *Deficit*	*20.85*	242.46	*64.94*	94.80	48.54	*54.40*	37.15	11.47	*11.28*	3.60	8.19
Balance as of December 31, 1945	380.69	460.22	607.47	204.77	334.24	153.36	99.73	220.95	208.96	183.02	168.56

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, 1945

Montreal	Niagara Peninsula	Ottawa	Peterborough	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Toronto	Vancouver	Victoria	Winnipeg
2	..	1	..	..	..	..	..	..	..	..	1	..	1	8
1141	72	359	41	112	68	43	53	18	65	20	457	171	45	146
176	19	65	18	14	20	4	14	6	8	5	73	8	7	32
680	15	79	13	27	10	14	21	4	4	1	108	46	8	65
30	1	8	..	3	..	3	1	..	..	1	8	5	..	4
2029	107	512	72	156	98	64	89	28	77	27	647	230	61	255
..	..	..	..	..	..	..	..	..	..	..	..	1	..	2
85	7	95	17	24	7	63	5	..	77	33	13	59	8	21
18	..	26	5	3	1	7	1	..	22	5	3	10	1	5
42	..	51	5	12	1	55	5	..	71	5	4	16	1	10
2	..	4	3	1	1	..	1	..	..	..	1	2	..	..
147	7	176	30	40	10	125	12	..	170	43	21	88	10	38
2,176	114	688	102	196	108	189	101	28	247	70	668	318	71	293
1,872	106	628	91	177	94	170	91	..	227	64	674	266	67	266
12	7	22	11	..	..	12	..	..	..	14	..	1	1	10

*For voting purposes only, there should be added to Montreal Branch, an additional 319 members, 195 being resident in the United
ates, 83 in British possessions and 41 in foreign countries.

Montreal	Niagara Peninsula	Ottawa	Peterborough	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Toronto	Vancouver	Victoria	Winnipeg
491.51	239.62	983.93	294.23	359.67	224.94	347.88	158.45	..	26.24	73.35	879.28	331.68	117.91	365.77
417.13	221.61	682.91	155.43	303.49	192.88	38.70	170.95	51.90	119.50	148.69	874.56	407.50	129.78	369.09
..	..	..	..	..	..	190.00	..	..	301.94	..	..	..	..	..
43.00	30.00	15.00	24.00	..	..	72.00	..	..	..	42.00	..	..	3.00	45.00
30.00	3.75	40.62	0.55	..	..	..	..	..	..	15.12	12.82	1.15	..	28.50
..	..	..	..	520.15	80.28	..	..	225.00	..	59.50	80.20	..	..	392.35
490.13	255.36	738.53	179.98	823.64	273.16	300.70	170.95	276.90	421.44	265.31	967.58	408.65	132.78	834.94
411.37	75.37	215.84	69.52	135.88	10.99	100.08	49.21	7.15	60.93	34.23	308.24	76.13	37.94	165.55
134.70	40.23	..	42.50	37.53	90.90	100.85	56.60	78.50	197.50	80.00	20.50	38.00	3.55	12.58
251.69	65.49	276.75	85.22	681.76	152.20	73.35	7.50	158.00	..	26.20	166.74	44.25	..	38.78
400.00	75.00	..	..	100.00	25.00	25.00	..	..	62.00	25.00	100.00	50.00	35.00	75.00
120.00	5.00	75.00	..	..	..	15.00	5.00	..	10.00	..	50.00	20.00	..	..
9.25	15.18	..	..	..	..	7.10	..	..	34.36	..	110.85	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	14.33	6.00	8.00	..	..	24.00	..	..	..	..	..	..	..	20.00
..	4.93	520.00	..	..	..	15.00	..	..	..	..	275.86	..	5.00	258.94
107.30	8.34	66.74	77.90	27.98	11.20	15.90	..	0.30	32.35	3.50	47.52	11.19	..	5.06
434.31	303.87	1,160.33	283.14	983.15	290.29	376.28	118.31	243.95	397.14	168.93	1,079.71	239.57	81.49	575.91
55.82	*48.51*	*421.80*	*103.16*	*159.51*	*17.13*	*75.58*	52.64	32.95	24.30	96.38	*112.13*	169.08	51.29	259.03
547.33	191.11	562.13	191.07	200.16	207.81	272.30	211.09	32.95	50.54	169.73	767.15	500.76	169.20	624.80

Mar. 21—Ladies Night. (79.)
Apr. 12—Mr. E. C. Gosnell, Lukens Steel Company, on **Clad Steels.**
June 9—Annual Meeting and Picnic. (62.)
Sept. 29—Joint Meeting with A.I.E.E. Toronto Branch. J. Cameron, Canadian General Electric Co., on **Some Aspects of Insulating Electrical Conductors.** (81.)
Oct. 18—Major S. Stucken, R.C.E.M.E., Barriefield, on **Some Notes on Canadian Tank Development.** (31.)
Nov. 20—Mr. D. Boyd—Victory Aircraft Limited, on **Manufacture of Heavy Aircraft.** (46.)
Dec. 12—Annual Dinner. President Fetherstonhaugh's visit. (47.)

QUEBEC BRANCH

The Executive Committee held seven meetings with an average attendance of eight (8) members for the transaction of Branch business.

The activities of the branch were varied and numerous. Two records were established: (1) in the number of meetings (15); (2) in the attendance (average of 68).

The programme of activities was as follows (attendance is given in brackets):

Jan. 15—**Wood, an Engineering Material,** by Dr. J. Risi, professor of organic chemistry, Laval University. (58.)
Jan. 22—President Beaubien's visit. (65.)
Jan. 29—**Training, Yesterday, To-Day and To-Morrow,** H. N. Bronson, Employment and training supervisor, Bell Telephone Co. (39.)
Feb. 12—Ladies' Night—Miss Rachel Audet, Quebec Power Co. **Interior Lighting.** (125.)
Feb. 26—Junior Night, Jules Mercier,'**Lightning.** Mr. L. Trudel. (66.)
Mar. 12—**Industrial Utilization of Waste Sulphite Liquor,** by Dr. A. C. Hill. (33.)
Mar. 26—**Technical Aspects of Radio Repairing,** Albert Dumas, Ecole Technique, Quebec. (60.)
Apr. 9—**"New Apparatus" for the Study of the Deformation of Solids,** Roger Potvin, professor of electrometallurgy, Laval University. (45.)
May 16—Luncheon—Speaker: T. E. Lyons, Sec'y.-administrator of American Free Ports. (24.)
May 21—Annual meeting. (32.)
June 8—Films. (80.)
June 13—President Fetherstonhaugh's visit. (130.)
Sept. 10—Annual Golf Tournament. (90.)
Nov. 19—**What's New in Lighting Sources,** by M. Laflamme. (115.)
Dec. 10—**A New Industry—Peat,** by J. P. Drolet. (65.)

SAGUENAY BRANCH

During the year the Branch held a total of 15 general meetings as follows:

Jan. 30—A special meeting called to present the steps taken by Headquarters with respect to **Collective Bargaining** and Order-in-Council P.C. 1003. This was followed by a showing of the Tacoma Bridge picture.
Feb. 16—**The Commercial Fabrication and Technical Applications of Precious Metals,** by D. C. Lloyd of Johnson Mathy Company, Montreal. This was a joint E.I.C.-C.I.C. meeting.
Mar. 23—**Cathodic Protection,** by Dr. John J. Grebe of Dow Chemical Company, Midland, Michigan. This was a joint E.I.C.-C.I.C. meeting.
Apr. 17—**Boiler Water Conditioning,** by W. J. Tomlinson, Technical Director, Betz Laboratories, Montreal.
May 9—**Flame Priming of Metal Surfaces,** by R. J. Anderson, Engineer-In-Charge of Union-Melt Welding, Dominion Oxygen Ltd., Toronto.
May 16—**Uses and Abuses of Paint and Varnish,** by Norman Holland, President and Managing Director, Brandram-Henderson Limited, Montreal.
June 18—A dinner meeting held in the Grill Room of the Saguenay Inn for the purpose of meeting the Institute President, Dean E. P. Fetherstonhaugh and Assistant General Secretary Louis Trudel.
June 28—**Central Control of a Power Station,** by Perry Pederson of Control Corporation, Minneapolis, Minn.
July 3—**England in War Time,** by J. Thwaites, Development Engineer, Canadian Westinghouse Co., Hamilton, Ont.
July 13—**Operational Research with the R.C.A.F.,** by Dr. J. W. T. Spinks, Professor of Chemical Engineering, University of Saskatchewan. This was a joint E.I.C.-C.I.C. meeting.
July 25—**Soils and the Engineer,** by Prof. R. F. Legget, University of Toronto.
Aug. 15—**The 12,500 Kw. Steam-Electric Station of the Nova Scotia Light and Power Co. Ltd.,** by J. T. Farmer, Mechanical Engineer, Montreal Engineering Company Ltd., Montreal.
Oct. 11—A special meeting called to discuss changes to the Institute constitution as proposed by the Membership Committee and the Finance Committee.
Oct. 25—**A Modern Electric Boiler Installation at Arvida,** by F. L. Lawton, Assistant Chief Engineer, Aluminum Company of Canada, Limited, Montreal, and Mr. M. G. Saunders, Plant Engineer, Aluminum Company of Canada, Limited, Kingston.
Nov. 25—**Sailplanes; Their Construction and Operation,** by J. D. O. Barry, Aluminum Company of Canada, Limited, Shipshaw, P.Q.

In addition to the above, the Junior Section held 9 general meetings.

SAINT JOHN BRANCH

The Executive held twelve meetings during the year with an average attendance of seven members.

Eight dinner meetings were held in the Admiral Beatty Hotel with the attendance noted below in brackets.

Jan. 25—Annual joint dinner meeting of the Branch and the Association of Professional Engineers of the Province of New Brunswick. R. A. H. Hayes, Assistant Chief Engineer, Aluminium Laboratories Ltd., Montreal, addressed the Branch on **The Shipshaw Power Development,** illustrating his talk by slides and films. (81.)
Feb. 15—A dinner meeting was held at which the guest speaker was Senator G. P. Burchill who spoke on **The Forest Resources of New Brunswick.** A programme of motion pictures was also shown at this meeting including **Lifeline of the Nation,** depicting the part the railways have played in World War II. (59.)
Mar. 8—A dinner was held at which two films were shown—**Manufacture of Ball Bearings** and **Micro Instrument Bearings—Their Care and Handling.** Mr. H. Little also addressed the meeting and displayed samples of the various types of bearings. (46.)
Apr. 18—A special dinner meeting of the Branch was held in honour of Dean Fetherstonhaugh and the presidential party on the occasion of the president's annual visit. This meeting was also attended by the wives of the members. (89.)
May 10—The annual dinner of the Branch was held with the new chairman, J. M. Lamb, presiding. Through the courtesy of M.D. 7 two sound films were shown which proved of great interest to engineers. (30.)
Oct. 30—Mr. Huet Massue of the Shawinigan Water and Power Co., Montreal, addressed the Branch while on a Maritime tour on **A Factual Analysis of the Tennessee Valley Authority.** (51.)
Nov. 16—A dinner meeting was held at which H. W. Hole, Manager of the New Brunswick Gas and Oil Fields, Ltd. spoke on **The Formation and Development of the Stoney Creek Oil and Gas Field, Albert County, N.B.** (58.)
Dec. 6—A dinner meeting was held at which John Flood spoke on **The Port of London.** This paper was compiled by an eminent British engineer and issued under the Port of London Authority. (38.)

ST-MAURICE VALLEY BRANCH

During the year 1945 the following general meetings were held:

Jan. 24—**Application of Electronics,** by G. Clarkson of the Canadian Westinghouse Company Limited with a film entitled "Electronics at Work". This was a joint meeting with the Chemical Institute of Canada.
Apr. 12—**Industrial Engineering,** by S. Lyman of Canadian Industries Limited. This was a joint meeting with the Chemical Institute of Canada.
June 12—**Presidential Visit and Annual Meeting.** This was an unusually good meeting. President Dean E. P.

Fetherstonhaugh spoke on **The Engineer and His Education** after relating some interesting engineering developments which he had experienced during his practice. P. E. Poitras, president of the Corporation of Professional Engineers of Quebec spoke on **The Engineering Profession.** L. Trudel, assistant general secretary, spoke on the administration of Institute affairs. Officers for the following year were elected.

Sept. 20—**A Factual Analysis of the Tennesee Valley Authority,** by Huet Massue, Statistical Engineer with the Shawinigan Water & Power Company. This was a dinner meeting held in Grand'Mère. (40.)

Oct. 31—**High Speed Photography** (with slides), by V. O. Marquez of the Northern Electric Company Ltd. This was a lecture meeting held in conjunction with the Chemical Institute of Canada.

Dec. 13—**Radio Frequency Heating** (with film and slides), by J. B. Knox of the R.C.A. Victor Co. Limited. This was a lecture meeting held in conjunction with the Chemical Institute of Canada.

SARNIA BRANCH

The Sarnia Branch was newly organized this year, and received its charter at the Inaugural Meeting on October 6, with many Institute officials present. Two other meetings were held as follows:

Nov. 17—Regular meeting, addressed by J. T. Thwaites on **Now It Can Be Told,** the story of radar and related subjects in England during the War.

Dec. 11—Annual meeting, election of officers and discussion on by-laws.

SASKATCHEWAN BRANCH

All meetings were held jointly with the Association of Professional Engineers. The programmes were as follows:

Jan. 19—Regular Meeting, 2 films followed by a social get-together.

Feb. 16—Annual Meeting, addressed by Judge P. E. Gordon on his trip to England as head of the National Red Cross.

Mar. 14—Regular Meeting, addressed by E. E. Eisenhauer, Deputy Min. of Reconstruction & Rehab. on **Reconstruction & Rehabilitation in Saskatchewan.**

June 8—Special Meeting to view film—**Tornado in a Box.**

Oct. 26—Regular Meeting, addressed by Henry Lewis, Deputy Minister of Nat. Res. & Ind. Dev. on **Industrial Development in Saskatchewan.**

Nov. 16—Regular Meeting, addressed by L. Austin Wright, gen. sec., on **Institute Affairs.**

Dec. 14—Regular Meeting, film—**Steam Generation** followed by a tour through the City Power House.

The average attendance at these meetings was 45. Eight Meetings of Executive were held during the year.

SAULT STE-MARIE BRANCH

During the year 1945, the Sault Ste. Marie Branch held four executive committee meetings and six general meetings.

The general meetings were:

Feb. 2—**Beam and Column Design,** by W. H. M. Laughlin, Dominion Bridge Co., Toronto.

Apr. 30—**Manufacture, Assembly and Final Inspection of Ball Bearings,** by H. Little, R. & M. Bearings Canada Ltd.

June 1—**Forest Insects,** by Dr. C. E. Atwood, Forest Insect Laboratory.

Nov. 12—Visit to the Branch by L. Austin Wright, gen'l. sec. E. I. C., and J. A. Vance, Councillor, London Branch.

Nov. 30—**Long Haul and Overland Belt Conveyor Systems,** by T. O'Neill, Field Engineer, Goodyear Tire & Rubber Company.

Dec. 28—Annual Dinner and Installation of Officers

The average attendance at the general meetings was thirty.

TORONTO BRANCH

The executive held sixteen meetings with an average attendance of ten.

Regular meetings of the Branch are listed below, with the attendance given in brackets:

Jan. 18—**Wartime Transport of Food,** by Dr. W. H. Cook. (25.)

Jan. 26—Joint meeting with the American Institute of Electrical Engineers. **The T. V. A. Hydro Plants—Mechanical and Electrical Features**—paper by Messrs. H. J. Peterson and R. A. Hopkins of T.V.A., read by Mr. A. H. Frampton. (101.)

Feb. 1—Ladies Night. Dance at Casa Loma. (135.)

Feb. 15—Student Night. **Metallurgical Testing by Electronic Means,** by R. T. Cavanagh; **Cavitation in Marine Propellers,** by D. E. Becks; **Continuously Moving Forms,** by H. H. Todgham. (62.)

Mar. 1—**Reinforced Concrete Design in South America,** by A. J. Boase. (81.)

Mar. 15—Joint meeting with the American Society of Mechanical Engineers. **Army Engineering Problems.** (84.)

Mar. 28—Annual meeting. (68.)

Sept. 24—**Timber Structures,** by Verne Ketchum. (102.)

Oct. 4—**Structures in Steel,** by W. H. M. Laughlin. (87.)

Oct. 18—**General Motors Technical Centre,** by W. J. Davidson. (52.)

Nov. 2—**Engineers' Ball,** joint under Aff. Engineering and Allied Societies. (493.)

Nov. 8—In collaboration with Hudson's Bay Company for Ladies Night showing of **Mulberry;** joint meeting with American Society of Mechanical Engineers, American Institute of Electrical Engineers, and Institute of Radio Engineers. (423.)

Nov. 29—**Problems Facing Canadian Engineers,** by Brigadier G. Walsh, R.C.E. (56.)

Dec. 11—Presidential visit. (65.)

VANCOUVER BRANCH

Jan. 8—A joint meeting with the A.I.E.E., Prof. Engineers Association of B.C. and Engineering Bureau of the Board of Trade. Speaker: T. Ingledow, on **Hydro-Electric Power Development on the Lower Coast Mainland of B.C.**

Feb. 22—Student Night. D. A. Fraser, S.E.I.C. spoke on **The Landing Wharf at Esquimalt Drydock.** W. G. Grimble, S.E.I.C. spoke on **Landing Floats for Pleasure Craft.** F. E. Turley, S.E.I.C. spoke on **Contracting and the Young Engineer.**

May 2—Speaker: Brig. A. T. MacLean, C.B.E., on **Engineering in Warfare.**

May 8—Joint meeting with American Society of Metals. Speaker: H. Little, Esq., on **The Manufacture and Care of Ball Bearings.**

May 17—Speaker: J. H. Maude, M.E.I.C., on **Improved Hydraulic Presses for Wartime Requirements.**

June 14—Ladies' Night at Stanley Park Pavilion, Oscar A. Olson, Esq., showed **Travel Films of B.C.**

Sept. 10—Joint meeting with A.I.E.E. Professional Engineers Association of B.C. and the Engineering Bureau of the Board of Trade. S. R. Weston, M.E.I.C., on **The Programmes of the British Columbia Power Commission.**

Nov. 27—Visit of the general secretary.

VICTORIA BRANCH

During the year there were two meetings of the executive committee and four general meetings of the branch. The branch meetings may be summarized as follows:

Jan. 15—Annual meeting. This was a luncheon meeting held in Spencer's Dining Room. The branch officers for 1945 were elected. The main feature of these elections was the re-election of Lt. Col. Sherwood as chairman.

Feb. 12—Lecture Meeting with a visit to the Mechanical Training Establishment of the R.C.N. at Esquimalt, B.C. The speaker and host was Commander Thomas Fife. Refreshments were served in the officers' mess after the meeting.

Apr. 25—Lecture Meeting. **Town Planning,** by Miss Jacqueline Tyrrwhitt of London, England. This meeting was held in conjunction with the Victoria Chapter of the Royal Architectural Institute of Canada.

Oct. 12—General Business Meeting. This meeting was held in the Oak Bay Municipal Hall for the purpose of studying the memorandum submitted by the finance committee with regard to an increase in fees of membership.

The following meetings were held by the Winnipeg Branch during the year 1945.

Jan. 11—P. A. Macdonald, Physicist, Manitoba Cancer Institute spoke on **The Design and Construction of High Voltage X-Ray Tubes.**

Feb. 15—Annual meeting of the branch. Following the business of the meeting two films were shown: **Making and Shaping of Steel and The Canol Oil Project.**

Mar. 1—W. D. Hurst, City Engineer and Commissioner of Buildings presented a paper on **City Engineering Problems.**

Apr. 5—J. V. Dillabough, Transportation Engineer, Canadian National Railways, presented a paper on **Transportation in Wartime.**

May 3—Two films were presented: **Lifeline of a Nation and Tornado in a Box.**

Sept. 20—Mr. Daoust addressed the meeting on **The Role of Private and Public Investment in a Full Employment Economy.**

Oct. 18—Two Student members addressed the meeting: W. C. Porter spoke on **The Principles of Seismic Exploration in Relation to Ore and Oil Bodies.** E. M. Scott spoke on **Operation and Construction of the Modern Oil Circuit Breaker.**

Nov. 15—Mr. Moran of Stevenson & Kellogg Ltd. spoke on **The Place of Management Engineers in Industry and Commerce.**

Dec. 6—On this day the branch was honoured by the official visit of our president, Dr. E. P. Fetherstonhaugh, Vice President J. E. Armstrong and General Secretary L. Austin Wright. Dr. Wright addressed the meeting on Institute Affairs.

IRRIGATION *(Continued from page 84)*

contour ditches with outlets cut where desired, or by various other methods depending on topography, the crop to be irrigated, and the practice in vogue in the locality.

21. It is customary in many places for farmers to form a group along a lateral running through their land and to operate it by agreement among themselves, under certain legal formalities, the water to which they are collectively entitled being supplied and measured at the head of the lateral by the Irrigation District or other parent organization. By this method, rotation of service permits each individual to use a larger head of water at one time than would be possible otherwise. Each parcel of irrigable land is entitled to a fixed legal duty of water during a certain irrigating period, which generally covers the crop growing season and varies from about 100 to 150 days in different parts of the United States and Canada.

22. Irrigation water used in excess of actual requirements may, by its movement in the soil and by evaporation at the surface, or by transpiration through plants, cause an accumulation of salts (known as alkali) in certain areas to such an extent as to be injurious to crop growth. This condition may however be remedied by drainage in many cases.

23. The duty of water is actually an expression of depth of water allowed per acre in a given time. If the duty is 2 ac. ft. per acre, that means that all the irrigable area in a certain farm unit is entitled to a depth of 2 ft. of water over the whole area during the irrigating season, and if the season is (say) 100 days, 1 cu. ft. of water flowing continuously will cover 100 acres 2 ft. deep in that period; but as crop requirements are much greater at certain times, rotation permits the flow to be increased to (say) 3 cu. ft. per second for such peaks and little or no flow at other times, until the full amount has been delivered. The duty of water is expressed by other equivalent units, according to locality and local practice.

24. The benefits derived from irrigation not only go to the farmer who irrigates the land and the local community with whom he has immediate dealings, but to the country as a whole, through transportation, marketing, processing of the products of the farm and the creation of trade by exchange of farm products for other commodities. The soil is one of the greatest of the natural resources and a source of wealth which can only attain its greatest value by production, and this is only possible in arid districts if the land is irrigated.

25. The fact that irrigation, when properly applied under proper farming methods, will produce higher and more profitable yields than could be obtained without it, is well established and needs no substantiation by figures. This fact is most evident in the more arid regions; but in semi-arid districts irrigation is profitable when the border line between wet and dry is not too nearly approached and is an assurance against a dry season or a cycle of dry seasons. The effect of irrigation is to raise the watertable, which even in areas of almost sufficient rainfall is very beneficial for stock and domestic use. Dry land farming areas, adjacent to irrigation districts, are also benefited to a great extent by their proximity.

Provision of irrigation usually means increased numbers of farmers on a given area. In extreme cases irrigation is provided for desert areas devoid of population in anticipation of settlement. The earlier stages of an irrigation project are usually associated with colonization.

From Month to Month

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

A BREAK IN THE CLOUDS

Signs are developing in Ottawa that some real consideration is being given to the subject of salaries for professional workers in the Civil Service. A reclassification survey is under way with the object of determining each employee's ability and responsibility. As an interim measure a supplementary bonus is being given to meet the situation at least partially, until the survey can be completed and new scales of remuneration approved by the Treasury Board.

The *Journal's* information is not official, but as the newspapers say, it comes from "a reliable source". It is not difficult to discern what the Civil Service Commission itself hopes to accomplish. Whether or not its proposals will be accepted by the Treasury Board remains to be seen. The past record of the Board is not encouraging, but a special effort is being made by officers of the Professional Institute of the Civil Service to inform cabinet members. It is believed that with a well informed cabinet there will be less chance of the Treasury Board refusing or revising the proposals.

It is expected that the reclassification survey will be finished about the first of April and the new salary scale in the hands of the Board shortly after.

The *Journal* understands that it is proposed that in the future there shall be a change in the system whereby an employee may continue to get salary increases even though he has reached the top rate for his classification and there are no openings for him in the next higher classification. Such a procedure would remove one of the greatest evils of the present system. Many men have been held for countless years at low salary levels because there were no openings ahead to which they might be transferred. The setting up of a fixed establishment has some advantage, but in the past it has been used as a cruel weapon to hold people at ridiculously low income levels. The hope of a promotion and the fear of losing accumulated pension benefits have kept many a man on his job who, with advantage to himself, might have taken employment elsewhere. It is encouraging to hear that this out-moded method of denying increases is to be done away with—at least if the Commission gets its way.

As for the new salaries—no one can be sure what will emerge from the present cover of secrecy, but the *Journal* has good reason to believe that the following classifications and salaries are to be recommended to the Treasury Board. The present rates are tabulated also for comparison purposes. Generally speaking, the proposed rates are from $900. to $1,200. a year better than the present ones. This is still nothing to enthuse about, but it is a substantial improvement. It surely does not meet the scales offered for the same services by industry at large. This scale is for the Department of Public Works but will be typical of that being considered for all departments.

Present Classification	New Grading	Proposed Salary	Present Salary
Junior Engr.	Grade 1	\$1800–\$2400	\$1800–\$2100
Asst. Engr.	Grade 2	\$2400–\$3000	\$2100–\$2400
" "	Grade 3	\$3000–\$3600	(new classif.)
Sr. Asst. Engr. (senior)	Grade 4	\$3600–\$4200	\$2400–\$3000
Grade 1	Grade 5	\$4200–\$4800	\$3000–\$3600
Grade 2	Grade 6	\$4800–\$5400	\$3600–\$4500
Supt. Engr.	Grade 7	\$5400–\$6000	\$4500–\$5100
Asst. Chief	Grade 8	\$6000 – ?	\$5100–\$6000

The creation of a second classification of "Assistant Engineer", designated as Grade 3, will be of inestimable value. There are great numbers of assistant engineers, and many hardships have developed because of the present top salary of $2,400. With this limit raised to $3,600 as proposed, some of the iniquities of this present scale can be overcome—or partially overcome.

There appears to be no basis for the report in the Ottawa papers that a Royal Commission is to be set up to examine the whole civil service salary structure. As far as engineers are concerned, no such commission is necessary. It is all very simple. There are no difficulties in the way of determining what should be paid in order to get proper results. It would be too bad if a commission were used as a means of further prolonging the present unjustifiable schedules. In the past, royal commissions seem to have accomplished very little, for the reason that governments would not accept the results of their studies unless they happened to suit the governments' preconceived ideas and policies, not always based on considerations of the employee or the national interest. Remember the Beatty report? Remember the Coon Committee? Let's have no more of such heartbreaking experiences.

If the government really wants to know all about the situation, it can still go back to the Beatty report and by using a modest factor make it equally applicable today. Or perhaps the report of the Coon Committee would be more up to date. Certainly no new fact-finding body is required. The need is for someone or something that will make the Treasury Board do something about it.

A break in the clouds is appearing. Let us hope it develops until the professional civil servant can get his just share of the golden sunshine so essential to decent living and to proper service.

CANADIAN RADIO TECHNICAL PLANNING BOARD

A report from A. B. Hunt, M.E.I.C., the Institute representative on the Administrative Committee.

The Canadian Radio Technical Planning Board, of which the Engineering Institute is a sponsoring member, was organized in November 1944 with the approval and support of the Department of Transport. Its stated objectives are to formulate sound engineering principles and to organize technical facts which will assist in the development, in accordance with public interest, of the electronic industry and electronic services of the nation, to advise Government, Industry and the People of its findings and recommendations.

At the first annual meeting held in Montreal on December 6th, 1945, the President, Mr. Brophy, announced that 16 non-profit-making organizations had given their support to the Board as sponsoring members. Total membership of the various panels and committees consists of 160 of the top ranking engineers, scientists and specialists of all kinds in the electronic fields who have been devoting a considerable portion of their time and effort to the work of the Board. The sponsoring members as at the annual meeting are as follows:

Air Industries and Transport Association of Canada
American Institute of Electrical Engineers, District No. 10
American Radio Relay League (Canadian Section)
Canadian Association of Broadcasters
Canadian Broadcasting Corporation
Canadian Electrical Association
Canadian Electrical Manufacturers Association
Canadian Transit Association
Dominion Motor Coach Association
Hydro-Electric Power Commission of Ontario
Institute of Radio Engineers
Quebec Hydro-Electric Commission
Radio Manufacturers Association of Canada
The Engineering Institute of Canada
The Railway Association of Canada
The Telephone Association of Canada

Invaluable assistance and technical advice has been given to the Board by representatives from the three Armed Services, the National Research Council and the Canadian Standards Association.

The Administrative Committee is the senior controlling body of the Planning Board and consists of one representative or alternate appointed by each of the sponsoring members. This Committee is responsible for the establishment of policy, and controls all financial expenditures. All reports and findings of the panels and committees are submitted to the Administrative Committee for final approval before being released for publication or forwarded as a recommendation to any department of government.

The Administrative Officers were re-elected at the annual meeting for a second term, with the exception of the Secretary-Treasurer, Mr. W. W. Richardson, who asked to be relieved of his duties due to his resignation as General Manager of the Radio Manufacturers Association to accept a position in Industry. He was replaced by Mr. S. D. Brownlee. The Administrative Officers for the ensuing year are as follows:

R. M. Brophy, President
R. A. Hackbusch, Vice-President
S. D. Brownlee, Secretary-Treasurer
A. B. Oxley, General Co-Ordinator
G. W. Olive, Co-Ordinator
G. J. Irwin, Co-Ordinator

A Steering Committee comprising the Vice-President, the Co-Ordinators, the Panel Chairmen and Vice-Chairmen acts in a technical advisory capacity and guides the overall operation of the Panels.

The work of the Board has been broken down into six main Panels identified by letters "A" to " F " inclusive and the Panels are in turn divided into a total of eleven Committees working on various aspects of their Panel problems. The Engineering Institute has representation on all of these Panels and Committees, as shown in the following list:

Panel A—Spectrum Utilization and Frequency Allocation. Institute representative: J. L. Clarke.

Panel B—Broadcasting Transmitters — Standard, Short Wave, FM, Television, Facsimile and Relay Systems pertaining thereto. Institute representative: R. W. Dobridge.
- Committee 1: Transmitters FM, Television, Facsimile and Relay Systems pertaining thereto.
- Committee 2: Transmitters AM, Standard and Short Wave.

Panel C—Radio Communication including Point-to-Point, Portable, Mobile and Emergency Service (other than Broadcasting). Institute representative: S. Sillitoe.
- Committee 1: Police, Fire, Forestry and Power Utilities.
- Committee 2: Railroad, Highway and Transit Utilities.
- Committee 3: Telephone, Telegraph, Facsimile (Public Service), Point-to-Point and Marine Communication Services and Relay Systems pertaining thereto.

Panel D—Broadcasting Receivers—Standard, Short Wave, FM, Television and Facsimile Services. Institute representative: A. S. Runciman.
- Committee 1: Receivers FM, Television and Facsimile.
- Committee 2: Receivers AM, Standard Broadcasting and Short Wave Sets.
- Committee 3: Standards Committee—Formulation of Proposed Canadian Standards based on U.S. Standards.

Panel E—Aeronautical Radio and Radio Aids to Navigation. Institute representative: A. B. Hunt.

Panel F—Industrial, Scientific and Medical. Institute representative: J. A. Ouimet.
- Committee 1: Industrial, Scientific and Control Applications.
- Committee 2: Medical and Surgical Applications.
- Committee 3: Interference.

The planning by the members of the Board is a co-operative effort of all branches and phases of industry and has been primarily concerned in making an exhaustive study of the allocation of radio frequency channels so as to recommend a fair and equitable distribution of the available frequencies to best serve the many demands for communications, aids to navigation and industry itself, using the radio frequency spectrum.

In the first year of operation, over thirty formal meetings were held by the panels and committees with a total attendance in excess of 450.

A tremendous amount of data has been handled by the committees and panels and preliminary reports were issued by practically all panels indicating their frequency allociation requirements during August of last year. These were forwarded to the Department of Transport for use at the Rio de Janeiro Conference on Frequency Allocations held during September. Unfortunately time did not permit the co-ordination of the preliminary reports to ensure that there was no overlapping of requirements between panels, so they were submitted as a guide only to the Department of Transport without the final approval of the Administrative Committee of the Board.

As indicated by the President at the annual meeting, final reports of all panels are now nearing completion and will soon be passing through Panel A for screening. This Panel is responsible for reconciling the frequency allocations recommended by the other panels and on the basis of the most efficient use of the common medium, to develop and recommend an overall frequency allocation plan.

The activities of the panels are co-ordinated by the Steering Committee and all panel reports, including the overall frequency allocation plan from Panel A, are submitted to the Administrative Committee for final consideration and approval.

The financial statement of the Canadian Radio Technical Planning Board, as approved at the annual meeting in December for the year ending November 30th, 1945, shows total receipts of dues from sponsoring members at $3,850. The expenses incurred during the same period amounted to $829.74, leaving a net surplus on the year's operations of $3,020.26. The expenses consisted principally of printing and mailing charges for the various reports and charts. No remuneration was paid to officers or clerical staff, the latter being supplied free of charge by the staff of the Radio Manufacturers' Association.

THE WAR RECORD OF BRITISH INDUSTRY

The Story of a Great Achievement

The effort to describe the Herculean task so successfully accomplished during the war by British industry has been made many times, but it is doubtful if there is any better account than that given in a special issue of the *London Times*. It is called "A Record of British War Production — The Story of a Great Achievement". It consists of 32 full newspaper size pages on a special paper of a weight very much like tissue.

The articles are full of startling information for one who does not know the history. The story of sudden expansion—the development of efficient methods — the mobilization of manpower, the denials and sacrifices of the people are told carefully and dispassionately.

The foreword, written by the Rt. Hon. Oliver Lyttelton, M.P., describes succinctly the British record. Here it is:—

"Victory in the War of 1939-45 was not only on the battlefield, on the sea and in the air, but in the workshops and factories of the Allied Nations.

"In this record there is collected together, for the first time in one document, a comprehensive summary of the many and varied aspects of Britain's achievement in war production. And a truly remarkable achievement it was.

"Of all the munitions used by the Armed Forces of the British Commonwealth and Empire (8¾ million men in all) since the beginning of the war, no less than 70 per cent was produced in the United Kingdom itself. The rest came from the United States of America, from Canada, and from the other nations of the Commonwealth. The First Lord of the Admiralty, the Minister of Supply, and the Minister of Aircraft Production can testify with me, who was responsible for the overall coordination of this vast and complex system of supply, that, nothwithstanding our own high rate of production, this aid from overseas was indispensable.

"In addition to what we produced for our own forces and those of the Commonwealth and Empire, we made and sent substantial supplies to our other Allies — the United States Forces in Britain, the U.S.S.R., China, and others of the United Nations.

"All this we had to do under conditions of almost unbelievable difficulty. We were bombed from the air; against this we had to disperse our production to black-out our cities, our railways, our roads, our factories. U-boats sank our ships bringing in our life-blood, food and raw materials. Yet, with our imports of raw materials cut by 50 per cent, we achieved the highest industrial output ever attained in the history of our country.

"Such a prodigious effort was made possible only by the great labours and heavy sacrifices of the British people. All men up to age 64 and all women to age 59 were mobilized; food, clothes, petrol were severely rationed; and supplies of other everyday things drastically limited. Our export trade too had to be deliberately curtailed, so that in 1943 and 1944 it was less than one-third in volume of the 1938 level. This meant hardships for our overseas customers, but it released over 1,000,000 men and women hitherto engaged in making exports for direct war work.

"During all this great outpouring of effort, the quality and ingenuity of British production have been more than maintained. We were the pioneers of radar and jet propulsion; it was a British scientist who discovered penicillin, a British engineer who invented and designed the Bailey Bridge; we designed and built the Mulberry harbours, the prefabricated portable harbours which made the invasion of France possible, British aircraft have proved themselves second to none in the world; and British scientists collaborated with American and Canadian scientists to develop and produce the Atomic Bomb.

"The inventiveness and ingenuity of British scientists and engineers, and the high standard of quality in our production, point the way to the future and show that we shall conquer too the problems which peace is bringing."

Not all of us appreciate that "It is claimed for the British people, after the most careful examination of the facts in all countries, that it was more fully deprived of its peace-time comforts and more fully mobilized for war than the people of any other country — not excluding Germany".

It would be a splendid thing if every Canadian could read this record. It would do much towards building within him not only an appreciation of what has been done, but as well a confidence that the British people will meet the problems of the future with the same courage, resolution and skill as they exhibited in their conquest of the problems of the past.

BRITISH SCIENCE AIDS RECONSTRUCTION

For the following sketch of plans for British industry and the leadership given by research, we are indebted to the United Kingdom Information Office. This is an abridgement of information supplied to the Institute.

" Today the United Kingdom intends to achieve similar, and even greater results, in the application of science to peacetime industry. Here she has entered the peace with the considerable asset that many of her wartime advances are applicable to non-military purposes. Sir John Anderson has listed some of them: Research in the textile industry has resulted in the production of cotton fabrics in which the fibres are so twisted that, on contact with water, they immediately swell and render the cloth waterproof, while at the same time allowing for the passage of air. Again, in the steel and non-ferrous metal industries, new processes have been developed and new materials produced for the first time including many types of alloy steel and great quantities of magnesium from sea water. " In television ", said Sir John, " we undoubtedly led the world before the war and are probably still ahead. Before the war the United Kingdom gained all the speed records in the air, on the water and on land, with British pilots and British machines made in British workshops. We now hold all those records again. All aeroplanes are fitted with perspex—a transparent, non-splintering plastic produced in this country, and during the war our chemical industry produced also polythene—the finest known insulator. An insecticide, gammexane, probably more efficient than DDT, a range of selective weedkillers, linked with the discovery of hormones produced in the growing tips of plants—which may well mean a revolution in agricultural methods—a synthetic adhesive, heat, water and acidproof, giving unions stronger than those obtained by riveting or spot welding, are other achievements of our progressive and virile chemical industry. In the manufacture of scientific instruments there is the same story of technical skill and successfully applied research.

" When the war ended the United Kingdom Government and industry immediately turned to the means of expanding scientific research and still further intensifying scientific and industrial collaboration. In August the Federation of British Industries announced the formation of a new research committee to establish a close peacetime partnership between individual industries and research centres. This was followed in September by the Government's plans for the reorganization of the scientific civil service on to a basis ensuring greater incentive and improved facilities. Last month, the Government announced its ten years plan for the full utilisation of the country's scientific manpower and resources. These three measures have been accompanied by a series of other important developments undertaken by different United Kingdom industries. The steel industry, for example, has set up a new research association with resources of four hundred thousand pounds a year, while the textile industry has announced a two-fold increase in the capacity of cotton research.

" There are three main factors involved in this large scale expansion of scientific research now under way in Britain; personnel, finance and organization. As far as financial aid is concerned, we now have the framework within which all that is required can be secured. More scientists are needed—but the Government and industry are determined to overcome this shortage. Here the contribution of British industry is of special interest. Among the many manufacturers who have given considerable financial assistance in training scientific workers are the Shell group (who have made a gift of four hundred and thirty-five thousand pounds to Cambridge University for the Department of Chemical Engineering, together with a yearly grant of two thousand five hundred pounds for scholarships), Imperial Chemical Industries who have given eighty fellowships at universities for research in physics and chemistry, and Courtaulds who have given one hundred eighteen thousand pounds for similar purposes to the Imperial College of Science. During the war the nation-wide scale of the organization of research was to a large degree responsible for the successes achieved."

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, January 12th, 1946, at nine thirty a.m.

Present: Vice-President J. E. Armstrong in the chair; Vice-President E. V. Gage; Councillors R. S. Eadie, R. C. Flitton, J. A. Lalonde, C. C. Lindsay, E. Lavigne, C. A. Peachey and P. E. Poitras; Treasurer R. E. Chadwick; J. B. Stirling, chairman of the Committee on Professional Interests; Secretary Emeritus R. J. Durley and General Secretary L. Austin Wright.

Community Planning: The general secretary reported that in reply to the president's telegram relative to amendments to the National Housing Act (which was reported in full at the December meeting of council), the following letter had been received from the Minister of Finance.

Ottawa, December 12th, 1945.

Dear Mr. Fetherstonhaugh:

I wish to thaink you for your telegram of December 7th regarding the amendments to the National Housing Act and the legislation creating a Central Mortgage and Housing Corporation.

Your suggestion that a competent Town Planning Engineer be included on the Board of the Corporation will receive every consideration.

As to the amendments made by Order in Council P.C. 5794 giving the Minister some discrimination in the matter of community planning, I can understand your concern and I can assure you that I share your views as to the importance of promoting community planning wherever possible. When the Bill is under discussion in the House, I shall try to make my attitude on this point perfectly clear. The immediate problem is, however, that a number of large scale projects have been proposed for various cities where overcrowding and congestion are particularly serious. If the requirements regarding community planning do remain in the Act in its original form, it would have been necessary to delay construction of these projects until the municipal authorities had taken action to put a satisfactory plan into effect. In view of the very urgent need for accommodation, the Government did not consider that it could justify such a delay and it is therefore proposing to give the Minister some discretion in the matter of community planning until the immediate emergency is passed.

Yours very truly,

(Signed) J. L. Ilsley.

The general secretary reported that certain members of the Institute, very close to the housing situation, who had been consulted, stated that the amendment, if used only in cases of emergency, could be a useful thing, but they admitted also that it could readily mean the end of the government's support for planning.

Following up the portion of the letter which related to the Institute's recommendation that an engineer be included on the board of the new Central Mortgage and Housing Corporation, the secretary reported that the president of this new organization had recently been announced. He was D. B. Mansur, a life insurance and banking official. Mr. Wright also informed the meeting that information had come to him that the present plans did not include the appointment of an engineer to the board. Mr. Mansur had been informed directly of the necessity of such services but had not reacted favourably. He had not indicated who the other directors were to be but implied that they would not be engineers.

The general secretary reported other matters related to developments in the Department of Finance which indicated that technical personnel would not be used by the Corporation except as employees in a minor capacity.

A long discussion followed in which all councillors expressed their concern as to the efficiency of planning done without the support of engineers working with the financial personnel at the administrative level. Eventually, on the motion of Mr. Poitras, seconded by Mr. Peachey, it was unanimously agreed that a message should be sent to Mr. Ilsley urging definite action with regard to the use of engineering knowledge. Accordingly, the following telegram was approved, with copies going to the Minister of Reconstruction, the governor of the Bank of Canada, and Mr. Mansur, all of whom are to be represented on the Board.

"Pursuant to your letter of December twelfth and subsequent study of Bill twenty-three authorizing the establishment of the Central Mortgage and Housing Corporation the Council of The Engineering Institute of Canada is now more than ever convinced that in the public interest engineers should be appointed to the board of the Corporation Stop Community planning is an important function of the engineer and is essential for success in any type of housing it cannot be overemphasized that the inclusion of qualified engineers at the administrative level is essential to the formulation of sound policy necessary for the protection of owners and tenants and public funds Stop The council of the Institute therefore urges that an engineer be appointed to the office of Vice-President of the Central Mortgage and Housing Corporation and that two of the five directors to be appointed be selected from among the membership of the engineering profession Stop It is convinced that only in this way can the objectives of the National Housing Act be attained Stop The officers of the Institute will be glad to submit a list of persons qualified for the appointments."

Institute Medals and Prizes: At the last meeting of the Council consideration had been given to the desirability of establishing an over-all committee to co-ordinate the work of the various medal and prize committees. In order that the recommendations of such a committee might be made available before the end of the present prize year (June 30th), it was unanimously agreed that such a committee be appointed as soon as possible, the selection of members to be left with Vice-President Armstrong and the general secretary.

Financial Statement: The chairman of the Finance Committee reported that as the Institute's books had only closed on December 31st, the auditors had been unable to present the financial statement for the year 1945 until half an hour before the Finance Committee meeting on Friday evening, the 11th. Before accepting the statement and presenting it to Council, the Finance Committee desired to discuss certain items with the auditors, and following some discussion, it was agreed that this meeting of Council should be adjourned to seven thirty p.m. on Thursday, January 17th, so that the chairman of the Finance Committee and the general secretary could discuss the various items with the auditors and present the final statement for approval at that time.

Sarnia Branch By-Laws: The proposed branch by-laws for the new branch at Sarnia, as submitted by the executive, were unanimously approved.

A.S.M.E. Joint Committee: The general secretary reported that the revised co-operative agreement between the Institute and the American Society of Mechanical Engineers had now been approved by the Councils of both organizations, and it would therefore be in order for the Institute to name three representatives to the joint committee whose duty it will be to promote co-operation. It had been suggested that if possible this committee might meet in Montreal at the time of the Institute's annual meeting.

Following consultation with the general secretary and Mr. Eadie, who had attended the recent annual meeting of the A.S.M.E. in New York, Mr. Stirling recommended that the Institute's representatives be—John G. Hall and Robert C. Wiren of Toronto and W. A. Newman of Montreal. On the motion of Mr. Poitras, seconded by Mr. Eadie, it was unanimously resolved that these three members be appointed as the Institute's representatives on the joint committee, other members to be named by Vice-President Armstrong if any of these members is unable to act.

Meeting of Association Representatives: Mr. Stirling reported that arrangements were being made to have a representative of each of the provincial associations with which the Institute has a co-operative agreement attend a conference in Montreal on Wednesday, February 6th, at which matters of mutual interest will be discussed, particularly the subject of increased Institute fees in those provinces.

He reported that as a member of the New Brunswick Association he had received a copy of the report of the Council of the Association to the annual meeting of the Association to be held on January 24th. There were one or two items in it which he would like to report to Council. First, he read the following minute:

"In accordance with the policy decided on at the annual meeting, Council continued to oppose the Canadian Council of Professional Engineers and Scientists. It was felt after several discussions on the subject that the C.C. of P. E. and S. was being given authority in various matters that the Dominion Council had never had except as approved by the several Provincial Associations. It was noted that the trend was away from engineers in the new body. In view of the Council's stand regarding this body Dominion Council's assessment against this Association for the year 1945 was fully scrutinized to insure that none of the money paid to Dominion Council was being diverted toward support of the C.C. of P.E. and S."

Secondly, the Association approved of the proposal made by the Institute that non-graduates applying for membership in the Institute should be asked to write the examinations of the Association.

Thirdly, he read the following minute:

"Council declined to support proposal to support continuance of the Wartime Bureau of Technical Personnel although this move was favoured by Dominion Council. Council considered that the Bureau filled no useful purpose insofar as employers in New Brunswick were concerned."

The chairman thanked Mr. Stirling for bringing this information to the attention of the meeting.

Proposal to establish a Parliamentary and Scientific Committee: The general secretary read a letter dated December 10th which has been received from the Canadian Association of Scientific Workers, which stated that the Association had circularized members of the Federal Parliament to secure their opinions with regard to supporting a parliamentary and scientific committee along the lines of a similar committee operating in England.

The letter stressed the importance of science in the post-war period and the essentiality that such a committee be established in order to keep members of parliament properly informed.

The letter suggested that a meeting be held about the middle of January to which members of parliament who had indicated an interest, and delegates of organizations who are prepared to participate in the work, be invited. It concluded with an invitation to the Institute to participate.

The general secretary reported that he had submitted the entire file to a prominent member of the Institute who was in the best position to judge of the merits of the proposal. His reply had stated that such a committee was well established in England but he pointed out that it had the support of outstanding engineering and scientific bodies, and that only under such circumstances was such a body likely to be accepted in Canada. He emphasized the fact that such a committee would never be of any influence unless the non-parliamentary group was made up of the very best people in the country.

At the chairman's suggestion Mr. Wright read the aims and objects of the committee according to the material supplied by the Association. It was agreed that the description of purposes was vague in many details and that something much more definite should be prepared if the proposal were to succeed.

Mr. Stirling, as chairman of the Committee on Professional Interests, questioned the usefulness of such a committee in Canada. He was interested in knowing what the committee could do that could not be done by the National Research Council and other bodies particularly interested in science and engineering.

After further discussion, it was moved and seconded and approved unanimously that the general secretary investigate the matter further and report to a later meeting.

At twelve fifty the Council adjourned for lunch, and reconvened at two thirty p.m. with Vice-President Armstrong in the chair.

The Engineer in the Civil Service: The attention of Council was drawn to certain aspects of the Civil Service Commission with the suggestion that the Institute should make recommendations to the Minister of Finance. Following considerable discussion it was finally decided that the matter should be referred to the Institute's Committee on the Engineer in the Civil Service with the request that it present a report with recommendaions to the next meeting of Council.

Wartime Bureau of Technical Personnel: The general secretary reported that at the last meeting of the Advisory Board of the Wartime Bureau of Technical Personnel, it was agreed that opinions regarding the future of the Bureau should be secured from each of the three sponsoring organizations, namely, the Canadian Institute of Mining and Metallurgy, the Canadian Institute of Chemistry and The Engineering Institute of Canada. He pointed out that there appeared to be three possible developments (1) that the Bureau remain essentially as it is now, administering the legislation in accordance with the power and authority given to it; (2) the personnel of the Bureau to be distributed in the offices of the Executive and Professional Division of the employment offices of the Department of Labour, and (3) that the Bureau be abolished in its entirety.

Mr. Wright was of the opinion that the Department of Labour favoured the second proposal, the idea being that the experienced members of the staff would take over the operations of the Executive and Professional offices in the larger centres. Mr. Wright stated that there would be another meeting of the Advisory Board on January 24th and asked that he be given instructions on that point.

A very long and general discussion followed in which several members of Council expressed the opinion that the usefulness of the Bureau was now over insamuch as there was no longer any real scarcity of engineers nor were there any priorities which had to be considered. They were of the opinion that the present restrictions which required an employer to notify the Bureau of any openings in his organization and of any engineer whom he has employed, and which required the employee to report his availability, were in no way useful and therefore should be abolished.

Mr. Poitras called attention to the survey of their records which was being made by the Bureau. An early cessation of activities might stop this work which he thought should be continued to completion. It was explained by the general secretary that a separate appropriation had been made by the Department for this survey and that additional personnel had been employed to complete it. Therefore it stood by itself as a separate activity and under such circumstances might be continued even though the Bureau were abolished.

Eventually, it was moved by Mr. Gage, seconded by Mr. Chadwick, and carried unanimously, that the Engineering Institute is appreciative of the excellent work done during the war by the Wartime Bureau of Technical Personnel, but as the war is now over and priorities abolished it is the opinion of the Council of the Institute that the irksome and unavailing restrictions still remaining with the Bureau be abolished and that the Bureau itself be discontinued as quickly as possible. As for the survey of the records, it is feared the information will be out of date before it is completed, and therefore Council recommends that the end of the present fiscal year be set as the date for the cessation of Bureau activities.

Dominion Coat of Arms: The general secretary explained that a number of prominent engineers from the United States and Great Britain would be attending the annual meeting and a friend of the Institute would like to donate, for presentation to these distinguished guests by the president and Council of the Institute, plastic plaques of the Dominion Coat of Arms. The general secretary submitted a sample, and it was unanimously and enthusiastically agreed that this generous offer be accepted..

At four thirty p.m. the Council adjourned to reconvene on Thursday, January 17th, 1946, at seven thirty p.m.

The adjourned meeting of Council was held at Headquarters on Thursday, January 17th, 1946, at seven thirty p.m.

Present: Vice-President J. E. Armstrong in the chair; Councillors R. S. Eadie, J. A. Lalonde and C. A. Peachey; Treasurer R. E. Chadwick, and General Secretary L. Austin Wright.

Financial Statement and Treasurer's Report for the Year 1945: At the chairman's request, the general secretary presented the auditors' statement for the year 1945, explaining the various items in detail. Following some discussion, Mr. Armstrong suggested that it might be advisable to defer action on the financial statement until the treasurer had presented his report.

Mr. Chadwick presented his report which was a concise summary of the financial statement. Following some discussion and some explanations by Mr. Chadwick, on the motion of Mr. Lalonde, seconded by Mr. Eadie, it was unanimously resolved that the auditors' statement for the year 1945 be accepted for presentation to the annual meeting.

On the motion of Mr. Peachey, seconded by Mr. Lalonde, it was unanimously resolved that the treasurer's report be accepted for presentation to the annual meeting.

There being no further business the Council rose at eight o'clock p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered, and the following elections and transfers were effected:

Members

Cameron, Donald Roy, B.Sc., (Elect. Engrg.), (Univ. of Man.), asst. estimator, Vulcan Iron Works, Ltd., Winnipeg, Man.
Carswell, David B., (Manchester Tech. College, Manchester, Eng.,) president, Wartime Shipping Ltd., Montreal, Que.
Heatley, John Pratt, B.A.Sc., (Chem. Engrg.), (Univ. of Toronto), contact man, production control dept., Imperial Oil Limited, Sarnia, Ont.
Henderson, Gordon Roberts, B.Sc., (Civil), (Queen's Univ.), chief engr., Polymer Corporation Ltd., Sarnia, Ont.
Johnston, Alan H., B.Sc., (Chem. Engrg.), (Queen's Univ.), project designer, Aluminum Co. of Can. Ltd., Arvida, Que.
Piper, Richard Lloyd, B. Eng., (McGill Univ.), office engr., (design), Imperial Oil Limited, Sarnia, Ont.
Raymond, Antonio, B.Eng., (McGill Univ.), industrial engineer, Dominion Rubber Co., Ltd., Montreal, Que.
Ring, Roy Percival, Lieut. (E), R.C.N.V.R., B.Eng., (Mech.), (Nova Scotia Tech. Coll.), student, special course, industrial relations, Queen's Univ., Kingston, awaiting discharge.
Robertson, Ernest E., B.A.Sc., (Univ. of Toronto), graduate student, Univ. of Western Ontario, London, Ont.
Sturdee, Charles P., B. Eng., (McGill Univ.), process mech. engr., Imperial Oil Limited, Sarnia, Ont.
Walker, Charles F., mech. engr., (Cornell Univ.), plant engr., Canadian International Paper Co., Three Rivers, Que.

Juniors

Cormack, Jack Waitt, B.Sc., (Civil Engrg.), (Univ. of Manitoba), engr. grade 2, Public Works of Canada, Winnipeg, Man.
Gibson, Desmond Hope, Major, R.C.E., graduate, Royal Military College, engr., Canadian Military Mission, Washington, D.C.
Jelly, Keith Braden, B.Sc., (Acadia Univ.), cost engr., Aluminum Co. of Canada, Ltd., Arvida, Que.
Ohrner, William Ernest, Base Mtce. Officer, R.C.N.V.R., B.Sc., (Elect. Engrg.), (Univ. of Manitoba), H.M.C. Dockyard, Esquimalt, B.C.
Woods, John Parker, Lieut. (E), R.C.N.V.R., B.Eng., (Mech.), (Nova Scotia Tech. Coll.), 4328 Walkeley Ave., Montreal, Que.

Transferred from the class of Student to that of Member

Asplin, Albert Grant, B.Eng., (McGill Univ.), asst. chief dftsman., Horton Steel Works Ltd., Fort Erie, Ont.
Edson, Ralph Everett, B.Eng., (McGill Univ.), apparatus sales engr., Canadian General Electric Co., Ltd., Montreal, Que.
Mason, Vere Karsdale, Lieut., (E), R.C.N.V.R., B.Eng., (McGill Univ.), H.M.C.S., "GIVENCHY", Esquimalt, B.C.

Transferred from the class of Student to that of Junior

Hiller, Walter Andrew, B.Sc., (Civil), (Univ. of Alberta), Officer in Charge, Special Engrg. Equipment, Petawawa Camp.
Koropatnick, Capt., R.C.E., B.Sc., (Civil), (Univ. of Manitoba), 3rd Canadian Repat Depot., Canadian Army Overseas.
Orloff, Irving, B.Sc., (Civil), (Univ. of Manitoba), asst. supt., Pembina Mountain Clays, Limited, Winnipeg, Man.

Admitted as Students

Allison, Russell Stafford, (Queen's Univ.), 288 Frontenac St., Kingston, Ont.
Anderson, Glover Samuel, (Univ. of Manitoba), 612 Lipton St., Winnipeg, Man.
Babington, Harold Ormond, (Univ. of Manitoba), 587 Rathgar Ave., Winnipeg, Man.
Bird, Robert Allen, (Univ. of Manitoba), 626 South Drive, Winnipeg, Man.
Booth, John Nelson, (Univ. of Toronto), 1185 Dufferin St., Toronto, Ont.
Carson, James Hunter, B.A.Sc., (Univ. of Toronto), Lieut., R.C.E.M.E., 1102 St. Clarens Ave., Toronto 10, Ont.
Chant, Raymond Earle, (Univ. of Manitoba), 454 Greenwood Place, Winnipeg, Man.
Craig, Albert Franklin, (Univ. of Manitoba), 65 Cordova St., Winnipeg, Man.
Crawford, Robert Theodore, (Univ. of Manitoba), Ste. 3, Anvers Apts., Winnipeg, Man.
Daiter, Philip, (Univ. of Manitoba), 149 Charles St., Winnipeg, Man.
Daoust, Jean Marc, (Ecole Poly.), 6350 Christopher Columbus St., Montreal, Que.
Dawson, Gerald Peter, (Dawson College), St. Johns, Que.
De Pauw, George, (Univ. of Manitoba), Box 195, Fort Garry, Man.
Durnin, George Rowe, (Univ. of Manitoba), 97 Balmoral Place, Winnipeg, Man.
Flavell, George, (Univ. of Manitoba), 257 Oakwood Ave., Winnipeg, Man.
Fokschaner, Peter, (McGill Univ.), 4414 Girouard Ave., Montreal, Que.
Gall, William J. C. Jr., (Univ. of Toronto), Trinity Coll., Hoskin Ave., Toronto, Ont.
Hermeston, Raymond, (Univ. of Manitoba), 1175 Dominion St., Winnipeg, Man.
Hicks, James Stewart, (Univ. of Manitoba), Ste. 31, Fairmont Apts., Winnipeg, Man.
Jex, William David, (Univ. of Manitoba), 134 Scotia St., Winnipeg, Man.
Kernahan, George Martin, (Univ. of Manitoba), 1841 Assiniboine Ave., Winnipeg, Man.
Labossiere, Gerard Romeo, B.Sc., (Elect.), (Univ. of Manitoba), jr. welding engr., Dominion Bridge, Lachine, Que.
Lucas, Ronald Owen, (Univ. of Manitoba), 826 Dorchester Ave., Winnipeg, Man.
MacLaren, James Wade, (Univ. of Toronto), 126 Golfdale Rd., Toronto, Ont.
Malmgren, Edward Vernon, (Univ. of Manitoba), 651 Henderson Ave., Winnipeg, Man.

Matheson, Donald Thomas, (N.S. Tech. Coll.), 327 South St., Halifax, N.S.
McIntyre, Alphonse Joseph, (Univ. of Manitoba), 780 Ingersoll St., Winnipeg, Man.
Murray, Denby Charles, (Univ. of Manitoba), 3rd Ave., So., Geraldton, Man.
Ott, Helmuth George, B.Eng. (Civil), (McGill Univ.) civil engr., Atlas Construction Co., Montreal, Que.
Overgaard, Edmund Christian, (Univ. of Manitoba), 524 Sprague St., Winnipeg, Man.
Patterson, Hugh John Trevor, (McGill Univ.), 5607 Queen Mary Rd., Hampstead, Que.
Pearson, John Henry Allnut, (Univ. of Manitoba), 97 Balmoral Pl., Winnipeg, Man.
Persoage, Nicholas, (Univ. of Manitoba), 421 Home St., Winnipeg, Man.
Reynaud, Julien C., (Univ. of Manitoba), Box 221, Univ. of Manitoba, Winnipeg, Man.
Richman, Harold, (Univ. of Manitoba), 524 Mountain Ave., Winnipeg, Man.
Roles, Clemence, (Univ. of Manitoba), Bruno, Sask.
Senyshyn, Emil, (Univ. of Manitoba), 565 Anderson Ave., Winnipeg, Man.
Smith, Russell Harvey, (Univ. of Manitoba), 40 Eastgate, Winnipeg, Man.
Speed, Stewart Richard, (Univ. of Manitoba), 799 St. Mary's Rd., St. Vital, Man.
Stober, Julius Leonard, (McGill Univ.), 15 Ainslie Ave., Outremont, Que.
Taylor, Jack Richard, (Univ. of Manitoba), 346 Home St., Winnipeg, Man.
Thomson, Alexander Findlay, (Univ. of Manitoba), 53 Home St., Winnipeg, Man.
Thorsteinson, Sigurdur Baldwin, (Univ. of Manitoba), 621 Maryland St., Winnipeg, Man.

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

Alberta

Member

Bate, Thomas Edward, B.Sc., (Elect.), (Univ. of Alberta), asst. radio engr., Dept. of Transport, 222 Tegler Bldg., Edmonton, Alta.

Saskatchewan

Juniors

Ayers, Frank Edward, B.Sc., (Civil), (Univ. of Sask.), instructor, Univ. of Saskatchewan, Saskatoon, Sask.
Potts, Gerald Anderson, B.Sc., (Mech.), (Univ. of Saskatchewan), Engr. Officer, R.C.N., Regina, Sask.

Students at University of Saskatchewan

Anderson, Reidar, 509 Dufferin Ave., Saskatoon, Sask.
Bell, Charles Edward, 2 McKim Block, Saskatoon, Sask.
Butler, Percy Millard, 1006 - 13th St., E., Saskatoon, Sask.
Campbell, William Ralph, 1035 University Drive, Saskatoon, Sask.
Chalmer, Thomas Edward, 203 Albert Ave., Saskatoon, Sask.
Davis, Ernest George, 509 King St., Saskatoon, Sask.
Dunbar, Thomas William, 209 Albert St., Saskatoon, Sask.
Millar, Alan Stuart, 626 - 3rd Ave., North, Saskatoon, Sask.
Opsal, John Oliver, 333 - 4th Ave., North, Saskatoon, Sask.
Swystun, August, 304 - 4th Ave., North, Saskatoon, Sask.
Weckman, Byron Thomas, 841 Temperance St., Saskatoon, Sask.
Wilks, George Haden, 323 - 3rd Ave., South, Saskatoon, Sask.

Student to Junior

Traynor, John Clair, Capt., R.C.E., B.Sc., (Univ. of Saskatchewan), 1017 University Drive, Saskatoon, Sask.

Quebec

Members

Asselin, Louis, B.A.Sc., (Chem. & Civil), (Ecole Poly.), chief chemist, Industrial Steel & Fibre Co., Montreal, Que.
Bastien, Paul Maurice, B.A.Sc., C.E., (Ecole Poly.), asst. chief engr., J. M. Eugene Gray, Inc., consultg. engrs., Montreal, Que.
Beaulieu, Joseph Rene Roland, B.A.Sc., C.E., (Ecole Poly.), chief of divn., Dept. of Roads, Grand'Mere, Que.
Bleau, Jean Marie Alphonse, B.Sc., (McGill Univ.), M.Sc., (Queen's (Mett.) Univ.), mining engr., Dept. of Mines, Quebec, Que.
Bourgoin, Louis Georges, Dr.Sc., (Univ. of Algiers), Chem. Engr., (E.N.P.C.), Paris, France, director, Research Centre, Ecole Polytechnique, Montreal, Que.
Brodeur, Paul, B.A.Sc., C.E., (Ecole Poly.), sales engr., Imperial Oil Limited, Montreal, Que.
Cote, Gaetan Jules, B.A.Sc., C.E., (Ecole Poly.), sr. assoc. member, Crepeau & Cote, consultg. engrs., Sherbrooke, Que.
Delage, Jean, B.A.Sc., C.E., (Ecole Poly.), economic technician, City of Montreal, Que.
Deslauriers, Joseph Hormidas, B.A.Sc., C.E., (Ecole Poly.), plant engrg. dept., Dominion Bridge Co., Lachine, Que.
Dumont, T. F. Robert, B.A.Sc., C.E., (Ecole Poly.), chief acct. & asst. plant supt., Meagher Bros. & Co., Ltd., Montreal, Que.
Forgues, J. Arthur, B.A.Sc., C.E., (Ecole Poly.), engr., Hydro Quebec, Montreal, Que.
Francoeur, Georges, Brigadier, O.B.E., District Administrator "E" Quebec, Dept. of Veterans' Affairs, Quebec, Que.
Gaulin, Jacques, B.A.Sc., C.E., (Ecole Poly.), chemical engr., Ayerst, McKenna & Harrison Ltd., Montreal, Que.
Lacasse, Gerard, B.A.Sc., C.E., (Ecole Poly.), constrn. engr. & mgr., D. Lamothe, contractor, Noranda, Que.
Lalonde, Jean-Paul, B.A.Sc., C.E., (Ecole Poly.), divn. engr., Dept. of Roads, Victoriaville, Que.
Lanctot, Theo., B.A.Sc., C.E., (Ecole Poly.), chief engr., City of Hull, Hull, Que.
Langlois, Alfred Maurice, B.A.Sc., C.E., (Ecole Poly.), chief engr., Page Equipment & Construction Co., Ltd., Three Rivers, Que.
Laurendeau, Camille, B.A.Sc., C.E., (Ecole Poly.), genl. contractor, Montreal, Que.
Ledoux, J. A. Rolland, B.A.Sc., C.E., (Ecole Poly.), mgr., Clare Osborn Equipt. Ltd., Montreal, Que.
Lippe, Louis Ernest Herve, director, municipal service, City Hall, Joliette, Que.
Pepin, Abias, B.A.Sc., C.E., (Ecole Poly.), president, Abias Pepin, Ltd., Longueuil, Que.
Poirier, Jean Paul, B.A.Sc., C.E., (Ecole Poly.), divn. engr., Roads Dept., Joliette, Que.
Racicot, Felix, B.A.Sc., C.E., (Ecole Poly.), architectural work for self, Saint Roch, Que.
Rosenberg, David John, B.Sc., (Mech.), (Tri-State Coll., Angola, Ind.), chief inspector, incoming inspecn. dept., R.C.A. Victor, Montreal, Que.
St. Arnaud, Herve T., B.A.Sc., Civil & Chem. (Ecole Poly.), chemical engr., French Supply Council, Montreal, Que.

Junior to Member

Dery, Jacques Louis, Graduate, (R.M.C.), jr. engr., D.P.W., Canada, Montreal, Que.
McMillan, Thomas Stewart, B.Sc., (Civil Engrg.), (Univ. of New Brunswick), plant engr., Canadair Reconversion Plant, Montreal, Que.
Sherwood, Marvin Lorne, B.A.Sc., (Univ. of Toronto), district plant engr., The Barrett Co., Ltd., Montreal, Que.
Wong, Walter James, B.Eng., (Civil), (McGill Univ.), structl. designer, Aluminum Co. of Canada, Ltd., Montreal, Que.

Student to Member

Labrosse, Fernand J., B.A.Sc., C.E., (Ecole Poly.), constrn. engr., Clairvale Construction Co., Montreal, Que.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their January 1946 copy to headquarters.

On account of difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

JAMES BERTRAM HAYES

PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA, 1946

The incoming President of The Engineering Institute of Canada is a Nova Scotian, one of the many engineers, born and educated in the Maritime Provinces, who have rendered distinguished service to their profession and to the Dominion of Canada. Like many of his brother engineers from the Maritimes, Mr. Hayes has spent a substantial proportion of his time in work outside the limits of his native province, having held positions of responsibility in the United States and in the West Indies as well as in Canada. His career has in fact shown very clearly that the professional training of an engineer may well lead to the successful performance of important executive duties. For more than twenty years he has been connected with the management and organization of public utilities giving service in the electric light and power, gas, and transportation industries.

J. B. Hayes, M.E.I.C.

Mr. Hayes was born at Springhill, Nova Scotia, in 1892, and educated at schools there and at Mount Allison University. After graduating there he proceeded to Dalhousie University and the Nova Scotia Technical College for his courses in science and engineering, taking his engineering degree at the latter institution in 1916. In that year he enlisted for active service and went overseas as a gunner in the Canadian Artillery. From May 1916 to June 1919 he served first with the 14th Brigade Headquarters, Canadian Field Artillery, then with the 12th Battalion, Royal Canadian Engineers, as lieutenant.

On returning to Canada he held for a year a position, in Halifax, as Industrial Surveyor in the Department of Soldiers' Civil Re-establishment. In 1920 he joined the staff of the Nova Scotia Tramways and Power Company in Halifax, as an Engineer of Maintenance of Way. The company was then being operated under the direction of the Stone and Webster Corporation of Boston; in 1922 Mr. Hayes went to the Boston office of that firm as secretary to their District Manager. A year later he was transferred to the staff of the Jamaica Public Service Company at Kingston, Jamaica, where he was appointed assistant manager.

In 1924 he went to Fort Madison, Iowa, as manager of the Fort Madison Electric Company. The following year he was sent to Richmond, Virginia, as assistant to the president of the Virginia Electric and Power Company. At that time, both these organizations were operated by the Stone and Webster Corporation. His next appointment in 1927 was that of general superintendent of transportation at Norfolk, Virginia, for that division of the Virginia Electric & Power Company. Mr. Hayes resigned that position in 1929 to become general manager of the Nova Scotia Light and Power Company at Halifax.

From that time to the present, under his progressive direction, the company's record has been one of steady achievement. During World War II, in addition to the maintenance of the regular services of the company in Halifax and the vicinity, heavy special assignments had to be carried out to meet the requirements of the naval and military authorities. As an example of these, the company, under the direction and organization of Mr. Hayes, degaussed the largest number of ships so equipped by any unit engaged in that line of activity. He also found time to undertake the onerous duties of Regional Chairman of A.R.P. for the Maritime Provinces.

Mr. Hayes became a member of The Engineering Institute of Canada in 1920. He has served on the executive committee of the Halifax Branch and is a Registered Professional Engineer of Nova Scotia. He was elected president of the Canadian Electrical Association in 1944. He is a past-president of the Halifax Board of Trade and of the Canadian Transit Association. Thus he is no stranger to the presidency of important technical and industrial societies.

From these biographical notes it will be evident that the new president of the Institute needs no introduction to our members in the Maritimes or indeed to any of those engaged in public utility engineering throughout Canada. The membership at large will welcome him as an engineer familiar with professional problems, and of wide experience with questions of management and organization.

Personals

Relatives and friends of members in the active forces are invited to inform the Institute of news items, such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form a basis of personal items in the *Journal*.

Sir Hugh Beaver, M.E.I.C., has relinquished his wartime appointment as Director-General in the Ministry of Works, London, Eng. Prior to his service in this capacity he was a partner with Sir Alexander Gibbs and Partners, consulting engineers, at London.

Frank A. Patriquen, M.E.I.C., of the Saint John, N.B., district office of the Department of Public Works of Canada, has been promoted from junior engineer to assistant engineer.

K. R. Swinton, M.E.I.C., who was recently discharged from the army with the rank of lieutenant-colonel after more than four years' service, has been appointed manager of the elctronic apparatus division of engineering products sales department of RCA Victor, Montreal.

A graduate of the University of Vienna with degrees in radio and television engineering, applied mathematics and physics, he came to Canada in 1940, shortly afterwards joining the Royal Canadian Corps of Signals. Attached to the Department of Munitions and Supply for a time as a technical assistant to the director general of signals production branch he was later appointed assistant director of the directorate of electrical communications design of the Department of National Defence in Ottawa. In this capacity he was responsible for the design of all radio and telephone equipment for the Canadian Army and of all development projects on such equipment undertaken by Canada on behalf of the British War Office.

In his new position Mr. Swinton will be responsible for the selection, merchandising and sales supervision of radio communications equipment (other than broadcast station equipment), industrial sound systems, R.F. heating and other electronic industrial equipment, electron microscopes and radio relay systems.

E. S. C. Carpenter, M.E.I.C., has received his release from the Canadian Army, after serving as a captain with the Royal Canadian Engineers overseas. He has returned to his former position as district engineer with the P.F.R.A., Dominion Department of Agriculture, Saskatoon.

S. A. Charters, M.E.I.C., has accepted a position as sales engineer with Westeel Products Limited, Montreal. Mr. Charters served in Canada and overseas as a captain in the Royal Canadian Artillery. A graduated from McGill University in civil engineering in 1936, he was prior to enlistment assistant sales manager for Watson Jack and Company Limited, in Montreal.

J. L. Charles, M.E.I.C., is back in his civil occupation with the Canadian National Railway Company in Winnipeg, after nearly four years service as a major in the Royal Canadian Engineers. Mr. Charles saw active service in the war of 1914-1918, and re-enlisted in the active army on September 3rd, 1939, with the 20th Field Company on the Pacific Coast.

News of the Personal Activities of members of the Institute

R. A. H. Hayes, M.E.I.C., has accepted a position with H. G. Acres and Company at Niagara Falls, Ont. He was formerly acting chief engineer with the Aluminum Laboratories, Limited, Montreal, which firm he joined in 1938. Mr. Hayes was the recipient of the Ross Medal of the Institute for 1945.

George S. Lace, M.E.I.C., has resigned his position of deputy chief inspector with the War Assets Corporation and has been appointed supervising inspector for the Montreal area, with the Civil Aviation Branch, Department of Transport.

R. J. Mattson, M.E.I.C., is now connected with the Canadian and General Finance Company Limited, Toronto, Ont., as an engineer. He was previously with the Aluminum Company of Canada Limited at Montreal.

A. T. Hurter, M.E.I.C., has become associated with John Stadler, M.E.I.C., consulting engineer. The organization, under the name of Stadler, Hurter & Company, consulting engineers, is located in Montreal and will specialize in pulp and paper mills from forest to finished product.

Prior to coming to this continent, Mr. Hurter worked in London with Brown & Pooley, consulting engineers, and also in Rumania as partner in the industrial engineering company of Huber & Hurter, Bucharest. In 1923 he was employed by Mr. John Stadler as draughtsman for the Cornerbrook mill. In the following year he became associated with Geo. F. Hardy, consulting engineer, New York, as designing engineer and for the next four years was successively field representative on mills for Price Brothers & Company Limited, Manitoba Paper Co. Ltd., and Anglo-Canadian Pulp & Paper Mills, and resident engineer for St. Lawrence Paper Co. Ltd.

From 1929 until 1937 Mr. Hurter was resident engineer for the Iroquois Falls Division of Abitibi Power & Paper Company, and during that time he was also acting as consulting engineer for other Abitibi divisions. During the following year he was engineer in charge of mill construction of Lake Sulphite Pulp Company Limited at Red Rock, Ont. From 1938 until 1940 he was representative at Red Rock of the receiver and general manager of the Lake Sulphite Pulp Company, in charge of all operations.

In 1940 he became project engineer of Defence Industries Limited in charge of layout and design and in the following year was transferred to the Bouchard Works at Ste. Therese, Que., in charge of production of shell filling plant. In 1942 he was transferred by Allied War Supply Corporation and worked for one year as project engineer in charge of layout and design for extension of Cherrier shell filling plant of Canadian Car Munitions Limited. From 1943 until his resignation Mr. Hurter held an executive position with Canadian Car and Foundry Company Limited, reporting to the vice-president and general manager on various war contracts.

Colonel Clarence E. Davies, M.E.I.C., was recently awarded the medal of the Legion of Merit in Washington for meritorious service while on active duty with the Ordnance Department of the United States Army. Colonel Davies is secretary of The American Society of Mechanical Engineers and has recently resumed his duties in New York after an extended leave of absence.

As Chief of the Control Division, Office of the Chief of Ordnance, he was concerned with problems of policy, organization, methods, procedures and statistical reporting practices for the Ordnance Department. He has been with the engineering society since 1920, consecutively as associate editor, managing editor, assistant secretary, executive secretary and, since 1934, as national secretary.

The Legion of Merit medal recognizes "extraordinary fidelity and essential service" in a position of responsibility, and is conferred on "outstanding officers and enlisted men of the armed forces of the United States or of friendly nations". It is the second highest award given to service forces.

Colonel Davies' citation reads:

"Colonel Clarence E. Davies, Ordnance Department, Army of the United States, demonstrated remarkable initiative as Chief, Control Division, Office of the Chief of Ordnance, from June 1942 to November 1945. Through his extensive engineering and production experience, able administration and continual analysis of Ordnance requirements, he successfully contributed to the efficient expansion of the Ordnance Department to a wartime basis."

Dr. O. W. Ellis, M.E.I.C., director, department of engineering and metallurgy, Ontario Research Foundation, Toronto, has been honoured by his *alma mater,* the University of Birmingham, England. In December last, by special warrant, the University conferred on him *in absentia* the degree of Doctor of Science (Metallurgy).

W. E. Hobbs, M.E.I.C., has resumed his former position of assistant manager, Land Department, Hudson's Bay Company, in Winnipeg. Mr. Hobbs served as a wing commander with the No. 2 Training Command, R.C.A.F.

O. Inkster, M.E.I.C., who served as a flight lieutenant with the R.C.A.F. for nearly three years, has returned to his civilian practice as consulting engineer and surveyor in Edmonton, Alberta.

G. Moes, M.E.I.C., is now president of Hamilton Sterling Company Limited. He has been associated with this company for several years, having been made general manager in 1932. In 1944, he obtained leave of absence to manage No. 10 Elementary Flying Training School, R.C.A.F. at Pendleton, Ontario.

K. Y. Lockhead, M.E.I.C., who served as an aeronautical engineer in the R.C.A.F., has been released with the rank of squadron leader. He has returned to the Hudson's Bay Company as building superintendent, Vancouver store.

C. H. Rosier, M.E.I.C., has accepted a position with Building Products Limited, in Montreal. He served overseas with the R.C.N.V.R. as lieutenant (E).

C. K. Lockwood, M.E.I.C.

C. K. Lockwood, M.E.I.C., has been appointed sales manager of the stainless steel and alloys division of Shawinigan Chemicals Limited. He was formerly metallurgist with the company.

F. W. Alexander, M.E.I.C., has retired from the position of assistant chief engineer, western lines, Canadian Pacific Railway. He was tendered a testamentary banquet by his fellow employees at Winnipeg in December, at which time a Life Membership in the Institute was presented to him by President Fetherstonhaugh. Mr. Alexander entered the service of the C.P.R. in 1903 as transitman from which time he received successive promotions in the engineering department in western Canada.

J. S. Cooper, M.E.I.C., who for the past four and one-half years has been serving as an engineer officer in the Royal Canadian Navy has recently retired with the rank of lieutenant-commander (E). He has accepted the position of assistant to the chief engineer of the Temiskaming and Northern Ontario Railway at North Bay, Ont.

Major R. B. Jennings, M.E.I.C., has been appointed property engineer of War Assets Corporation. His task will be to set salvage values on buildings placed with War Assets for disposal, and to advise on all engineering matters of the Lands and Buildings Department of the Corporation.

In the first World War, Major Jennings commanded a company in the Canadian Railway Troops serving in France and Belgium and on demobilization was made division engineer for the Canadian National Railways in Toronto, Ottawa and Montreal. He resigned in 1926 to become general manager for Canada of Robert W. Hunt Co. Ltd., inspection and testing engineers. In 1930 he joined Crane Limited as railroad sales engineer and in 1933 engaged in highway and railway construction.

In 1939 he joined the Defence Projects Construction Branch of the Department of Munitions and Supply. An inspecting engineer of the Montreal district, he supervised the construction of industrial plants, shipyards, aircraft plants and runways, military camps and the enlargement of municipal water and sewage plants for war purposes.

Carlyle Gerow, M.E.I.C.

Carlyle Gerow, M.E.I.C., returned in January to the Toronto offices of Dominion Coal Company Limited and Dominion Steel and Coal Corporation Limited, to resume his duties as district manager, coal sales, Ontario, after four and one-half years' service as a civilian technical officer of the Department of National Defence for Air, on loan to the government by his company. This post involved constant travelling, reporting and advising on supply, delivery, efficient and economical utilization of heating fuels in R.C.A.F. and British Commonwealth Air Training Establishments. He also acted as liaison between the Department and the coal and oil controllers' offices. In recognition of his war services he was made a Member of the Order of the British Empire in 1943.

A graduate of Queen's University in 1922, Mr. Gerow was first employed as steam plant superintendent of the Bathurst Power and Paper Company. He joined the coal sales department of the Dominion Steel and Coal Corporation Limited in 1931.

R. A. McLellan, M.E.I.C., who served as squadron leader with the R.C.A.F., has returned to his civilian occupation as partner in Underwood McLellan in Saskatoon, Saskatchewan.

J. M. Riddell, M.E.I.C., has retired from active service with the Canadian army, in which he held the appointment of command engineer officer, acting as technical adviser to the G.O.C. in C. Atlantic Command, with the rank of lieutenant-colonel. He has rejoined the Department of Mines and Resources, in the Geodetic Service in Ottawa.

A. K. Robertson, M.E.I.C., who served for four years with the Royal Canadian Engineers, has retired with the rank of lieutenant-colonel. He was executive officer with the Special Commission for Defence Projects in North West Canada.

S. N. Tremblay, M.E.I.C., has returned to his former position with the Quebec Streams Commission in Montreal. He served as a captain at No. 5 Vocational Training School at Rimouski, Quebec.

H. L. Trotter, M.E.I.C., has retired from active service with the rank of lieutenant-colonel, after four years with the Royal Canadian Engineers. Colonel Trotter won the D.S.O. during the last war, when he served overseas with the 11th Battalion.

H. W. McMillan, M.E.I.C., has been appointed to the position of manufacturing consultant, and heads the new industrial engineering department of the Eastern Division of Dominion Bridge Company Limited, Montreal. Prior to this appointment, Mr. McMillan was works manager of the Lachine shops of the company for nearly 20 years. Apart from his long experience with Dominion Bridge, he has held responsible positions such as: superintendent of inspectors in the bridge engineering department, eastern lines of C.P.R.; chief inspector of St. Lawrence Bridge Company (subsidiary of Dominion Bridge Company); chief inspector of shop fabrication and later chief inspector of erection for the Quebec Bridge Commission.

Gordon Cape, M.E.I.C., has been made chief assistant, and research and methods engineer of the new industrial engineering department, Eastern Division, Dominion Bridge Company Limited. After graduating in civil engineering from McGill University in 1930, Mr. Cape joined the company as supervisor of welding and later became welding engineer. Concurrently he held the position of chief inspector and later that of research and methods engineer in the works department.

Peter Millar, M.E.I.C., has been appointed general superintendent of the works department of the Eastern Division of Dominion Bridge Company Limited. Mr. Millar has been associated with the company since 1923, prior to which he was apprenticed to the engineering firm of Mechans Limited of Glasgow, in which city he received his education.

During his career with the company he has held various responsible positions in the designing offices, including that of assistant engineer in the plate and boiler department. He held the latter position until 1941 when he joined the works staff in the capacity of structural superintendent and later operating superintendent.

C. S. Kane, M.E.I.C., has been appointed sales consultant, Eastern Division of Dominion Bridge Company Limited. He has been with the company since 1909, following a short period with the Hart-Otis Car Company. At Dominion Bridge Mr. Kane started first in the engineering department and in 1912 took charge of design and estimating in the Montreal contracting office. He also devoted considerable time to sales work, being appointed engineer in charge of these activities in 1921. In 1934 he was transferred to the head office at Lachine, Que., as sales manager, Eastern Division.

Mr. Kane has been associated with many developments and in particular, is the inventor of the Kane system, now known as "Steel-Concrete Composite Construction". His present activities will free him for special advisory and negotiation work in the Eastern Division.

H. M. Watson, M.E.I.C., has recently been made sales manager of the Eastern Division of Dominion Bridge Company Limited in addition to his previous duties. His first eleven years with the company, which he joined in 1911 after graduating from McGill University, were spent in the engineering and draughting departments. Following this he joined the contracting office and in 1928 was appointed contracting engineer, a post he still holds in addition to his present appointment.

Geo. H. Midgley, M.E.I.C., has been appointed assistant sales manager, Eastern Division, Dominion Bridge Company Limited. He received his engineering education in the maritimes, having graduated from Mount Allison University, Sackville, N.B., in 1922, and Nova Scotia Technical College, Halifax, N.S., in 1934. Prior to joining Dominion Bridge Company he was in the engineering department of Canadian International Paper Company, then with the Dodge Manufacturing Company and United Steel Corporation in charge of engineering and sales. He joined Dominion Bridge as a sales engineer in 1936 and during the war was on loan for a period as chief engineer of Wartime Merchant Shipping Limited. On his return to Dominion Bridge he was appointed manager of manufacturing, a position he has held until recently.

W. D. Jewett, M.E.I.C., is now export manager, Eastern Division, Dominion Bridge Company Limited. He graduated in applied science and engineering at the University of Toronto and joined Dominion Bridge in 1923. He has held numerous responsibilities with the company in engineering design, field engineering, sales and advertising. In recent years he has been in charge of mechanical sales in the Eastern Division. In connection with the present appointment, Mr. Jewett has just completed an extensive tour of South America and is now back at Lachine, Que., organizing the company's activities in the export field.

J. S. Walsh, M.E.I.C., has been appointed sales development manager, Eastern Division, Dominion Bridge Company Limited. He gained the greater part of his experience in engineering and sales work in England and, after graduating from London University in 1929, went on to the British Thomson-Houston Company electrical manufacturers in Rugby, and thence to Browett-Lindley Limited, mechanical engineers and manufacturers, Letchworth, where he became sales development manager. During the war period he occupied the position of production engineer with the Armament Supply Department of the Admiralty serving first in England and then with the British Admiralty Technical Mission in Ottawa. He joined the staff of the Dominion Bridge Company recently and his new duties involve publicity, advertising and other forms of sales development work.

M. J. Spratt, M.E.I.C., who was in command of No. 6 Canadian Artizans Works Company, Royal Canadian Engineers, engaged in the building of hospitals, camps, leave hostels, etc., has returned to his former position as chief engineer, Saskatchewan Pool Elevators Limited, Regina, Sask. Mr. Spratt has been associated with this work since 1928.

Lieutenant-Colonel Richard Walkem, M.E.I.C., who was mentioned in despatches last fall, has been appointed officer commanding the 11th (R) Anti-Aircraft Regiment, R.C.A., in Vancouver. The new O.C. returned to Canada recently after more than five years' service overseas which he concluded as second-in-command of the 6th Field Regiment, R.C.A.

Robert A. Bradley, M.E.I.C., is at present employed as chief engineer with the Civil Aviation Division at Gander, Newfoundland.

C. A. Stollery, M.E.I.C., who served with the Royal Canadian Navy as an acting lieutenant commander (S.B.) (E), has been demobilized and is now with the Poole Construction Company, Edmonton, Alberta.

Dr. R. S. Jane, M.E.I.C.

Dr. R. S. Jane, M.E.I.C., has been appointed vice-president in charge of research of Shawinigan Chemicals Limited. For the past three years he has been director of the industrial research department of The Shawinigan Water and Power Company.

Dr. Jane graduated from the University of British Columbia in 1922, and was awarded a Ph.D. by McGill University in 1925. He subsequently attended the University of London for two years having won the Wembley Scholarship. He joined the plant research department of Shawinigan Chemicals Limited in Shawinigan Falls in 1927, being transferred to the research and development department of the company in Montreal in 1936, where he remained until his appointment to The Shawinigan Water and Power Company in 1943.

Hugh A. Lumsden, M.E.I.C., who has served for the past six years with the War Supply Board and the Department of Munitions and Supply has resumed his practice as consulting engineer at Hamilton, Ont.

Charles D. Woolward, M.E.I.C., has recently been appointed chief engineer of Anglin-Norcross Quebec Limited at Montreal. He has been with this company since 1938, previous to which he was employed as steel designer with Canadian Industries Limited, Montreal.

Andrew MacGillivray, M.E.I.C., has retired from the post of assistant engineer, Department of Public Works of Canada, Halifax district, thus bringing to a close a professional career of 37 years in the public service.

After graduating with a B.A. from St. Francis Xavier University in 1904, he attended Provincial Normal College at Truro, N.S., and returned to his *alma mater* to teach. At the same time he did post-graduate work and in 1908 obtained his B.Sc. From 1908 until 1910 he was engaged as engineer on the construction of the New Brunswick section of the National Transcontinental Railway. In the latter year he returned to Antigonish to join the staff of the Public Works of Canada. In 1918 he was transferred to the North Sydney office and in 1921, with the consolidation of the various provincial branch offices at Halifax, he was transferred to that city where he was stationed until his retirement.

R. G. Scott, M.E.I.C., has received his discharge from the R.C.N.V.R., with which he served for nearly three years as electrical lieutenant. Mr. Scott is now with the lighting division, British Columbia Electric Railway Company Limited, in Vancouver. Prior to enlistment he was sales engineer for the Winnipeg Electric Company in Winnipeg, Manitoba.

F. H. C. Sefton, M.E.I.C., has returned to his former position with the Way and Structures Department, Toronto Transportation Commission, in Toronto. He served as a flight-lieutenant in the R.C.A.F. Mr. Sefton was overseas for four years with the Canadian Expeditionary Force 1915-1919.

J. G. Spotton, M.E.I.C., has re-established his pre-war business as manufacturers' representative in Toronto, He served overseas with the 12th Field Regiment, R.C.A., returning later to Canada to the appointment of T.S.O. II with the Director of Artillery at N.D.H.Q. with the rank of major.

Maurice Pépin, M.E.I.C., is now employed as general manager by Abias Pépin, Limitée at Longueuil, Que. He was formerly associated with Hall Engineering Limited, Montreal.

Charles Miller, M.E.I.C., has resigned his position as chief engineer of Aluminum Power Company Limited to become assistant general superintendent of the Beauharnois Light, Heat and Power Company Limited.

R. E. Tweedale, M.E.I.C., has accepted a position with the New Brunswick Hydro Commission in Saint John, N.B. He served overseas for nearly four years as a flight-lieutenant in the R.C.A.F. Prior to his enlistment Mr. Tweedale was district highway engineer, located at Perth, N.B.

E. L. Zealand, M.E.I.C., has retired from active service after five years overseas with the R.C.E. He served as a captain with 1st Canadian Division Construction Company, and later with headquarters, 21 army group. Mr. Zealand has returned to the Pigott Construction Company in Hamilton, Ontario, having been associated with this Company for many years.

G. H. W. McKee, M.E.I.C., has returned to the University of Western Ontario, London, where he is teaching industrial management and cost accounting in the Department of Commerce. Mr. McKee left his position in 1940 to proceed overseas, where he served for five years, as a captain in the 1st Survey Regiment, R.C.A.

G. V. Eckenfelder, Jr.E.I.C., has returned to the Calgary Power Company Limited in Calgary, with which he was associated before the war. He served as a captain in First Canadian Army Signals, having spent four years overseas.

R. C. Fairchild, Jr.E.I.C., is now in private practice as partner in the firm of Murray & Fairchild, architects, in Toronto. Mr. Fairchild was overseas with the Royal Navy Fleet Air Arm. He graduated from the University of Toronto in 1943 with the degree of Bachelor of Architecture.

A. C. Findlay, Jr.E.I.C., has been released by the R.C.A.F., in which he served for two years as a flying officer. He is now with Canadian Vickers Limited in Montreal. Mr. Findlay graduated in mechanical engineering from McGill in 1942, and was then with the Steel Company of Canada Limited for a year.

D. E. Haldane, Jr.E.I.C., until recently a lieutenant with No. 9 Brigade Work Shop, R.C.E.M.E., overseas, is now employed at International Nickel Harvester Company of Canada in Hamilton, in the capacity of designing engineer. Mr. Haldane graduated in mechanical engineering from the University of Saskatchewan in 1942, and immediately entered the army.

A. G. Jarry, Jr.E.I.C., who joined the R.C.A.F. upon graduation in 1940 in civil engineering at McGill, is now working at Jarry & Frère in Montreal. Mr. Jarry served in Canada and overseas and was discharged with the rank of flight-lieutenant.

F. Kennedy, Jr.E.I.C., has left the Department of Public Works, with which he was engineer-in-charge at Great Bear River Road, Northwest Territories. He is now with Shawinigan Engineering Company at Shawinigan Falls, Quebec. Mr. Kennedy served overseas as lieutenant in the Royal Canadian Engineers.

H. I. King, Jr.E.I.C., has returned to Truscon Steel Company of Canada Limited in Montreal, where he was employed prior to his enlistment in 1943. Mr. King was discharged from the army recently having served as a lieutenant in the Royal Canadian Engineers.

M. S. Layton, Jr.E.I.C., who served as a squadron leader in the R.C.A.F. overseas, and who was awarded the D.S.O. in 1942 in recognition of his services, has returned to the Steel Company of Canada Limited, Montreal.

H. C. Oatway, Jr.E.I.C., received his release from the R.C.A.F., in which he served as squadron leader at A.F.Q.H. and No. 12 Training Command in charge of development and design and as consultant. He has joined the staff of Canadair Limited and has been on loan to Douglas Aircraft Corporation as a stress analyst at Santa Monica, California.

G. Osberg, Jr.E.I.C., has been demobilized and is at present employed on design work for the Department of Reconstruction, Ottawa. Mr. Osberg served as an electrical lieutenant in the R.C.N.V.R. overseas, having joined the Navy immediately upon graduation in electrical engineering from the University of Manitoba in 1942.

J. S. Osborne, Jr.E.I.C., has returned to McGill University to complete his undergraduate studies. Mr. Osborne was demobilized with the rank of captain after six years with the Royal Canadian Engineers mostly overseas with the 4th Field Company.

R. S. Beaudry, Jr.E.I.C., has joined the staff of the National Film Board in Ottawa. Mr. Beaudry entered the Navy immediately following his graduation in 1943 from Queens University as an electrical engineer. He served in the capacity of electrical lieutenant with the Directorate of Naval Ordnance in Canada and overseas.

Noel Campbell, Jr.E.I.C., has returned to the Ford Motor Company in Windsor, Ont., after two and a half years as a lieutenant in the R.C.N.V.R. Mr. Campbell graduated in mechanical engineering from McGill University 1938, and joined the engineering staff of this company immediately afterwards.

D. R. Taylor, Jr.E.I.C., who is employed by Trans-Canada Air Lines at Winnipeg, Man., now holds the position of radio and electrical engineering supervisor in the engineering department.

W. J. Farago, JR.E.I.C., retired from the Canadian Army in November last and is now employed as mechanical engineer by the Dominion Electrohome Industries Limited in Kitchener, Ont. Prior to joining the Army he was in the engineering department of the Kelsey Wheel Company Limited at Windsor, Ont.

C. C. Tompkins, S.E.I.C., a graduate of Queen's University in the class of 1945, is now employed by Canadian Hanson & Van Winkle Co. Limited at Toronto, Ont.

Pierre Troalen, S.E.I.C., has accepted a position with Standard Brands Limited at Montreal. He graduated from Ecole Polytechnique with his B.A.SC. in civil engineering last year.

Richard J. Joy, S.E.I.C., a graduate of McGill University in chemical engineering in 1945, is now attending Harvard where he is taking a course leading to a master's degree in business administration.

C. Bailey, S.E.I.C., has returned to the Canadian General Electric Company Limited, in Toronto. Mr. Bailey graduated from Perdue University in electrical engineering in 1942, following which he took the test course at G.G.E. He was employed as industrial leading sales engineer with this company when he left to join the R.C.N.V.R. in 1943, in which he served with the rank of lieutenant in the Directorate of Electrical Engineering.

W. R. Chilman, S.E.I.C., is now employed by the Tape Construction Company in Hamilton, Ontario. Mr. Chilman graduated in 1942 from Queens University with the degree of B.Sc. in civil engineering. He served as a lieutenant overseas with the 13th Field Company of the Royal Canadian Engineers.

J. M. Dype, S.E.I.C., who served with the R.C.N.V.R. as a lieutenant in the Naval Research Establishment, has been released by the navy and is now employed at the John Inglis Company in Toronto. Mr. Dype entered the service immediately following his graduation as a mechanical engineer from the University of Toronto in 1943.

A. D. Hamilton, S.E.I.C., has been released by the R.C.A.F., with which he served as squadron leader overseas attached to No. 83 group main headquarters, R.A.F.B.L.A. He has returned to Dominion Rubber Company Limited in Montreal, where he worked upon graduation in chemical engineering from McGill University in 1940.

C. P. Lentz, S.E.I.C., is now attending the University of Saskatchewan studying electrical engineering. He served with the R.C.A.F. in Canada and Newfoundland, being discharged with the rank of sergeant.

C. A. Loden, S.E.I.C., is now employed by the Imperial Oil Company Limited in Regina, Saskatchewan. He enlisted as a lieutenant in the Canadian Army following his graduation in 1944 in mechanical engineering at the University of Saskatchewan.

J. G. Matthews, S.E.I.C., has been discharged from the R.C.A.F. and is now employed by the Hudson Bay Mining and Smelting Company at Flin Flon, Manitoba. Mr. Matthews graduated in geological engineering from the University of Saskatchewan in 1944.

E. B. Pearson, S.E.I.C., has returned to McGill University to complete his studies towards the degree of Bachelor of Engineering. He served for two years as pilot officer in the R.C.A.F.

R. M. Powell, S.E.I.C., has been demobilized, after six years' service with the R.C.N.V.R., with the rank of lieutenant-commander. Mr. Powell has returned to Canadian Industries Limited, in Montreal, having been with this company at Shawinigan Falls, Quebec, before his enlistment.

P. J. Provias, S.E.I.C., is now enrolled in the Faculty of Engineering, University of Toronto, as an undergraduate. He served overseas as a flying officer, R.C.A.F., with Bomber Command.

G. D. Russell, S.E.I.C., has been demobilized with the rank of flight-lieutenant after serving two years as a pilot overseas with the R.C.A.F. Mr. Russell joined the service immediately upon graduation from McGill in chemical engineering in 1941. He has returned to the university to do post-graduate work in organic chemistry.

B. Taylor, S.E.I.C., who was demobilized with the rank of flying officer from the R.C.A.F., after serving in aircrew overseas, has accepted a position as junior geologist with the Winnipeg Corporation of Canada at Noranda, Quebec. Mr. Taylor graduated in 1941 from the University of Saekatchewan with a B.Sc. degree in geology.

E. S. Sutherland, S.E.I.C., has been released from the Canadian Army, in which he served overseas as a lieutenant with the Royal Canadian Engineers. He is with the Dominion Water and Power Bureau at North Bay, Ontario.

P. A. Verdier, S.E.I.C., and his brother, **Henrik Verdier,** S.E.I.C., have both been released from the R.C.N.V.R., in which they served as lieutenants (S.B.) (E.) They have both returned to Sir George Williams College in Montreal to complete their undergraduate courses.

J. M. Yuile, S.E.I.C., who served overseas as a squadron leader in the R.C.A.F., is now associated with Peacock Brothers Limited, in Montreal. Mr. Yuile returned to McGill University following his retirement from the R.C.A.F. and completed his final year for his engineering degree.

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 on the postmark on the envelope, is taken as the date of payment. This gives equal opportunity to all members wherever they are residing.

Obituaries

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

Phillips Bathurst Motley, M.E.I.C., retired engineer of bridges for the Canadian Pacific Railway, died on January 13th, 1946, after a short illness, at the Western division of the Montreal General Hospital. Born at Calcutta, India, on March 22nd, 1871, he received his engineering education at the School of Practical Engineering at Sydenham, England.

Coming from England to Montreal in 1892 to join the engineering department of the Canadian Pacific Railway, Mr. Motley occupied the positions of draughtsman and inspector of bridges both in the shops and during erection. In 1903 he became assistant engineer in the department and five years later was made assistant engineer of bridges. In 1911 he was promoted to engineer of bridges for the entire system, overseeing all design, construction and supervision of bridges from the Atlantic to the Pacific. Among the more important bridges for which Mr. Motley had been responsible are the Lethbridge viaduct, the Edmonton City bridge, the crossings of various large rivers on the prairies such as at Saskatoon, Outlook, Nipawin and Winnipeg, the bridge at Galt, Ont., the bridge over the St. Lawrence river near Montreal which was reconstructed to allow for double tracks, and the Saint John, N.B., cantilever bridge. There were many others of lesser magnitude and of difficult construction, particularly in the Rocky and Selkirk Mountains and on the north shore of Lake Superior. He remained with the Canadian Pacific Railway for 45 years, retiring in June, 1937.

Mr. Motley joined the Institute as an Associate Member in 1898, transferring to Member in 1905. In 1929, 1930 and 1931, he was a member of Council representing the Montreal Branch. He was made a Life Member in 1942. He was also a Life Member of the American Society of Civil Engineers and a Member of the Institution of Civil Engineers of Great Britain.

George D. Macdougall, M.E.I.C., died in New Glasgow, N.S., on December 29th, 1945. Born at St. Peters, Cape Breton Island, on September 26th, 1873, he graduated from McGill University with a B.A.Sc. in mechanical engineering. He was employed as a mechanical engineer in Boston, Buffalo, Ontario, Newfoundland and Nova Scotia until 20 years ago when he retired.

Mr. Macdougall joined the Institute as an Associate Member in 1901, transferring to Member in 1909. He was made a Life Member in 1932.

Andrew McCulloch, M.E.I.C., one of the Canadian railwaymen who pioneered the country's expansion, died on December 13th, 1945, in the Penticton hospital, Penticton, B.C. Born in Lanark County, Ont., on June 15th, 1864, he received his preliminary education at Kingston, Ont., and went west to Seattle, Wash., in 1889.

On joining a survey party identified with the Great Northern Railway he travelled throughout what is now the state of Washington being employed successively as chainman, rodman, instrument man, and general utility assistant. In the autumn of 1893 he left for the World's Fair in Chicago, and on his return to Seattle the following spring found that railroad building had ebbed. He went to Vancouver and after trying placer mining for a time returned to work for the Great Northern at Spokane. In 1896 he was made resident engineer building a line in the Lake Superior vicinity. In the following year he went to work as transitman on the Crow's Nest Branch of the Canadian Pacific Railway. He was resident engineer on a number of related projects and had further experience in the Fraser Valley. In 1903 he went to Saskatoon as locating engineer to run a line from Saskatoon west toward Edmonton. He did other work on prairie lines and farther east in the Fort William vicinity.

In 1906 Mr. McCulloch moved to the Grand Trunk Pacific as district engineer in charge of grading from Winnipeg to Saskatoon. When his wishes to return to the mountains of British Columbia did not materialize he returned to the Canadian Pacific. He was appointed division engineer with his office at Montreal and for three years worked on eastern operations. In 1910 when the idea of completing the line through British Columbia to the coast revived he was appointed chief engineer of the project. The enterprise was to be known as the Kettle Valley Railway and on its completion Mr. McCulloch was both chief engineer and general superintendent in full charge of operating the section. He continued as chief engineer for several years. In 1930 the Kettle Valley Railway was merged with the Canadian Pacific Railway and there was no further need for a chief engineer on the line. Mr. McCulloch concentrated his attention upon branch line building which was completed by 1933, and in that year his active railroading terminated.

Mr. McCulloch joined the Institute as a Member in 1907.

Edward Emery Carpenter, M.E.I.C., died in Vancouver, B.C., on October 26th, 1945. Born at Americus, Kansas, on November 12th, 1872, he graduated from Stanford University, Cal., with his B.S. in civil engineering in 1898.

For seven years after graduation Mr. Carpenter followed railway engineering in Arizona, Nevada, and California. In 1905 he was employed as chief construction engineer for Sanderson and Porter on construction in San Francisco. Four years later he was sent by the company to Vancouver Island as chief engineer in charge of design and construction of a power development installation for the British Columbia Electric Railway Company. He later undertook for the same company the Sooke waterworks project for the City of Victoria, B.C.

Mr. Carpenter returned to California and from 1912 until 1915 was in charge of all civil engineering work for the Panama-Pacific International Exposition in San Francisco. In 1916 he became a member of the firm of Baker and Carpenter, engineers, San Francisco, Cal., and engaged in general consulting and executive engineering practice for some years. He was executive engineer and project manager for the construction of the Stanford Stadium at Stanford University.

In 1923 he returned to British Columbia and joined the B.C. Electric Railway Company as consulting engineer. Among his projects with the company was the Ruskin power plant and dam and a power plant at Stave River. From 1925 until 1932 he was in charge of construction of the Bridge River hydro-electric development plant. He retired in 1944.

Mr. Carpenter joined the Institute as a Member in 1924. He was made a Life Member in 1944.

News of the Branches

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

CALGARY BRANCH

A. B. Geddes, M.E.I.C. - *Secretary-Treasurer*

Thursday, December 13th was branch affiliate night. he meeting was addressed by Mr. J. R. Jenkins, Calıry Power Co. Limited. His address was on the **revention of Accidents.** He said that premeditated lling is ended on the battle front but not on the ome front. Accidents are on the increase, $113,000,000 ıving been lost in labour due to accidents in the pronce of Alberta in the last twenty-five years. From 40 to 1944 there were 1,400,000 accidents in Canaan industries. In the United States there were 260 dustrial accidents per day per 100,000 population. r. Jenkins also stated that day dreaming was the .use of most accidents .

A film entitled "Rules for Tools" brought Mr. enkins' talk to an end.

Mr. J. Warke of the Brown, Moyer and Brown imited was the next speaker and he spoke on oil ell drilling in Turner Valley. Mr. Warke gave a neral review of development in the Valley. He said out 75,000,000 barrels of oil had already been proıced and that 255 wells were now in production.

The derricks, with legs 26 feet apart at the base, uld lift 220 tons, he said. The rotary bits made 150 350 revolutions per minute. Usually there were ree boilers for generating steam, with the "mud" ımps consuming the greatest amount: Steam presre at 265 pounds was usually maintained. Gas essures of up to 4,000 and 5,000 pounds per sq. in. ere sometimes encountered in drilling. Most of the iation fuel used by the British Commonwealth Air aining Plan came from Turner Valley.

Much information was also given to the meeting on e coming explosion of the 5,000 quarts of nitroycerine which are to be exploded at the bottom of e West Flank No. 2 well. This is one of the largest ıdertakings of this kind ever to be attempted in oil ell shooting.

Persons "a long distance" from the well might hear slight rumble at the time of the explosion if they t their ear to the ground, he stated. There was no due excitement in Turner Valley at the prospect of e explosion. His own house was quite close to where e nitro-glycerine is stored.

The third speaker was Mr. H. Connolly, who spent years with the inspection department of the British miralty. He said the quality of work turned out at e Ogden munitions plant was second to none in ınada or Britain. He dealt with the fine precision quired in the manufacture of equipment for subırines. Replacements had to be made at top speed d under difficult conditions, and there was no room faulty tooling.

The meeting was under the chairmanship of F. Peele.

HAMILTON BRANCH

W. E. Brown, M.E.I.C. - - *Secretary-Treasurer*
L. C. Sentance, M.E.I.C. - *Branch News Editor*

On Thursday, December 20, 1945, approximately rty members of the Institute and their guests met at cMaster University for the regular monthly meeting the Branch. In the absence of N. Eager, chairman, R. Hannaford, vice-chairman officiated.

The speaker of the evening introduced by G. L. T. Vollmer, was Mr. S. R. Frost, past-chairman of the Toronto Branch of the Institute and past-president of the Ontario Association of Professional Engineers who chose for his subject **Canada's Nitrogen Industry.** By virtue of his previous association with the North American Cyanamid Company, Ltd. and his present association with the controller of chemicals, Department of Munitions and Supply, Montreal, as chemical engineer, Mr. Frost came before the meeting eminently qualified to develop his subject.

The speaker introduced his topic with a short historical sketch of the production of nitrogen, nitrates and fertilizers in general. The production of nitrates has always been an essential step in the production of explosives for war purposes. The low concentration of Chile nitrates combined with lack of shipping space has forced the synthetic production of suitable compounds of nitrogen. The largest plant producing such nitrates in Great Britain was located on the east coast in a position very vulnerable to air attacks. Early in the war it had been found necessary to seek additional and more reliable sources for these compounds.

The decision was made, therefore, to construct suitable plants in Canada and the site chosen for the main plant was at Welland, Ontario. The reasons for selection of this site were—easy access of rail and water transportation systems, proximity to an abundant source of electrical power and to the existing plant of the North American Cyanamid Company, Ltd.

The planning, designing and construction of this huge project involving many millions of dollars was accomplished in record time, partial production being attained approximately nine months after inception of the project.

The details of the construction of the plant were outlined by Mr. Frost and were well illustrated by means of a sound film.

Concurrent with construction work at Welland, Ontario, additional plants were being built at Trail, B.C. and at Calgary, Alta. With all three plants in operation the output of Canadian-made nitrogen and nitrates reached very great proportions.

By some strange quirk of fate the large nitrate plant in Great Britain was unharmed by bombing, with the consequence that the Canadian nitrate plants produced quantities far in excess of war requirements. In order to utilize the excess to advantage, an intensive research programme was undertaken and very shortly excess nitrogen was being converted into fertilizers. During the war a small part of this fertilizer production was used in growing Canada's crops.

At the present time the demand for nitrates and fertilizers is very great and Canada's production is in the neighbourhood of thirty million dollars per year. Canadian consumption of nitrate fertilizers is approximately 10 per cent of the total production. The remaining 90 per cent is being exported to approximately 40 different countries throughout the world.

At the conclusion of the talk Mr. Frost answered numerous questions which dealt chiefly with the technical phases of the production of various nitrogen compounds.

The members of the Hamilton Branch of the Institute met jointly with the Hamilton section of the Chemical Institute of Canada.

MONCTON BRANCH

V. C. Blackett, m.e.i.c. - *Secretary-Treasurer*

On Wednesday, October 31st, Huet Massue, statistical engineer of the Shawinigan Water and Power Co., Montreal, addressed the branch on the subject of the Tennessee Valley Authority, a project by which the United States Government had hoped to supply low-cost electricity in competition with privately owned companies.

The T.V.A., Mr. Massue stated, was a Roosevelt New Deal undertaking, commenced in 1933. Existing installations in the Tennessee Valley were bought, dams built and water powers developed. The project, costing over one billion dollars, produced two million horsepower, making the cost $500 per horsepower. The speaker pointed out that the maximum economical cost of a power installation was $100 per horsepower.

The people of the United States now pay twenty-five million dollars a year to the T.V.A. to make up the operating deficit. The power cost in Tennessee is very high, approximately three times as high as the cost in Quebec. Mr. Massue expressed the opinion that in a region where coal is plentiful, it is often more economical to use steam power rather than hydro. Among other things, the cost of huge dams is avoided.

H. W. Hole, the branch chairman, presented a vote of thanks to the speaker, on motion of A. Gordon, seconded by B. E. Bayne.

On Thursday, January 10th, an address on the mining of gypsum and the manufacture of gypsum products was given by B. W. Isner, manager of the Canadian Gypsum Company's Works at Hillsborough, N.B. H. W. Hole presided over the meeting.

The gypsum industry is one of the oldest in Canada, the speaker declared, and added that the mining of gypsum was carried on in the Hillsborough region early in the nineteenth century. During that period it was quarried by farmers in the winter and piled on the banks of the Petitcodiac River and in the spring was loaded in coasting vessels that arrived from New England ports. In 1847, the industry went on a 12-month basis with some 3,000 tons a year being produced. At the present time, the annual output is 60,000 tons.

Gypsum seams vary in depth from 33 inches to 120 feet. The seams at the Hillsborough development are, on the average, 30 feet deep. They are close to the surface of the ground and the product is obtained both by mining and quarrying. Mr. Isner described gypsum as hydrous calcium sulphate, and pointed out that it could be converted to plaster of paris by applying heat and driving off about 75 per cent of the water.

The industrial uses of gypsum are varied. It is used in the manufacture of paint, sulphuric acid, wall plaster, mouldings, self sealing gasoline tanks and wall boards. It is also used to sweeten soil, and to retard the setting of Portland cement.

J. A. Godfrey moved, and G. E. Smith seconded the vote of thanks to the speaker.

Following Mr. Isner's address, the film "Ten Thousand Feet Deep" was shown.

MONTREAL BRANCH

L. A. Duchastel, m.e.i.c. - - *Secretary-Treasurer*
Hyman Schwartz, s.e.i.c. - - } *Branch News Editors*
Eli L. Ilovitch, s.e.i.c. - - }

A joint meeting of the Montreal Branches of the A.I.E.E. and the E.I.C. was held at Headquarters of the E.I.C. on the evening of October 18, 1945, at which was presented a paper on **A Modern Electric Boiler Installation at Arvida, Que.**

M. G. Saunders, was mechanical superintendent at Arvida works for several years and has been responsible for the design of the steam generating plant. F. L. Lawton, assistant chief engineer of the Aluminum Company of Canada Limited also spoke at this meeting. The speakers told about steam generation with early forms of electric heating boilers and went on to describe the construction, design and operation of the electric steam generator at Arvida.

The meeting was very well attended and enjoyed by all those present.

G. R. Hale was chairman of the meeting.

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Central Steam Utilities as a Solution to the Urban Smoke and Heating Problem was the subject of a paper given before the Montreal Branch during the evening of October 25th, 1945. Mr. R. L. Fitzgerald, who was the speaker, is vice-president and general manager of the Duluth Steam Corporation and is recognized as an authority on the subject.

The early stages of domestic heating were covered from the fire in the centre of the floor of primitive man's cave, through the development of the hearth with its chimney, to the common stove and to-day's modern boilers and furnaces which are capable of using practically all the heat available in the fuel that they burn. A big problem in urban life due to manual firing of furnaces is the production of smoke and dirt. It has been estimated that the city of Cleveland, Ohio, a fairly typical American city, suffers an annual loss, due to smoke alone of close to $10,000,000.

Early attempts at central heating were not very economical because of low pressures under which the systems had to operate. Today, with modern methods and equipment, a central station can provide reliable service and maintain a clean healthful atmosphere in the area in which it operates. Steam for hot water heating is being provided through installation of heat exchangers, and a large portion of steam production is used in manufacturing processes. It may be of interest to note that in modern systems, 99.9 per cent of the steam generated at the plant is delivered to the customer. Because of the corrosive action of the condensate it is given to the customer to use as he sees fit.

There were 120 persons present and F. A. Combe, was chairman of the meeting.

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On Thursday evening, December 13th, Mr. E. T. Henry, legal expert of the Canadian Industries Limited, gave a short talk on **Patents.** The speech was followed by an hour and a half discussion period during which the speaker answered to the satisfaction of all a barrage of questions and statements on patents.

A summary of the speech and salient points brought out during the discussion period follows:

"The real purpose of the patent system is to encourage the development of new industries by giving to an individual who has invented something never before known, a limited monopoly in his invention.

The protection thus afforded induces risk capital in the development of new industries, but what is probably more important, it also induces disclosure of the invention so that others are stimulated to develop even better methods of producing the product. The result of this competition is that the public benefits by obtaining better articles at lower prices.

"A patent is really a contract between the inventor and the State and involves a consideration for the right granted. The right granted by the State is the right to exclude others from using the invention for a fixed period of time while the consideration required is the disclosure of the invention to the public so that it may be freely used by anyone on expiration of the patent. Patents are not granted on abstract theories or mere principles, but rather on practical applications of the new theory or principle. Furthermore, the matter patented must be new and useful and inventive ingenuity must have been exercised.

" The charge that patents are used to suppress competition or to stifle initiative is a most serious one, but under Canadian law no patent can actually be so used because remedies are provided against abuse of patents. These remedies are compulsory licensing or, if this does not correct the abuse, revocation of the patent may be obtained. Abuse of the patent monopoly may exist where the patent owner is not supplying the Canadian market by manufacture in this country or where unreasonable conditions are attached to the sale or license of the thing patented.

" To the engineering profession the importance of patents is through research and new developments which provide jobs for engineers. Because patents demand the disclosure of new inventions, research is stimulated and with it, competition. The modern patent system was devised over three hundred years ago to break the trade secrets of the ancient guilds. This it has done to the ultimate benefit of the public as a whole."

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr.E.I.C. - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

The Niagara Peninsula Branch held their annual ladies' night on Thursday, November 22nd, at the Leonard Hotel, St. Catharines, Ont., under the chairmanship of J. Ings.

A large gathering of members, and their guests attended the dinner and later listened with interest to a most instructive lecture and demonstration by George L. Long, historian for the Bell Telephone Co. of Canada. Mr. Long was introduced by F. S. Barclay.

The title of Mr. Long's address was **Your Voice as Others Hear It.** Beginning with the early experiments and development of the telephone by Graham Bell and his sons, he traced the advancement in speech communication up to and including some of the outstanding developments of the past war years. The advances made in new metallurgical alloys have done much to bring the telephone to the present day perfection and reduction in size.

Practical demonstrations showed the remarkable characteristics of two widely used alloys — "Vicaloy " for permanent magnets, and " Permaloy," very highly sensitive to the slightest magnetic field.

Mr. Long emphasized the importance of good enunciation when speaking and explained to the audience the two basic elements of speech—vocal sounds and breath sounds. He showed that personality in speech depends upon tongue, lips, resonant chambers, throat, mouth and nose. He illustrated by means of the artificial larynx. Many interesting hints for public speaking were also given.

Much equipment was displayed by the speaker and much interest was shown at the close of the meeting when members of the audience were given the opportunity to record and hear their own voices by means of the mirrophone.

On behalf of the guests and members Mrs. A. W. McQueen expressed the vote of thanks to the speaker.

OTTAWA BRANCH

C. G. Biesenthal, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

At an evening meeting, held in conjunction with the Ottawa Branch of the American Institute of Electrical Engineers, in the auditorium of the National Research Council on December 7th, 1945, the Ottawa Branch of the Engineering Institute heard an illustrated lecture on **Gas Turbine Fundamentals.** The speaker was Dale D. Streid, of the General Electric Company Ltd., Lynn, Mass.

The speaker told of the fundamentals of the gas turbine which was of great importance in the development of jet propelled aircraft in the later years of the war. Mr. Streid played an important part in the research and development of the gas turbine for the General Electric Company.

Following his talk, a film on jet propulsion, and illustrating the development of jet propelled aircraft was shown. A question period was also held.

The speaker was introduced by the chairman, L. Chabot, and thanked by Norman Marr, chairman of the Ottawa Branch of the Institute.

PETERBOROUGH BRANCH

E. Whiteley, M.E.I.C. - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - *Branch News Editor*

The annual dinner of the Peterborough Branch was held at the Empress Hotel on December 12th.

Members of the Branch Executive met President E. P. Fetherstonhaugh and Secretary L. Austin Wright, speakers of the evening, at the train from Toronto and lunched with them. After lunch E.I.C. affairs were discussed. Later in the afternoon Dean Fetherstonhaugh visited the Peterborough Works of the Canadian General Electric Co.

A reception for the president was held at the Empress Hotel at 6.00 p.m. and it was followed by dinner at 6.30.

Following the toast to the King, A. L. Killaly welcomed Dr. J. M. R. Fairbairn back to the branch and offered the congratulations of the branch members to him for receiving the Sir John Kennedy Medal, which is the highest award of the Institute, and also for receiving a life membership in the American Society of Railway Engineers.

D. A. Drynan introduced the president, Dean E. P. Fetherstonhaugh, of the Faculty of Engineering and Architecture of the University of Manitoba, who spoke on **Trends in Engineering Education.**

The president recalled his first visit to the works of the C.G.E., at Peterborough in 1899, and contrasted it with his impressions in the afternoon tour.

The president expressed his great interest in the achievements of Canadian engineers in the war effort as he had found it, on his tours all across Canada, shown in the design, construction and maintenance of stupendous and complex undertakings. He also recalled the debt we owe to those engineers who served overseas and expressed our pleasure at seeing many of them back again in our midst. He stated also that we must do everything possible to assist in re-establishing them in their chosen profession. In this latter connection the president recalled that the Institute was already working toward rehabilitation even before the war was over.

Dean Fetherstonhaugh then outlined the serious problems facing engineering colleges due to the overcrowding prevalent at this time, and discussed what the colleges can best do for their veteran students.

The growing importance of the " Humanities " in an engineering education was discussed and the present and immediate future position of the " Humanities " was evaluated.

The president then stated that the Engineering Institute's stand was 100 per cent behind the proposal for the establishment of technical institutes. For many returned men with some technical aspirations the opportunity to attend a technical institute would make the difference between incurring disappointment because of an overly ambitious course dropped before its completion, and satisfaction with a more modest effort well done and completed.

General Secretary L. Austin Wright reported to the branch on the affairs of the Institute. He also cited examples to illustrate what a colossal task the universities are now undertaking and commended the universal spirit of cheerfulness found among their faculties.

Dr. Wright reminded the branch that its member Ross Dobbin is chairman of the E.I.C. Committee on Community Planning.

Immediately following the meeting a motion picture film depicting the construction and operation of the artificial harbour " Mulberry " was shown and explained by Dr. Wright. Mulberry represents a tremendous undertaking which was the successful accomplishment of British engineers to whom the entire credit is due.

QUEBEC BRANCH

Leo Roy, M.E.I.C. - *Secretary-Treasurer*
A. E. Paré, M.E.I.C. - *Branch News Editor*

Soirée des jeunes tenue dans l'amphithéâtre de la Faculté des Sciences de l'Université Laval le 10 décembre 1945.

La réunion fut présidée par M. J.-O. Martineau, président de la section de Québec de l'E.I.C., et groupa une centaine de personnes, parmi lesquelles se trouvaient les élèves de la Faculté des Sciences, à titre d'invités.

Au début, M. Paul Vincent, exhorta ces élèves à faire partie de l'E.I.C. en leur donnant les raisons pour lesquelles ils devaient en faire partie et en démontra les avantages.

M. Adrien Pouliot, doyen de la Faculté des Sciences de l'Université Laval, invité à dire quelques mots, parla des liens qui doivent exister entre les hommes de sciences dans nos universités et les ingénieurs de la pratique privée.

M. René Dupuis, Directeur du Génie électrique à la Faculté des Sciences de l'Université Laval, remit ensuite le prix de l'E.I.C. pour l'année 1945 à M. Pierre Grenier, élève de 4e année de la faculté. Ce prix fut décerné à M. Grenier pour succès obtenus en 3e année l'année dernière.

M. J.-P. Drolet avait intitulé sa causerie **Une industrie nouvelle: la tourbe.**

Il nous donna d'abord la liste de nos ressources en tourbières au Canada et spécialement dans la province de Québec.

Au point de vue valeur commerciale, la tourbe se classe en deux catégories: la tourbe humifiée et la tourbe non humifiée. La première est désignée généralement sous le nom de " tourbe combustible " et la seconde comme " tourbe de mousse ".

Les différents modes d'extraction, de séchage et de traitement furent décrits par le conférencier.

La tourbe peut servir à plusieurs usages dont les principaux sont: emballage des bulbes, des tubercules et racines durant l'hiver, à cause du grand pouvoir d'absorption d'eau qu'elles possèdent; litière pour animaux et volailles à cause de ses qualités hygiéniques; utilisation de son grand pouvoir d'absorption qui varie de quinze à vingt-cinq fois son propre poids pour les gaz et les liquides; amendement des sols; amortissement du son; isolation contre le froid en hiver et contre la chaleur en été; emballage d'aliments périssables; fabrication de bandages et de tampons pour chirurgiens et vétérinaires; fabrication de briques de construction poreuses et de faible pesanteur et pour le chauffage, etc.

Au point de vue chauffage, si l'on compare la tourbe au bois et au charbon, on trouve que la tourbe a un pouvoir calorifique moyen, à 25 pour cent d'humidité, de 6,800 b.t.u. par livre; le charbon Pennsylvanie anthracite de 12,900 b.t.u. par livre tandis que le bois franc moyen, à 25 pour cent d'humidité, de 6,500 b.t.u. par livre.

L'an dernier, la province de Québec a produit 1,500 tonnes de tourbe combustible. La plus grande partie de la production de la tourbe cependant est expédiée aux Etats-Unis pour servir comme litières dans les étables.

Le conférencier fut remercié par M. Maurice D'Amours.

Un film intitulé " Noranda " nous fit voir les diférentes étapes de la production du cuivre, depuis l'extraction du minerai jusqu'au raffinage électrolytique.

TORONTO BRANCH

Junior Section

I. S. Widdifield, M.E.I.C. - *Secretary-Treasurer*

A dinner meeting of the Junior Section was held in the Winchester Hotel on November 14th, at which four members of the Section spoke on subjects that were of interest to all present.

Captain Ron Milne outlined the work of the Canadian Engineers in Holland and on the Rhine during the latter days of the war. Lieutenant Wilf Brotherhood, who was second in command of a corvette on convoy duty and latterly O.C. of a mine sweeper, told of some of his experiences in the Atlantic.

Mr. Murray Wiler spoke on aircraft liaison in the United Kingdom. He outlined the difficulties and procedures carried on in co-relating aircraft production in England and in Canada with particular reference to the production of the Lancaster Bomber. Mr. R. S. Segsworth described the cyclograph. He stated that this piece of electrical equipment is rapidly gaining ground as a new engineering tool for determining properties of materials which previously could be obtained only by destruction of the sample.

Dinner meeting held by the Junior Section of the Toronto Branch. The group standing at the rear includes, from left to right, E. Ross Graydon, chairman; Murray Wiler; Lieut. Wilf Brotherhood; Ivan S. Widdifield, secretary-treasurer; Capt. Ron Milne; R. S. Segsworth; J. Courtright; and Douglas D. Stiles.

VANCOUVER BRANCH

A. M. Eyre, s.e.i.c. - - *Secretary-Treasurer*
P. B. Stroyan, m.e.i.c. - *Branch News Editor*

On Tuesday, December 12th, about forty members of the Vancouver Branch had the pleasure of listening to Brian R. Perry, m.e.i.c., give an address on **The Development of the Plant and Manufacturing Methods for Penicillin.** Mr. Perry, formerly of Vancouver and now a prominent consulting engineer practising in Montreal, was introduced by T. V. Berry, who gave a brief summary of the speaker's training and engineering experience. The history of penicillin was traced from 1929 when it was first noted that the secretion from a mould retarded the growth of certain bacteria. Experiments were later carried on at Oxford University and, as these progressed, it was realized that the drug had marvellous properties although little progress was made in its commercial production until, in 1942, United States Army officials, impressed with the possibilities of penicillin, were responsible for getting a large appropriation for intensive research in the development of practical manufacturing methods. Rapid progress was made on the " bottle " method of producing the drug in quantity and the U.S. Army used all that could be manufactured. In 1943 it was decided to set up a Canadian plant near Montreal, and Mr. Perry was retained to design and supervise the erecting of the plant. The speaker paid glowing tribute to the work of scientists and research specialists whose indefatigable efforts proved so successful. The various steps were traced from the growing of the mould, its incubation in small bottles and its use to innoculate the matrix in the production bottles. Sterile conditions had to be maintained throughout the factory, the various sections of which were isolated from each other to prevent the passage of foreign moulds. All air used had to pass through triple filters to keep out dust particles which might carry spores. Constant supervision of each process was insisted upon and any sign of the appearance of foreign mould was checked immediately. Photographs and diagrams showed the various stages of manufacture, as well as an interesting conveyor and nozzle contrivance for cleaning and sterilizing the production bottles ready for use again in the process, some seventy-five thousand of which were necessary to produce the desired quantities of the drug.

As with many other wartime discoveries which were hardly perfected before being out of date, the " bottle " method of producing penicillin has now been superseded by the " tank " method, the principle being the same in both cases.

Mr. Peebles thanked the speaker for his most instructive address and Mr. Pybus, branch chairman, also conveyed the appreciation of the meeting.

WINNIPEG BRANCH

A. T. McCormick, m.e.i.c. - *Secretary-Treasurer*
V. W. Dick, m.e.i.c. - *Branch News Editor*

A joint meeting of the Winnipeg Branch and the Manitoba Association of Professional Engineers was held in theatre E, University Building, on Thursday, January 10th, with G. R. Fanset as chairman. Two papers were presented, one on field engineering for naval constructions, by E. V. Gilbert, who had considerable experience during the war in responsible charge of naval constructions on the East Coast and Newfoundland; and the other on field engineering for military constructions, by Lt.-Col. W. A. Capelle, giving his experiences on military constructions in England and Europe.

Mr. Gilbert gave an illustrated talk on his experiences while on loan from the Department of Public Works to the Board in charge of naval constructions in Canada, and confined his paper to the naval constructions at St. John's, Newfoundland, as typical of naval construction work.

A number of interesting views of St. John's harbour and works were shown along with a detailed description of the various facilities constructed, which included wharves, jetties, floating dock, ammunition storage vaults cut in the solid rock, gasoline storage farm with pumping station and fire protection, marine railway, and other interesting constructions including a complete training centre for naval personnel at Buckmasters Field, and a naval camp constructed on the sloping shore of the harbour in order to be close to a number of important naval constructions.

D. A. McCuaig moved a hearty vote of thanks to Mr. Gilbert for his interesting and instructive paper.

Lt.-Col. W. A. Capelle was then introduced by the chairman, and presented his paper, which described some of the interesting construction work done by the 2nd Battalion R.C.E. while in England and in Europe. A number of maps, photographs and blue prints illustrated the works described, the first being a detailed description of the construction of an airfield in England used to defeat the German U-boats. This airfield had to be built in a very short time to be of any use in the U-Boat war, and under adverse conditions; the worst of these being the rainy season during which this work had to be undertaken.

Despite these difficulties, the airfield was finished on schedule, and contributed greatly to the defeat of Germany's Wolf Pack.

The battalion then spent a period of training constructing Bailey bridges, etc. Shortly after D-Day they moved to France, and their first job was to rehabilitate an airfield at Carpiquet; the greatest difficulty encountered being to watch out for the German Air Force.

At this time preparations were being made for the big push against the Germans, and the 2nd Battalion R.C.E. were given the task of building a by-pass around the ruined city of Caen to enable the Allied armies to follow up the Germans and keep them on the run. This by-pass included the construction of a road and a bridge, the chief danger being the proximity of the German army, and for a while they were under direct observation of the Germans, who for some unknown reason did not take advantage of their position, so that the work was completed on time.

The battalion then moved to the Seine, near Rouen, where they were kept busy maintaining roads, and in the removal and moving forward of bridges.

The next move was to the other side of Brussels with the 2nd British Army, where they built two permanent bridges over a canal; an interesting feature being the removal of the old bridge destroyed by the Germans, and at the same time keeping traffic moving on the canal during construction.

Mr. Capelle stated that the prefabricated bituminous surfacing for temporary airfields used in the defeat of the Germans was distinctly a Canadian achievement, and closed by paying tribute to the sapper in warfare, as the best of officers and equipment would be useless without the sappers, who carried out the work under dangerous and difficult conditions.

W. D. Hurst expressed the appreciation of the audience for the presentation of this interesting paper, and moved a hearty vote of thanks to the speaker.

Items of business taken up before the presentation of the papers included the report of the Nominating Committee by T. H. Kirby, and a report by H. L. Briggs on the formation of an Electrical Section of the Winnipeg Branch, the first meeting to be held Monday, January 14th, when Mr. Perry Peterson, president of the Control Corporation of Minneapolis, would be in Winnipeg and would present a paper.

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A special meeting of the Winnipeg Branch and the Manitoba Association of Professional Engineers, sponsored by the newly formed Electrical Section, was held in theatre E, University Building, on Monday, January 14th, with C. P. Haltalin as chairman, to hear Mr. Perry Peterson, president of the Control Corporation of Minneapolis, on the subject of **Centralized Control of a Power System.**

H. L. Briggs gave detailed information on the formation of the Electrical Section of the Winnipeg Branch E.I.C. and urged all those interested to send their applications in as soon as possible, in order that the Nominating Committee could present a slate of officers at the next meeting of an election to be held in the near future.

S. G. Harknett then introduced Mr. Peterson, who gave in detail the application of centralized control to large power systems, including remote control operation, indication, and telemetering, with a demonstration on sample equipment.

All control operations are conducted over a pair of wires, which can be a system telephone line, using A.C. or D.C.; or over a pair of wires on H.T. line poles using insulating transformers for A.C. only; or by telephone wires rented from the local telephone company; or by carrier current over H.T. transmission lines.

Mr. Peterson then demonstrated the sample equipment, with detailed explanations of all operations, and described the operation of the relays which used four frequencies of 210, 270, 330, and 390 cycles per second to effect all operations over a single pair of wires.

A description of two out of seven systems used for telemetering was described, the first being the electronic bridge method which requires a metallic circuit for its operation. The second was the time delay impulse system, in which the length of the signal indicates the position of the pointer on the meter. This system can operate over any type of communication system.

An interesting discussion period followed, during which the remote control of synchronizing of generators, or interconnecting systems, was described, and also the use of combinations of 4 or 5 frequencies to control large numbers of breakers, or indications in large station or system. The discussion period was closed by J. W. Tomlinson, who moved a hearty vote of thanks to the speaker for his very interesting and instructive paper.

Library Notes

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

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ADDITIONS TO THE LIBRARY

Effective Speech; including Public Speaking, Mental Training, and the development of personality; a complete course; 6 volumes:

By Dwight E. Watkins. Chic., Markus-Campbell, 1940. 7½ x 5¼ in., $10.00.

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88-23—Electro-Organic Chemical Preparation, 111; Sherlock Swann, Jr.—88-24—Electrodeposition of Nickel-Cobalt-Tungsten Alloys from an Acid Plating Bath, P. F. Hoglund and M. L. Holt.—88-25—Methods of Preparation of Aluminum for Electrodeposition, Helmer Bengston.—88-26—Electrodeposition of Copper; a Review of Recent Literature, Herbert Bandes.—88-27—Separation of Cadmium from Zinc by Electrochemical Means, W. H. Hammond.—88-28—Effect of Various Surface Treatments in Cleaning and Preparing Copper, Nickel and Steel for Chromium Plating, W. M. Tucker and R. L. Flint.

Harvard University. Graduate School of Engineering:

Publication:—No. 411—Classical Experiment Illustrating the Notion of "Jerk", P. Lecorbeiller. (Reprinted from American Jl. of Physics, June 1945). Deflection Sensitivity of Parallel-Wire Lines in Cathode-Ray Oscillographs, H. G. Rudenberg. (Reprinted from Jl. of Applied Physics, May 1945).—No. 412—On Saint Venant's Principle, R. v. Mises. (Reprinted from American Mathematical Society, Bull., August 1945).—No. 413—On the Vibrations of the Rotating Ring, G. F. Carrier. (Reprinted from Quarterly of Applied Mathematics, Oct. 1945).

National Research Council, Canada:

Release No. 1:

Preliminary Review of the Work of the National Research Council in 1945.

Ohio State University. Engineering Experiment Station:

Bulletin:—

No. 124—Massive Quartzite; a Refractory Material for Handling Molten Iron and Steel, A. R. Blackburn.

PAMPHLETS

Britain and the Veteran; ID 595:

N.Y., British Information Services, 1945.

British Trade Unions and the War:

John Price. London, Ministry of Information, 1945.

Canada's Burden of Taxation; Pre-War and Post-war:

Stuart Armour and others. Toronto, Oxford Univ. Pr., 1945.

Civil Engineering:

Careers for Men and Women Series. London, Ministry of Labour and National Service, 1945.

Electronics: Their Scope in Heavy Engineering:

W. G. Thompson. North-East Coast Institution of Engineers and Shipbuilders, Dec. 17, 1945.

Garbage and Sewage Disposal:

A. W. Fawkes. Moose Jaw, Sask., 1945.

Gas Producers for Motor Vehicles; Second General Report of the Sub-committee on Producer Gas of the Associate Committee on Substitute Fuels for Mobile Internal Combustion Engines; N.R.C. No. 1293:

E. A. Allcut and R. H. Patten. Ottawa, National Research Council, 1945.

Influence of the Earth's Rotation on Bubble Sextant Readings:

J. J. Green. (Reprinted from Aeronautical Engineering Review, Sept. 1945).

Information Circular for Prospective Geologists, Mining Engineers, and Metallurgists:

Canadian Institute of Mining and Metallurgy, 1945.

War-born Techniques for Peacetime Production; Report to Industry:

Westinghouse Electric Corporation, 1945.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

ABSTRACTS ON UTILIZATION OF SAWDUST; N.R.C. No. 1285:

By Muriel E. Whalley. Ottawa, National Research Council of Canada, 1945. 103 pp., mimeo., $1.00.

These abstracts on the "Utilization of Sawdust" were compiled for the purpose of presenting means of utilizing this extensive Canadian waste. The material has been divided into two parts, namely, 160 articles, which have been arranged according to author, and 152 patents, arranged chronologically, each with a subject index. The abstracts were collected from the following sources:—1.—Forest Abstracts, vol 1 - 5, (1939-1944). 2.—American Chemical Abstracts, vol 1 - 38, (1907-1944). 3.—British Abstracts, vol 1 - 61, (1882-1942). 4.—Agricultural Index, vol 1 - 10, (1916-1944).

AMERICAN BUILDING CODE REQUIREMENTS FOR REINFORCED GYPSUM CONCRETE—A59.1-1945:

American Standards Association, N.Y., 1945, $0.25.

This new standard reaffirms many of the detailed definitions of the standard originally approved in 1941, but adds to it the results of four more years of study and experience with reinforced gypsum concrete as a building material. The standard covers design, construction and use of reinforced gypsum concrete, a building material widely used in floors and roofs. A new section deals with the position of the slabs of gypsum concrete in relation to the floor beams and roofs when they are installed by the suspension system.

The standard is divided into five main sections, covering "Materials", "Strength of Gypsum Concrete", "Allowable Stresses", "Design", and "Inspection".

INTRODUCTION TO PRACTICAL RADIO:

By Durand J. Tucker. N.Y., Toronto, Macmillan, 1945. 322 pp., illus., 8½ x 6 in., cloth, $4.00 (in Canada).

A single text dealing with the basic fundamentals of radio, this book may be used as a stepping stone to more advanced books on the subject. The book provides a complete basis for radio work. Beginning with the basic electrical principles, it covers all laws, and fundamental working parts of radio. In addition, the necessary mathematical tools are supplied as needed. Theory is explained in a practical manner and in simple language. Numerous specific examples of the practical application of principles to actual radio construction and operation are included throughout.

Because of its thoroughness, this book is a valuable reference tool for practising radio engineers and technicians, as well as a complete manual for beginners.

PORTABLE NOVELS OF SCIENCE:

Selected and with introduction by Donald A. Wollheim. N.Y., Viking Pr., Toronto, Macmillan, 1945. 737 pp., 7 x 4½ in., cloth, $2.75 (in Canada).

This volume is the first comprehensive collection of the science-fiction novel. The editor has made an interesting analysis of this type of fiction in his introduction, and has included the books in the field which manage "to combine a sound imagination and believable prognostication with a sincere desire to set the reader thinking along concepts as large at least as the movement of earth's inhabitants as a whole."

Included, with a preface to each, are: The First Men in the Moon, H. G. Wells; Before the Dawn, John Taine; The Shadow out of Time, H. P. Lovecraft; and Odd John, by Olag Stapledon.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

AMERICAN CHEMICAL INDUSTRY, The World War I Period; 1912-1922, Vol. 2.

By W. Haynes, D. Van Nostrand Co., New York, 1945. 440 pp. illus., tables, 9¾ x 6½ in., cloth, $8.00.

First to be published of a projected six-volume history, this volume covers the period during which the American chemical industry was stimulated and affected by the First World War. The first five chapters describe the political and commercial setting of the period. The succeeding chapters cover developments in the field of critical raw materials such as nitrates, potash, phosphates, sulphur, various metals, naval stores, and crude drugs. Over 100 pages of statistical data are appended. A chemical chronology precedes the text, and there is a bibliography.

AMERICAN PETROLEUM REFINING.

By H. S. Bell. 3 ed. D. Van Nostrand Co., New York, 1945. 619 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $7.50.

Beginning with the characteristics and chemical and physical properties of crude oils, this concise reference work covers the various materials, processes and equipment which are necessary in the petroleum refining industry. The theory underlying the main processes is discussed as well as the practical applications. Allied topics such as bulk transportation are also considered. References are provided to more expanded treatments of the various topics covered in the book.

APPLIED ENERGY CONVERSION, a text in Power Plant Engineering.

By B. G. A. Skrotski and W. A. Vopat. McGraw-Hill Book Co., New York and London, 1945. 509 pp., illus., diagrs., charts, tables 9 x 5¾ in., cloth, $5.00.

The authors of this text in power-plant engineering cover the equipment and economics of industrial and central station power plants, describing the characteristics and performances of the major elements, and discussing the coordination of equipment for the generation of energy from a physical and economic viewpoint. No attempt has been made to present an extensive treatment of structural details or design. The newer developments in gas turbines and wind turbines, as well as special and European types of steam generators are included.

AUTOMOTIVE CHASSIS (without Powerplant).

By P. M. Heldt. Publ. by P. M. Heldt, Nyack, N.Y., 1945. 583 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $6.00.

This final volume of a series of four on automotive engineering deals with the various parts of the automotive chassis, with the exception of the powerplant. It discusses the functions of these parts—frames, springs, wheels, gears, brakes, etc.—their theory, the materials of which they are made, and their design. Rules for the proportioning of parts are given, and a brief historical survey of developments is included in some cases. Production processes are not covered except in cases where special methods yield superior results.

CALCULUS for PRACTICAL ENGINEERS in a simple, quick Engineering Way.

By A. Cibulka. Send orders to Clarke & Courts, Houston, Texas, 1944. 100 pp., illus., diagrs., tables, 12 x 9½ in., paper, $3.00.

The basic equations and functions are given from algebra through trigonometry, analytic geometry, differential and integral calculus to differential equations. The processes of differentiation and integration are described in simple, practical language, with applications to a number of actual and varied engineering problems.

Data Book for Civil Engineers, DESIGN.

By E. E. Seelye. John Wiley & Sons, New York; Chapman and Hall, London, 1945. diagrs., charts, tables, 12 x 9¼ in., cloth, $7.50.

This first volume of a three-volume set presents a considerable amount of effective data necessary for design procedures in the main fields of civil engineering: structures, sanitation, water supply, drainage, roads, airfields, dams, docks, bridges, and soils. The object is to provide a single reference volume for the engineer whose work may spread into fields outside his specialty. The two subsequent volumes will consist of a field manual and a book containing cost data and model specifications.

DAVISON'S KNIT GOODS TRADE, "The Standard",

Fifty-fifth Annual, October 1945, Pocket edition. Davison Publishing Company, Ridgewood, New Jersey, 1945. 736 pp., illus., maps, 8 x 5 in., cloth, $5.50, Pocket ed.; $6.50, De Luxe Office ed.

The 1945 edition of this well-known directory follows the pattern of previous issues and provides a complete, up-to-date register of manufacturers of knit goods arranged geographically and by-products. Spinners, dyers, wholesalers, and chain and large retail stores are also listed as well as other information pertaining to the trade.

DIESEL-ELECTRIC PLANTS.

By E. J. Eates. American Technical Society, Chicago. 2 ed. 1945. 272 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.75.

The purpose of this book is to deal with the coordinated aspects of the specialized subject, owing to the influence of the characteristics of the Diesel engine on the electrical equipment involved. These important characteristics are described first, followed by a description of the types of generators suitable for Diesel engine drive. Important topics covered include voltage regulation, automatic synchronizing, engine governors, automatic controls, electric starting, installation and maintenance practice, and Diesel-electric locomotives.

ENGINEERING ALLOYS, Names, Properties, Uses.

By N. E. Woldman and R. J. Metzler. 2 ed. American Society for Metals, Cleveland, Ohio, 1945. 832 pp., tables, 9¼ x 6 in., cloth.

Section I of this compilation is an alphabetical list of alloys with corresponding serial numbers. In the more than 400 pages of Section II are given the alloy trade name, composition, properties, uses and key numbers designating the manufacturers. The alloys are here listed by serial number. Section III is an alphabetical subject index of special characteristics and typical uses. Section IV is a directory of manufacturers with their addresses and a summary of the alloys produced by each. A key index to manufacturers lists them by the designating numbers as used in Section II. A useful data appendix includes also a classification of corrosion and heat resistant alloys. Some 12,500 entries appear in Section II in the new edition as compared with 8,200 in the first edition.

EVERYDAY PROBLEMS IN ECONOMICS.

By M. Wood-Simons. American Technical Society, Chicago, 1945. 544 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.50.

The opening chapter presents a historical background of our economic structure. Succeeding chapters discuss the production, distribution and consumption of economic goods; markets and trading; mining and agriculture; capital and labor; profits and wages; money and banking; foreign exchange and tariffs; etc. In general the material is presented from the viewpoint of consumption and the consumer. A twenty-page, specialized dictionary of economic terms is appended.

FUNDAMENTAL THEORY of SERVOMECHANISMS.

By L. A. MacColl. D. Van Nostrand Co., New York, 1945. 130 pp., diagrs., charts, 9¼ x 6 in., cloth, $2.25.

The advance in the art of automatic control is essentially the development of the modern servomechanism in which a change of condition affects the mechanism which in turn changes the condition, etc. This book is concerned mainly with the general theory which is applicable to all linear continuously operating servomechanisms, with emphasis on its identity with the theory of feedback amplifiers. Some particular servomechanisms are discussed briefly, but no serious attempt is made to deal with the details of practical design.

(*Continued on page 136*)

PRELIMINARY NOTICE

for Applications for Admission and for Transfer

January 26, 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 March meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

A member shall be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examination of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations or Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiner that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall nor remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty seven years, 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 attainment 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

BIRD—DAVID ADDAGH GODFREY, of 7 Powell Ave., Toronto. Ont. Born at Toronto, Ont., Jan. 24th, 1916. Educ.: Graduate, Royal Military College, 1939; Graduate, Military Coll. of Science, Stoke-on-Trent, Eng., enlisted, Permanent Force, as Lieut., became Ordnance Officer at Camp Borden 1944; 1939, (6 mos.) control chemist, Hudnut & Warner, Ltd., Toronto; 1939-42, & Halifax (M.D. 6), promoted to Capt., 1942, embarked for overseas, 1942-43, promoted to Major, 2nd in command, No. 3 Sub. Depot C.B.O.D., 1943-45, at Military College of Science, then seconded to British Ministry of Supply, as Deputy Asst. Dir. of Artillery, involving design of & modification to artillery equipts. & assoc. stores, investigation of defects arising during use, 1945, (Oct.) retired for health reasons, and at present temporarily employed.
References: C. J. Printz, L. F. Grant, H. E. Brandon, W. S. Wilson, G. Walsh, C. R. S. Stein.

B:ACKBURN—GERALD ALLEN, Major, R.C.E.M.E., of Aylesford, N.S. Born at Aylesford, N.S., April 23rd, 1914. Educ.: B.Eng., Nova Scotia Tech. Coll., 1935; R.P.E., Nova Scotia; with St. F. Xavier Univ., as follows: 1936-38, instructor machine design drawing, applied mechanics & mathematics, 1938-40, asst. prof. applied mechanics & mathematics, and head, dept. of engrg'; and during the period consultg. engr. for the Institution; 1940, joined R.C.E.M.E., training in Canada, 1941, Military Coll. of Science, Woolwich, Eng., 1941-42, District Ord. Mech. Engr., Military Dist. No. 5, responsible for repair and mtce. of all vehicles, wagons, etc., of Ordnance, 1942-43, lecturer in gun constrn. at Ordnance Training Centre, 1943-45, Staff Capt., then Major and Deputy Asst. Q.M.G., Army Equipt., responsible for co-ording provision, repair and mtce. of all unarmoured vehicles in 21 Army Group, and at present head of dept. of physics, Khaki Univ. of Canada, England.
References: A. O. Monk, F. L. West, N. C. Sherman, G. H. Burchill, A. C. Davidson.

CLARKE—JAMES MURDOCH, Lt. (E)., R.C.N.V.R., of Montreal, Que. Born at Westville, N.S., Nov. 30th, 1921. Educ.: B.Eng., (Mech.), McGill Univ., 1944; 1941-42, (summers), asst. to chief engr., Dominion Oilcloth & Linoleum Co. Ltd., Montreal, prod. control work, Electric Tamper & Equipt. Co. Ltd., Montreal; 1944 to date, with R.C.N.V.R., as Engr. Officer on H.M.C.Ss., Royalmount ,New Liskeard, Portage.
References: E. Brown, A. R. Roberts, R. H. Patten, G. J. Dodd, C. M. McKergow.

COOTE—ALEXANDER HARCUS, Lt. (A/E), R.C.N.V.R., of Montreal, Que. Born at Montreal, Jan. 21st, 1920. Educ.: B.Eng., (Mech.), McGill Univ., 1943; 1940-42, (summers), Conarium Gold Mines, Noranda Mines Ltd., D.I.L., Verdun; 1943 to date, with R.C.N.R.V., as qualified marine engr., in latter practise held responsible job at an R.N. air station servicing Seafire Aircraft.
References: J. A. Coote, C. M. McKergow, F. M. Wood, R. De L. French, A. R. Roberts.

JANKOWSKI—JERZY W., of 43 Forest Ave., Hamilton, Ont. Born at Lodz, Poland, Dec. 26th, 1897. Educ.: Mech. Engr., Politechnika, Warsaw, Poland, 1928, (educational qualifications guaranteed by Assn. Polish Engrs. in Canada); R.P.E., Ontario with Warsaw Locomotive Works as follows: 1928-31, dftsman. & designer, 1931-34, designer & estimator; 1935-39, i/c design, (compres. air dept.), Metallurgical Works, Ostrowizc; 1939, on active duty with Polish Army as Captain; 1940, designer, Westinghouse Air Brake Co., Paris, France; 1941-42, genl. engrg., Montreal Locomotive Works; 1943, chief engr., Buffwel Engrg. & Machinery Co., Welland, Ont.; 1943 to date mech. designing engr. Hamilton Bridge Co., Hamilton, Ont.
References: W. B. Nicol, A. Love, W. S. Macnamara, H. J. A. Chambers, C. C. Parker.

KEARNS—JOHN EDWARD, of 3495 Van Horne Ave., W., Montreal, Que. Born at St. John, N.B., June 26th, 1914; Educ.: Sir George Williams Coll., Engrg. & Dfting., (evenings), 1943; 1931-38, with Beauharnois Power Project, Consumers Glass Co., Ltd., Dominion Textile, Valleyfield; 1938-41, Montreal Locomotive Works, Montreal, asst. to chief engr., power plant; with Defence Industries, as follows: 1941-44, sr. power supt., Villeray, 1945 to date, sr. power supt., Cherrier Works, St. Paul l'Ermite.
References: C. R. Bown, H. C. Karn, G. H. Archibald, H. M. Esdaile, W. M. Kellett.

LOCKWOOD—ROBERT ORVILLE, Capt., R.C.E.M.E., of 504 Clarence Ave., N., Saskatoon, Sask. Born at Dadivson, Sask., July 18th, 1920. Educ.: B.Sc., (Mech.), Univ. of Saskatchewan, 1942; 1941 to date, with R.C.E.M.E., (3 years overseas).
References: R. A. Spencer, N. B. Hutcheon.

MASON—ERNEST, of 1930 Oak St., Trail, B.C. Born at Bolton, Lancs., England, April 3rd, 1895. Educ.: Bolton Tech. School, 1916, 1917, 1919; Manchester Coll. of Technology, (assoc. course in mech. engrg.), 1920-22; R.P.E., British Columbia; 1913, machinist, B. Greening Wire Co., Hamilton, Ont.; 1916, Homer & Wilson, Hamilton; tool designer, Rolls Royce Co., England; 1917-22, machine designer with the following companies; Dobson & Barlow, Bolton, Hans Renold Ltd., Manchester, Thomas Ryder and Chatwood Safe Co., both of Bolton, Eng.; with Consolidated Mining & Smelting Co., Trail, B.C., as follows: 1922-35, designer, (genl. engrg.), 1935-41, chief dftsman., 1941-45, asst. to chief engr., and at present, chief designing engr.
References: E. M. Stiles, S. C. Montgomery, A. S. Gentles, G. H. Bancroft, C. E. Marlatt, A. C. Ridgers.

McLEAN—DONALD D., of 1486 Chomedy St., Montreal, Que. Born at Ottawa, Ont., Aug. 26th, 1921. Educ.: B.Sc., (Elect. Engrg.), Queen's Univ., 1943; R.P.E., Ontario 1941, (summer), dftsman, Inspection Board, Ottawa; 1942, (summer), jr. radio engr., Canadian Marconi Co.; 1943-45, with R.C.N.-V.R., as Elect. Lieut. (R), and for two years on loan to Royal Navy as Radar Officer, involving instalns., mtce. & genl. responsibility for all Radar equipt., on the ship (cruiser); at present radio engr., Canadian Marconi Co., Montreal.
References: D. M. Jemmett, R. A. Low, N. B. MacRostie, J. L. Rannie, A. A. Swinnerton.

PLOW—GORDON LOCKLIN PATRICK, of Quebec City, Que. Born at St. Albans, Vt., June 27th, 1902. Educ:. B.Sc., (Civil), McGill Univ., 1924; 1925-29, Chicago, Rock Island & Pacific Rly., as follows: asst. engr., yard & terminal, traffic studies, instru'man., constrn., Kansas, res. engr., new line constrn., Texas, instru'man., mtce, Iowa, Illinois and Missouri, transitman, location surveys; 1929, (6 mos.), instru'man., Canadian National Railways; 1929-30, field engr., Purdy & Anderson Co.; 1930-31, with C.P.R., Bridge Dept., res. engr., Maine; 1931, (10 mos.), engr., Canadian Airways Ltd., Montreal; 1931, (1 mo.), instru'man., City of St. Johns, Que.; 1932, (4 mos.), engr., City of Westmount, Que.; 1932, (4 mos.), dftsman. & inspctr., Fred B. Brown, Montreal; 1932-36, engr., City of Westmount; 1936, (5 mos.), dftsman., C.P.R., car dept.; 1936-41, instru'man., mtce. & constrn., C.N.R., Quebec dist.; 1941-46, R.C.E., Canadian Army (A), with the rank of 2/Lt., Lieut., Capt., and finally Major, now repatriated and demobilized, and at present, asst. divn. engr., Canadian National Railways, Laurentian divn., Quebec, Que.
References: S. J. Waller, J. E. Dumontier, C. B. Bate, J. B. Stirling, G. E. Shaw, P. J. Delgado, J. F. Plow.

SMITH—PAUL DORRIAN, of 163 Jackson St., West, Hamilton, Ont. Born at Vancouver, B.C., Jan. 29th, 1915. Educ.: B.A.Sc., Univ. of British Columbia, 1938; R.P.E., Ontario; 1938-40, apprentice course, Can. Westinghouse; 1942-45, First Can. Army Signals (Overseas), served as wireless advisor to Chief Signal Officer, work involved carrying out of comprehensive tests on all new types wireless equipt., drawing up performance specifications for proposed equipt., doing some of the engrg. work involved in installing complete stations in vehicles and tanks, responsible for setting up wireless link between Can. H.Q. in London and Can. Army Base in North Africa, in 1944 promoted to rank of Major, in France, Holland & Germany in addition to setting up & operating complex wireless network, was frequently called upon to carry out special jobs for which engrg. work was required; at present engr. on the design of metal enclosed switchgear, Canadian Westinghouse Co., Ltd., Hamilton, Ont.

References: P. M. Smith, E. M. Coles, H. A. Cooch, H. O. Peeling, G. L. T. Vollmer, J. R. Dunbar, W. L. Laurie.

SUTTIE, EARLE RITCHIE, Brigadier, of Montreal, Que. Born at Yarmouth, N.S., Feb. 23rd, 1909. Educ.: Graduate, Royal Military College, 1932; 1933-34, asst. engr., Dartmouth Airport project; 1934-36, asst. engr., plant & prod. mgr., Corbett-Cowley Ltd.; 1936-39, plant engr., Brandram-Henderson, Ltd., Montreal; 1939 to date, C.A.O., Lt. Col. I/C., 1st Cdn. Svy. Regt., Counter Battery Officer, 1st Cdn. Corps, and latter Brigadier, Commanding "A" Group, C.R.U., moved from Italian theatre to N.W. Europe, commanding group of Artillery Regiments until after V.E. Day, and in this theatre won the D.S.O.

References: E. G. M. Cape, L. F. Grant, W. D. Kirk, G. H. McKee, J. M. Cape.

WALKINSHAW—WILLIAM MAXWELL, Capt., R.C.E., of Toronto, Ont. Born at Truro, N.S., May 29th, 1912. Educ.: B.Sc., (Civil), Univ. of Toronto, 1939; R.P.E., Ontario; 1939, (4 mos.), asst. to field engr., Canadian Dredge & Dry Dock, on constrn. Toronto Harbour head wall; 1939-40, (8 mos.), instru'man., Sudbury Divn., i/c running spurs into D.I.L. plant at Nobel, C.P.R.; 1943-45, Overseas with R.C.E., 1945, Khaki Univ. of Canada, vocational extension course; and at present attached to Sir Alex. Gibb & Partners, consultg. civil engrs., London, Eng., employed as engr. & salaried member of staff in hydraulic dept., investigating & collating data, estimating costs & assisting in preparation of report on combined irrigation & hydro-electric scheme for Persia.

References: W. E. Bonn, E. A. Cross, E. M. Proctor, R. F. Legget, R. A. Rule, H. W. Tate.

WALTON—ERNEST NORMAN, of 5795 de Gaspe St., Montreal, Que. Born at Ladysmith, B.C., June 5th, 1914. Educ.: B.Sc., (Elect. Engrg.), Univ. of British Columbia, 1942; with Phillips Electrical Works, Montreal, as follows: 1942-43, supvr. development prod. & testing of 7 quad. tele. cable for U.S. Signal Corps, 1943-44, chief high voltage tester in test dept., 1944 to date, asst. foreman of lead & impregnating dept. and foreman power cable & armouring depts.

References: J. W. Brackinreid, W. W. Ingram, J. N. Finlayson, J. H. MacLeod, G. A. Wallace.

WAROWAY—ROBERT R., of Regina, Sask. Born at Winnipeg, Man., March 6th, 1909. Educ.: 1930-32, prod. engrg., plant supervision, time-study, develloped a mech. coil impregnating machine, supervn. of design & instaln. of equipt. of machine shop used for experimental work, developed testing equipt., for research & develpt. of coils for short wave receivers, etc.; 1932-35, sales engr., asst. sales mgr., for western provinces, tech. assistance, testing & recommending changes to be made in any manufactured products, Grimes Radio Corp., Kitchener, Ont.; 1936-45, asst. to chief engr., dfting. & in complete charge constrn. & power mtce. of power plant equipt., time-study and prod., promoted to ch. engr. i/c power, steam, refrign., air comp., machine design, later, consultg. engr., for three plants owned by Western Breweries Ltd., designed & constructed space saving storage cellar smaller by 60% as in respect to other conventional methods, etc., and at present chief engr. & supt. i/c mech. machine, plant design, steam & elect. power & prod. engrg., and consultg. engr., for three plants operated by this company, Drewry's Limited, Regina, Sask.

References: F. E. Estlin, C. B. Jackson, J. N. De Stein, J. W. D. Farrell.

WATT—ANDREW GIBB, of Saint John, N.B. Born at Passilpark, Glasgow, Scotland, Oct. 31st, 1901. Educ.: Royal Tech. Coll., Glasgow, (evenings), 1917-19; 1916-22, ap'ticeship with Armstrong & Main, Ltd., struct'l. engrs., Glasgow, 1924-25, dftsman., (structl.), Harland & Wolff Ltd.; 1925-26, sr. structl. dftsman., P. & W. MacLellan, Ltd., Glasgow; 1926-27, checking structl. dftsman., Sir. Wm. Arrol Ltd., Glasgow; 1927, dftsman., Caledonia Shipb. Co., Dundee; 1927-29, structl. dfstman. & checker, Canadian Vickers Ltd., Montreal; with St. John Drydock & Shipb. Co., as follows: 1929-40, ch. dftsman., 1940-42, personnel mgr.; 1942-43, personnel mgr., Foundation Maritime Ltd., Pictou Shipyard; 1943-45, ind. relations & personnel dir., Ferguson Industries, Pictou, N.S.; and at present chief dftsman, structl. steel dept., St. John Drydock & Shipb., Co. Ltd., Saint John, N.B.

References: J. N. Flood, V. S. Chesnut, H. W. McKiel, A. A. Turnbull, S. Hogg, H. A. Stephenson.

YOUNG—RICHARD HENRY, Major, R.C.E., of Vancouver, B.C. Born at Vancouver, B.C., March 1st, 1909. Educ.: Polytechnic Coll. of Engrg., Oakland, Calif., 1929-11, (not accre. E.C.P.D.); 1927-28, rod & instru'man., Stuart Cameron, Vancouver; 1928-29, rest. engr's asst., Cassidy's Tacoma, Wash., 1930, (4 mos.), engr.'s asst., Stuart Cameron, Vancouver; 1931-32, comc. form & steel details, Northern Construction; 1932-37, spent with various contractors on constrn. work as a labor, concrete, carpenter, reinforc. steel & millwright foreman, with view to learning all aspects of bldg. constrn.; 1937-39, bldg. supt., Bennett-White Construction Co.; 1941 to date, with R.C.E., Overseas, and at present Deputy Commander Works.

References: H. W. Love, G. Walsh, J. L. Melville, J. C. Oliver, J. P. Carriere, W. G. Swan.

FOR TRANSFER FROM THE CLASS OF JUNIOR

LILLEY—LEDFORD GEORGE CHESTER, Lieut. Col., R.C.E., of Ottawa, Ont. Born at Saint John, N.B., June 11th, 1913. Educ.: B.Sc., (Elect. Engrg.), Univ. of New Brunswick, 1935; jr. engr., National Harbours Board; 1937-38, jr. engr., Public Works, Canada; 1938-39 plant dept., Bell Telephone Co. of Canada; with R.C.E., as follows: 1942-44 Corps of R.C.E., Overseas, as Major, O. C., 3rd & 1st Fd. Coys., 1944-45, Lt. Col., R.C.E., 2 Cdn. Corps R.C.E. & C.R.E., 2 Cdn. Div.; and at present Executive Officer, Corps of R.C.E., Army Bldg., N.D.H.Q., Ottawa, Ont.

References: G. Walsh, J. P. Carriere, F. C. Jewett, E. O. Turner, V. S. Chesnut, H. Kennedy.

FOR TRANSFER FROM THE CLASS OF STUDENT

BALL—WILLIAM HENRY WARREN, of 607 Huron St., Toronto, Ont. Born at Grand Falls, N'fld., Nov. 6th, 1923. Educ.: B.Eng., (Elect.), Nova Scotia Tech. Coll., 1944; jr. elect., wiring & instaln., E.G.M. Cape & Co., Torbay, N'fld.; land surveyor, appraisal of city lots, Housing Commission, St. John's, N'fld.; 1944-45, with Canadian Army Active, R.C.E.M.E. as Lieut.; and at present post-graduate study leading to degree of M. A. Sc., Univ. of Toronto.

References: F. H. Sexton, D. S. Nicol, S. Ball, S. J. Hayes, G. H. Burchill, H. A. Ripley.

BROWN—GEORGE CAMERON, of 114 St. John St., Quebec City. Born at Woodstock, Ont., Aug. 7th, 1916. Educ.: B. Eng., (Elect.), McGill Univ., 1940; 1940-41, cable testing & circuit balancing, Bell Telephone Co.; 1942-45, with R.C.A.F., as Tech. Adjutant, Jarvis, Ont., Squadron Engr. Officer and Chief Tech. Officer; and at present, design of outside plant facilities, dist. engr.'s office, Bell Telephone Co. of Canada, Quebec City.

References: J. A. Loy, W. J. S. Dormer, R. H. Vaughan, L. Buteau.

HENSLEWOOD—EDWARD WILTON, Lt. Col., R.C.E., of Ottawa, Ont. Born at Winnipeg, Man., Sept. 24th, 1915. Educ.: B. Sc., (Elect. Engrg.), Univ, of Manitoba, 1937; 1937-39, engr., Canadian General Electric; 1942-45, with AF as Major, Commanding 2 Cdn. Fd. Coy., Staff Officer, Cdn. Planning Staff, London, Commanding 9 & 18 Cdn. Fd. Coy., Royal Engineers, 2 Cdn. Inf. Div., as Lt. Col., and at present, Q.M.G.Br., N.D.H.Q., Ottawa.

References: E. P Fetherstonhaugh, J. L. Melville, G. Walsh, J. P. McKenzie, J. W. Ross.

MacCOY—GERALD BATES, of 61 Maple Avenue, Shawinigan Falls, Que. Born at Saskatoon, Sask., Feb. 21st, 1918. Educ.: B.Sc., (Mech.), Univ. of Saskatchewan, 1942; 1941, (summer), dfting., Sask. Power Commission; 1941-44, Lieut., R.C.E.M.E., Overseas; and at present designing dftsman., engrg. dept., Shawininigan Chemicals Lts., Shawininigan Falls, Que.

References: J. S. Whyte, H. K. Wyman, C. R. Morris, R. A. Spencer, I. M. Fraser, N. B. Hutcheon.

MONTI—THOMAS ATTILIO, of 4188 Northcliffe Ave., Montreal, Que. Born at Venice, Italy, March 8th, 1917. Educ.: B.A.Sc., C.E., Ecole Poly., 1941; 1940-43, (summers), res. engr., Dept. of Roads; mech. designer, Dominion Bridge; 1943-44, engr., Colonial Industries; 1944-45, tech. adviser, Frontenac Machine Shop; 1945, (part), tech. adviser, Standard Machine Shop; and at present, assistant, Ecole Poly., Montreal.

References: A. Circe, H. Gaudefroy, R. Boucher, K. O. Whyte, J. A. Hurtubise, J. A. Beauchemin.

MUNDEE—LAWRENCE STERLING, of Saint John, N. B. Born at Saint John, N.B., March 1st, 1921. Educ.: B.Sc., (Elect. Engrg.), Univ. of New Brunswick, 1943; R.P.E., Ontario; 1940-42, (summers), with N.B. Electric Commission, as student engr., surveying power lines into R.C.A.F. airports, working with constrn. crew building distribution lines, dfting. in engrg. office; also, with Packard Electric Co., assembly work in factory on transformers, transformer test dept., engrg. design office; 1943-45, Elect. Lieut., with Dir. of Electrical Supply at N.S.H.Q., Ottawa; and at present, asst. equip. engr., N.B. Telephone Co. Ltd., Saint John, N.B.

References: R. M. Richardson, G. A. Vandervoort, A. A. Turnbull, A. F. Baird, K. V. Cox.

PHOMIN—BARNEY LOUIS, of Winnipeg, Man. Born at Winnipeg, Man., March 28th, 1915. Educ.: B.Sc., (Civil), Univ. of Manitoba, 1938; 1938-39, (summers), dftsman., reinforced concrete, Dominion Bridge Co., Winnipeg; 1938-39, P/O., R.C.A.F., Trenton, Ont.; 1940-42, Asst. Engr., i/e Constrn. at No. 10, S.F.T.S., Dept National Defence, Dauphin, Man.; 1942-45, Lieut., R.C.E., and at present Camp Engineer Officer, Fort Osborne Barracks, Winnipeg, Man.

References: E. P. Fetherstonhaugh, G. H. Herriot, A. E. Macdonald, G. N. Range, N. M. Hall, W. F. Riddell, J. N. MacLean.

RIGSBY—DAVID LORREN, of 198 Albert St., Kingston, Ont. Born at Galt, Ont., April 15th, 1917. Educ.: B.Sc., (Mech.), Queen's Univ., 1940; 1940, (6 mos.), dftsman., Sheldons Ltds., Galt, Ont.; 1940-42, aircraft inspectn., supervn. of contracts, co-ord. of supplies, British Air Commission, Washington, D. C.; with Aluminum Co. of Canada, Kingston, Ont., as follows: 1940-45, prod. engr., and at present engrg. expeditor & co-ordinator.

References: D. S. Ellis, A. L. Clark, N. P. Taylor, M. G. Saunders, R. A. Low, A. Jackson.

SLATER—STEWART, of 2920 Van Horne Ave., Montreal, Que. Born at Kingston, Ont., June 9th, 1914. Educ.: B.Sc., (Civil), Queen's Univ., 1938; Graduate, R.M.C., 1937; 1939-45, R.C.E., on constrn. of defence works. Halifax, constrn. military camps, England, constrn. of accommo., bridges & roads, Europe, and at present attached to D.E.O. Staff, Hdqts., Military District No. 4, Montreal, Que.

References: D. S. Ellis, R. A. Low, L. F. Grant, W. L. Malcolm, A. S. Rutherford.

STEELE—OWEN STEVENSON, of Birkenhead, Eng. Born at St. John's N'fld., June 23rd, 1921. Educ.: B.Eng., (Elect.), Nova Scotia Tech. Coll., 1944; 1944 to present, R.C.N.V.R., mtce. of elect. equipt. on H. M. Minesweepers as Sub. Lieut., H.M.S. Onset, M/S Base, Norfolk Dock, Birkenhead, England.

References: F. H. Sexton, D. S. Nicol, G. H. Birchall, S. Ball, J. W. March.

TOPHAM—WILLIAM RICHARD, of McMasterville, Que. Born at Togo, Sask., Feb. 26th, 1918. Educ.: B.Eng., (Civil), Univ. of Saskatchewan, 1940; 1940, (4 mos.), prod. work & material control, Ottawa Car & Aircraft; 1940-41, design & dfting, structl. & mech., plants layout, Defence Industries Ltd., Montreal; 1941-42, ind. relations, plant efficiency & time study, Canadian Industries Ltd., Beloeil, Que.; 1942-45, R.C.A.F., as Tech. Adjutant Officer i/c Aircraft, & Sq. Engr. Officer; and at present asst. works engr. i/c plant constrn., Canadian Industries Ltd., Beloeil, Que.

References: R. A. Spencer, N. B. Hutcheon, R. Peterson, W. M. Diggle, G. A. Cowan.

WHILLANS—THOMAS GEORGE DOUGLAS, of 22 Sunset Blvd., Ottawa, Ont. Born at Kingston, Ont., Feb. 9th, 1921. Educ.: B.Sc., (Mech.), Queens' Univ., 1944; R.P.E., Ontario; 1942, (summer), machine shop, E. B. Eddy Co., Ltd., Hull, Que.; 1943, (summer), dftsman., J. R. Booth Ltd., Ottawa; 1943 to date, Lieut. (E.M.E.), R.C.E.M.E., C.A.

References: D. S. Ellis, C. M. Johnston, T. Foulkes, A. N. Ball, R. O. MeGee.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET,
MONTREAL 2, QUE.

3

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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.

NOTICE

SERVICE PERSONNEL: The completed rehabilitation questionnaires have indicated a need for the employment service to be made available to all members of the E.I.C. in the Armed Forces. It is suggested that all those who are interested—
1. **Consider these positions as indicative of present conditions.**
2. **Reply to interesting advertisements to establish contact for the future.**
3. **Apply for any of these positions when discharge is imminent.**

CIVILIAN TECHNICAL PERSONNEL should not reply to any of the advertisements for situations vacant unless—
1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**
   A person's services are considered available only if he—
   (a) is unemployed;
   (b) is engaged in work other than of an engineering or scientific nature;
   (c) has given notice as of a definite date; or
   (d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.

Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER, recent graduate, is required by a company in the Montreal area to learn glass making. Salary would be $175. to $200. a month. Apply to Box No. 3225-V.

JUNIOR CHEMIST, with university degree in chemistry, or chemical engineering, is wanted for the research department of a firm engaged in the manufacture of dry colours and white lead in the Montreal area. Work would consist of laboratory research and some plant control. Salary would be about $175. a month. Apply to Box. No. 3229-V.

CHEMIST OR CHEMICAL ENGINEER, preferably veteran, age 28-40 with ability to express himself clearly and possessing analytical mind, is required in Ottawa for patent work. Some familiarity with this type of work and a knowledge of foreign languages would be useful. Salary about $275. a month. Apply to Box No. 3231-V.

CHEMICAL ENGINEER with at least two years' experience in organic chemistry is wanted by a large manufacturing company in Montreal. Salary about $225. Apply to Box No. 3237-V.

SEVERAL CHEMICAL ENGINEERS for technical service and plant operations, (not laboratory work) with good personality and background are required by a manufacturer in Montreal. Preference will be given to ex-service men and successful candidates will be completely trained at a starting salary of $170. per month. Apply to Box No. 3260-V.

CHEMICAL ENGINEER preferably with graduate training in chemical engineering and some industrial experience will shortly be required in the chemical engineering department of a university in Ontario. Apply to Box No. 3280-V.

CIVIL

CIVIL ENGINEER, young and preferably bilingual, for surveying and supervisory work on sewer construction, is required by a contractor in the Montreal area. Salary would be $175. up according to qualifications. Apply to Box No. 3228-V.

STEEL BRIDGE INSPECTOR, not necessarily a graduate but with good experience, is wanted by a railway company with headquarters in Montreal, to supervise the erection and repair of steel bridges. Salary about $250. a month. Apply to Box No. 3246-V.

ENGINEER SALESMAN, preferably returned man under 40, with some road-building experience is wanted in Toronto by a firm engaged in the manufacture of asphalt emulsions. Apply to Box No. 3250-V.

ASSISTANT TO PURCHASING AGENT is wanted by a consulting engineer in Montreal. Candidates should be 23 to 28 years old, not necessarily graduates but preferably with some experience in construction work. Salary about $175. a month. Apply to Box No. 3254-V.

SALES ENGINEER with knowledge of building materials, preferably discharged service man with sales ability and inclinations, is required by a manufacturer in Montreal. Successful candidate will have opportunity to become head of this department. Salary is open according to qualifications. Apply to Box No. 3263-V.

CIVIL ENGINEER, graduate with road construction experience, preferably bilingual, age 30-45 years, is required to act as sales engineer for a manufacturer of building materials in Montreal. Candidates should have good personality and appearance to be able to contact government officials, sit in at council meetings, etc. Apply to Box No. 3264-V.

CIVIL ENGINEER, veteran from recent graduate up, is required to act as structural designer for a steel company in the Montreal area. Salary would be from $200. a month up according to experience. Apply to Box No. 3271-V.

CIVIL OR MECHANICAL ENGINEER with experience in plant layout, structures, steam plants, etc. is required by a mining company in Ontario for work in connection with changes in mining and smelting operations. Apply to Box No. 3285-V.

ELECTRICAL

ELECTRICAL ENGINEER with five to ten years' experience in industrial plants, age 30-40, preferably but not necessarily bilingual, is required for plant engineering, maintenance work, etc., in a new factory in the Montreal area. Salary would be about $300. a month. Apply to Box No. 3224-V.

PHYSICIST OR ELECTRICAL ENGINEER with knowledge of modern nuclear physics, preferably veteran, age 28-40 with ability to express himself clearly and possessing analytical mind is required in Ottawa for patent work. Some familiarity with this type of work and a knowledge of foreign languages would be useful. Salary about $275. a month. Apply to Box No. 3231-V.

ELECTRICAL ENGINEER, graduate with some experience in electronics, age 25-35, is required by a company in Montreal at a salary of $250. a month. Apply to Box No. 3236.

ELECTRICAL ENGINEER, graduate is required for work in the radio field by a manufacturer in eastern Ontario. Apply to Box No. 3256-V.

ELECTRICAL ENGINEER is required to be employed in the capacity of sales engineer representing a manufacturing company in the northern Ontario and Quebec mining districts. Apply to Box No. 3269-V.

ELECTRICAL ENGINEER, graduate, preferably ex-service man, is required by a large company in the Montreal area for work on wiring diagrams on electrical drives, etc. Apply to Box No. 3270-V.

ELECTRICAL ENGINEER with four or five years general design experience is required by a mining company in southern Ontario for work in connection with changes in mining and smelting operations. Apply to Box No. 3285-V.

MECHANICAL

MECHANICAL ENGINEER, recent graduate, preferably ex-service man, is required to act as assistant to the plant engineer on mechanical supervision and maintenance in a plant in South America. Salary would be about $200. a month. Apply to Box No. 3218-V.

MECHANICAL ENGINEER, age about 25 is required to act as sales engineer for a company engaged in the manufacture of bearings with headquarters in Montreal. Salary would be about $200. a month. Apply to Box No. 3219-V.

MECHANICAL ENGINEER with five to ten years' experience in industrial plants, age 30-40, preferably but not necessarily bilingual, is required for plant engineering, maintenance work, etc., in a new factory in the Montreal area. Salary would be about $300. a month. Apply to Box No. 3224-V.

MECHANICAL ENGINEER is required for general duties in connection with plant improvements by a pulp and paper company in western Ontario. Some experience in this type of work is desirable. Apply to Box No. 3226-V.

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in western Ontario. Salary would be $300. to $350. a month. Apply to Box No. 3227-V.

JUNIOR AND SENIOR MECHANICAL ENGINEERS, preferably veterans, are wanted by a large paper company for vacancies in a number of mills in eastern Canada. Senior men should have experience in design and layout work, if possible in the pulp and paper field. Salaries would be $175. to $250. a month depending on qualifications. Apply to Box No. 3232-V.

MECHANICAL ENGINEER with about ten years' experience in mechanical equipment for buildings, is wanted for office work on heating, ventilating and air conditioning by a firm of consulting engineers in Montreal. Salary would be $300. a month. Apply to Box 3233-V.

MECHANICAL ENGINEER with pulp and paper mill experience is required to act as assistant mechanical superintendent for a newsprint manufacturer in the St. Maurice Valley. Work will involve supervision of machine shop and all mechanical maintenance of paper mill machinery, and up-keep of buildings. Good advancement opportunity. Salary about $300. a month. Apply to Box No. 3234-V.

MECHANICAL ENGINEER age about 25, preferably veteran with some experience particularly in die work is wanted by a firm in Montreal. Salary $175. a month. Apply to Box No. 3235-V.

MECHANICAL ENGINEER, graduate with four or five years' experience in heating and ventilating layouts is wanted by a consulting engineer in Montreal. Apply to Box No. 3243-V.

MECHANICAL DRAUGHTSMAN, recent graduate is wanted by a railway company in Montreal for work in connection with plumbing, heating and lighting. Salary would be about $250. a month. Apply to Box No. 3245-V.

MECHANICAL ENGINEER, graduate under 30 years old, is wanted to act as sales engineer in Montreal for a distributor of marine and industrial engineering equipment. Starting salary $195. a month. Apply to Box No. 3247-V.

MECHANICAL ENGINEER with two or three years' experience in refrigeration work is required by a firm of contractors in Montreal. Salary would be about $250. Apply to Box No. 3252-V.

SALES ENGINEER preferably graduate mechanical with some shop experience, particularly in gearing, under 40 years old, is wanted by a manufacturer in Montreal. Preference will be given to ex-service man with good personality, and suitable inexperienced candidate would be trained. Salary $250. to $300. a month. Apply to Box No. 3253-V.

MECHANICAL ENGINEER with experience in general machine design, who can handle his own designing with a minimum of supervision, is required by a manufacturer in eastern Ontario. Preference will be given to ex-service man. Apply to Box No. 3261-V.

MECHANICAL ENGINEER, graduate, preferably but not necessarily experienced, is required for research and development work on new mechanical equipment by an experimental station in the Maritimes. Salary would be $200. to $250. per month. Apply to Box No. 3265-V.

ENGINEER SALESMAN, not necessarily a graduate but with good experience on truck mechanical work and some sales background, age 35-40, is required by an automobile manufacturer for work in the Montreal area. Preference will be given to ex-service men, and R.C.E.M.E. and workshop experience would be useful. Salary $250. to $350. a month. Apply to Box No. 3266-V.

MECHANICAL ENGINEER, graduate with two or three years' experience, preferably ex-service man, is wanted by a consulting engineer in Montreal for mechanical and electrical work in connection with plumbing, heating and ventilating installations in public and industrial buildings. Salary would be about $200. a month. Apply to Box No. 3267-V.

MECHANICAL ENGINEER, fluently bilingual, is required for the province of Quebec to represent a company engaged in the manufacture of bakers' machinery and candy-making machinery, etc. Apply to Box No. 3268-V.

JUNIOR AND SENIOR MECHANICAL DRAUGHTSMEN are required in Montreal by a firm engaged in the manufacture of conveyors, crushers, elevators, etc., Applicants for junior position should be 25-30 years of age and for senior position, 30-40 years of age. Apply to Box No. 3276-V.

SALES ENGINEER, age 30 to 35, preferably discharged service man, not necessarily a graduate but with good personality and mechanical inclinations, is required by a firm in Montreal engaged in the manufacture of marine equipment. Salary $300. to $350. a month. Apply to Box No. 3279-V.

MECHANICAL ENGINEER, graduate, under 35, with experience in production management and general drawing office work, also if possible, some structural experience, is wanted by a manufacturer in southern Ontario. Successful candidate will be trained to enable him to take complete charge of the plant and maintain production schedules, and generally under-study the works manager. Apply to Box No. 3282-V.

TWO AUTOMOTIVE ENGINEERS, university graduates, not over 35, with experience in the automobile business and familiar with the design, general operation and performance of major components, are required by an automobile manufacturer in Windsor, Ont. Apply to Box No. 3287-V.

MISCELLANEOUS

CONSTRUCTION AND MAINTENANCE ENGINEER and a DESIGNING ENGINEER, preferably with pulp and paper mills experience are wanted for a paper mill in Newfoundland. Salaries would be from $250. a month up depending on qualifications. Apply to Box No. 3239-V.

DRAUGHTSMAN, not necessarily a graduate, age about 25, ex-service man is required for a permanent position in the buildings and grounds department of an institution in the Montreal area. Salary would be about $150. a month. Apply to Box No. 3242-V.

TWO ENGINEERS, fairly recent graduates, with aggressiveness and ability to handle men, preferably discharged service men, are wanted to be trained as superintendents of field work in connection with the installation of plastic tank linings. Starting salary would be about $45. a week. Apply to Box No. 3248-V.

GRADUATE MECHANICAL OR CIVIL ENGINEER who has had four, or five years' experience in design and drawing in the pulp and paper industry is wanted by a company with mills in eastern Ontario. Apply to Box No. 3251-V.

SALES ENGINEER, bilingual and owning his own car, is required for the sale and servicing of small gas-driven pumps and generators. Remuneration is satisfactory and there is opportunity for self-advancement. This company is in the Montreal area. Apply to Box No. 3255-V.

PRODUCTION ENGINEER, either graduate or with good practical experience is required by a manufacturer in eastern Ontario. Candidates should be 30 to 40 years old and should have experience in production methods in the manufacture of small parts and assemblies, and in cost control. Apply to Box No. 3257-V.

SAWMILL SUPERINTENDENT, not necessarily a graduate engineer but with practical experience in the production of lumber and preferably with some engineering training is required for a mill in western Quebec. Successful candidate would be in charge of mill production and would supervise the piling and shipping of lumber and also would supervise the steam plant, machine shop, garage, etc. Salary would be about $300. a month. Apply to Box No. 3274-V.

ENGINEER accustomed to efficiency work, time study, methods, etc., is wanted by a manufacturer of malleable castings, brass and hardware in eastern Ontario. Apply to Box No. 3275-V.

GRADUATE ENGINEER in mechanical and electrical is required for a junior position as assistant to the works engineer of a company in southern Ontario engaged in the manufacture of wire, fences, gates, mesh, etc. Apply to Box No. 3278-V.

GRADUATE ENGINEER with a good knowledge of the manufacture of steel containers such as oil drums, etc., and with sales and manufacturing inclinations is required by a manufacturer of this type of product in Toronto. Apply to Box No. 3281-V.

TWO YOUNG ENGINEERS, university graduates, ex-service men, who have some knowledge of agriculture, are required by a firm engaged in the manufacture of farm machinery and implements in southern Ontario. Salary would be $2400. to $3600. a year depending upon ability and experience. Apply to Box No. 3283-V.

ASSISTANT SUPERINTENDENT OF MAINTENANCE age 40 to 50, preferably but not necessarily bilingual, is required by a textile company in the province of Quebec, to supervise all repair and maintenance, machine shop,plant protection, steam production, etc. Apply to Box No.3284-V.

METALLURGICAL, MINING OR CHEMICAL ENGINEER, age 25-30 years is required to act as sales engineer for a chemical company in northern Quebec and Ontario. Preference will be given to an ex-service man. Candidates should have a conversational knowledge of the French language and should expect to do considerable travelling. Salary $160. to $250. a month depending on qualifications. Apply to Box No. 3134-V.

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

CHEMICAL

CHEMICAL ENGINEER, young graduate, necessarily with some pulp and paper mill experience is required to take over control of the testing laboratories and to take charge of various engineering problems in a mill in the Eastern Townships of Quebec. Salary would be about $250 a month. Apply to Box No. 3211-V.

CHEMICAL ENGINEER, age about 34, graduate, preferably with some experience in the sale of chemical products is required by a company in Toronto for work in connection with problems of distribution, merchandising and selling. Salary would be about $300 a month plus share in profits. Apply to Box No. 3215-V

CIVIL

CIVIL ENGINEER, age 27-35, with experience in reinforced concrete and steel is required to act as structural designer for a large company in Montreal. Salary would be about $250. a month. Apply to Box No. 3140-V.

CIVIL ENGINEER with experience in the design of hydro-electric power stations is required to act as designer on reinforced concrete structures in Winnipeg. Apply to Box No. 3155-V.

CIVIL ENGINEER recent graduate is required to act as lecturer and assistant in the engineering faculty of a university in Ontario. Work will involve lecturing to third and fourth year students on highway and railway course, also elementary surveying and assisting in laboratory. Preference will be given to returned service man. Apply to Box No. 3163-V.

CIVIL ENGINEER, preferably discharged service man with considerable experience in construction, maintenance and servicing of buildings and real estate generally, is required to act as the manager of a company of this nature in a small town on the lower St. Lawrence. The successful candidate would be expected, in addition, to supervise the maintenance staff, rentals, sale of properties, town services, etc. Apply to Box No. 3198-V.

SEVERAL CIVIL ENGINEERS, not necessarily graduates but with from at least three years up to very extensive experience in construction, are required by a company in Montreal to estimate several big new developments. Salary would range from $200 to $450 a month depending on experience. Apply to Box No. 3209-V.

ELECTRICAL

ELECTRICAL ENGINEER with five years' aeronautical experience is required to be in charge of the electrical work in connection with modifications to aircraft. This position will be in the Montreal area and would be worth about $275. a month. Apply to Box No 3107-V.

ELECTRICAL ENGINEER with experience around mills or smelters, English-speaking, with a working knowledge of French, age 32-36, is required by a firm engaged in the manufacture of abrasives and refractories in the province of Quebec. Apply to Box No. 3122-V.

MECHANICAL

MECHANICAL ENGINEER, having some familiarity with pulp and paper machinery and suitable personality is required to act as sales engineer for a small manufacturing company in northern New Brunswick. This is a permanent position with a good future for the right man. Candidates should be between 30 and 35 years old and can expect a salary of between $200 and $300 a month depending on experience. Apply to Box 3088-V.

MECHANICAL ENGINEER, recent graduate, preferably returned service man is required by a well-known company in Montreal for draughting and design work on structural and mechanical problems. Apply to Box No. 3146-V.

MECHANICAL ENGINEER experienced plant and production superintendent is required for a machine shop and grey iron foundry in the Ottawa district, to take full charge of operations and planning. Salary $300. to $375. a month depending on experience. Apply to Box No. 3159-V.

MECHANICAL ENGINEER, recent graduate, is urgently required for the position of foreman in the mechanical department of a newsprint manufacturer in the St. Maurice Valley. Salary will be between $150 and $225 a month depending on qualifications. Preference will be given to ex-service men. Apply to Box No. 3174-V.

MECHANICAL ENGINEER with approximately ten years experience divided between design and machine shop is required to act as principal assistant to a mechanical engineer in a corporation in Toronto. Candidates should have general all around experience and particularly some manufacturing experience with heavy machinery. Salary would be from $300 a month according to qualifications. Apply to Box No. 3175-V.

SEVERAL MECHANICAL ENGINEERS, preferably recent graduates and discharged service men, are required by an engineering company in Montreal for draughting, testing and research work. Salary would be $185 to $220, depending on experience. Apply to Box No. 3183-V.

MECHANICAL ENGINEER is required to act as chief design engineer for a paper company in southern Ontario. Candidates should have had five or six years' experience preferably in pulp and paper mill work. Salary would be about $325 a month. Apply to Box No. 3184-V.

MECHANICAL ENGINEER, age 25-35 with some experience, preferably bilingual, is required by a manufacturer in the Eastern Townships of Quebec, to work under the supervision of the plant manager with responsibility for executing production schedules, manufacturing operations, and for quality and cost control work. Apply to Box No. 3192-V.

MECHANICAL ENGINEER, young graduate, preferably ex-service man with draughting ability, is required for general mechanical work by a paper mill in eastern Quebec. Apply to Box No. 3205-V.

MECHANICAL ENGINEER is required as draughtsman for layouts and general mechanical engineering by a paper company in the Lake St. John area. Salary would be $225 to $250 a month depending on experience. Apply to Box No. 3208-V.

MECHANICAL ENGINEER is required by a firm engaged in the manufacture of building materials in Montreal to act as junior engineer and to start on draughting and layout work of new equipment. Candidates need not be graduate engineers but preference will be given to ex-service men. Salary will be about $175 a month. Apply to Box No. 3213-V.

METALLURGICAL

METALLURGICAL ENGINEER with B.Eng., or B.Sc., in chemical or metallurgical engineering and at least one year's experience in non-ferrous metallurgical chemical analysis is required by a company in Montreal. Preference will be given to ex-service man and salary would be about $250 a month. Apply to Box No. 3200-V.

MISCELLANEOUS

ARCHITECT OR ARCHITECTURAL DRAUGHTSMAN with about three years' experience is required by a consulting engineer in the Montreal area. Salary would be about $250 a month. Apply to Box No. 3165-V.

DRAUGHTSMAN with about ten years' experience in structural and steel plate work, preferably, but not necessarily a graduate engineer, is required by a large company in Montreal. Apply to Box No. 3193-V.

ARCHITECTURAL DRAUGHTSMAN with enough experience to develop new types of windows, doors, trusses, steel sections, etc., is required by a manufacturer in Montreal. Salary would be about $300 a month. Apply to Box No. 3212-V.

MECHANICAL ENGINEER

For technical staff of a hydro electric utility. Experience in connection design hydraulic turbines, layout and piping for plant auxiliaries, and general hydraulics, are essential requirements. Salary $300-$350. depending upon qualifications. Location Toronto.

Apply to Box No. 3296-V.

MECHANICAL ENGINEER

Required by a paper company for a senior engineering position at mill located in an established town. Also, a position open for a junior mechanical engineer.

Apply to Box No. 3204-V.

WANTED

Experienced mechanical or architectural draughtsman for general work on equipment and building layout in processing industry in southern Ontario town. Position possibly permanent.

Apply to Box No. 3244-V.

WANTED

Personnel Director, by pulp and paper company in Quebec province. Prefer man with training in personnel management and industrial relations and some experience in personnel administration. Must speak both French and English. Address application to File No. 3214-V.

WANTED

Architect to undertake responsibility along general lines, such as class of work which comes under the jurisdiction of a Provincial Department of Public Works. Desirable age, not exceeding forty. Applicants to submit in writing, academic qualifications and practical experience, together with references and salary expected to the Civil Service Commission, Province of Nova Scotia, P.O. Box 943, Halifax, N.S.

WANTED

Graduate Mechanical or Aeronautical Engineer with at least five (5) years experience in aircraft, preferably in manufacturing. Must have a fair knowledge in mechanical aircraft installation. Familiar with heat and ventilating installations, controls, de-icing, hydraulics and landing gear. Permanent, responsible position. Candidates who do not qualify as above, please do not apply. Apply to Box No. 3300-V.

Qualified Engineer (and Architect if possible) required for position of Building Inspector for City of Regina. Applications will be received by City Commissioners to Noon, March 30th, 1946. Man capable of designing municipal buildings preferred, also experienced in dealing with public generally. Applicants should state age, qualifications, experience and salary expected.

Situations Wanted

CIVIL ENGINEER, B.Sc.M.E.I.C., R.P.E. (Man.) and Dominion Land Surveyor, now in the army but expects early discharge. Experience comprises seven years air photo surveys, land subdivision, drainage plans, precise levels and topographic mapping and seven years administrative and technical direction in connection with sewers, water mains, roads, building and camp construction. Age 42, married. Apply to Box No. 589-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont.) age 42, married. Experience in general plant engineering work, design, layout and testing of equipment. Also worked as field engineer on various construction projects. Position in Ontario preferred. Apply to Box No. 1249-W.

EXECUTIVE ENGINEER available. Graduate in mining, Jr.E.I.C., age 35, married, two dependents. Five years' experience in mining and milling, mine development, construction and operation. Canadian and foreign experience. Five years' administrative experience, mass production, development and supervision. Was assistant superintendent of operations in large industrial munitions works. Capable of handling personnel and planning, seeks a responsible position in industrial business or mining. Available on short notice, registered with W.B.P.P. Apply to Box No. 1423-W.

CHEMICAL ENGINEER, young university graduate, previously engaged in war industry, desires permanent position. Available immediately. Apply to Box No. 2464-W.

ELECTRICAL ENGINEER, M.E.I.C., P.E.Q., available on one month's notice or less. Age 39 years. Experience as plant engineer of 400,000 KVA. hydro-electric generating station, operating engineer of 800,000 KVA. transformer and switching station and A.C. and D.C. conversion station handling approximately 90% of the output of the above station. Also one year's experience as electrical maintenance engineer of large industrial plant. Some experience in electrical construction and in cost and manufacturing methods engineering. Would prefer position in Ontario or the Maritimes. Apply to Box No. 2562-W.

GRADUATE CIVIL ENGINEER, age 24, presently in Vancouver, Experienced in layout of townsite and construction of buildings, ground service, and central steam-heating system. Familiar with soils investigation. Has 1½ years' experience as junior engineer on highway location, design and estimate. Apply to Box No. 2570-W.

CIVIL ENGINEER, graduate of UNB in 1941, age 27, with experience as instrumentman on highway construction, assistant engineer on town concrete street paving and concrete inspection, and one year as aircraft inspector for Department of National Defence. Expects early discharge from R.C.A.F. after nineteen months service overseas with bomber command as aeronautical engineer, and desires to make contacts for employment, preferably in Ontario. Apply to Box No. 2585-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill graduate, age 27, single. Five years' design and executive experience in manufacturing plants. Now available for position with progressive organization. Highest references from former employers. Apply to Box No. 2586-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 23, single, with degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy. Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

GRADUATE ELECTRICAL ENGINEER, UBC '41, P.E. Ont., Associate A.I.E.E. Age 32, married, one child. Six years school teaching, five months thawing assistant engineer; first class honors degree, C.G.E. Test Course. Major, Technical Staff, R.C.E.M.E., four years active service. Radar trained. Active part in build-up of Canadian Army Telecommunications maintenance and repair organization and production of technical literature. Accustomed to planning, forecasting, general organizing and supervision. Not a specialist. Available in B.C. after discharge February '46. Apply to Box No. 2588-W.

MECHANICAL ENGINEER, Jr.E.I.C., single, age 27, graduate Royal Naval Engineering College (Practical Engineering Prize) wishes work of practical nature, mainly outdoor. Interested in operation or construction of steam, hydro or internal combustion machinery. Eight years in R.C.N., including operational, overseeing and instructing. Medical discharge. Seven months on shipyard staff. Prefer to remain near Pacific Coast but would consider temperate climate like New Zealand, South Africa, southern England. Apply to Box No. 2589-W.

GRADUATE MECHANICAL ENGINEER (Sask. '36). Six years' experience on estimating, design and construction of industrial buildings and heavy. equipment installation as well as a fair amount of general shop experience Four and a half years as Engineer Officer in R.C.A.F. Two years in charge of servicing and maintenance of Anson trainers and two years in charge of Mosquito maintenance with operational squadrons in England and Europe. Interested in executive position on construction maintenance. Apply to Box No. 2591-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in Canada and abroad in tool design, product design, shop and industrial engineering, labour relations. Successful organizer. Available due to closing of war plant. Apply to Box No. 2592-W.

CHEMICAL ENGINEER, single, age 25, B.Sc., Sask. '42. Recently discharged from the army. At present taking post graduate work. No significant industrial experience. Interested in a position in production or plant control. Services available in May 1946. Apply to Box No. 2593-W.

CHEMICAL ENGINEER, B.A.Sc., U.B.C., S.E.I.C., Jr.A.I.Ch.E., age 25, married, no dependents, residing in east, desires employment in production control and/or sales service in Ontario or Quebec. Apply to Box No. 2594-W.

CIVIL ENGINEER, R.P.E. (Ont.) desires executive position as plant engineer; seventeen years' experience, initial and layout surveys and plant installation for production of gold, coal and slate. Drainage design and road construction. Five years construction engineer officer (R.C.A.F.) supervising the construction and maintenance of air stations under the Commonwealth Air Training Plan. Available on one or two months' notice. Apply to Box No. 2595-W.

ELECTRICAL ENGINEER, R.P.E. (Ont.) age 28, married, C.G.E. Test Course and Sales. Five years' plant experience in direct charge of engineering, maintenance and construction of several large chemical plants. Would consider employment with progressive engineering organization or in sales. Prefer Ontario. Apply to Box No. 2596-W.

LIBRARY NOTES *(Continued from page 130)*

La FATIGUE des METAUX.

By R. Cazaud and L. Person, preface by A. Caquot. 2 ed. Dunod, Paris, 1943. 259 pp., illus., diagrs., charts, tables, 10 x 6½ in., paper, 262 frs.

This monograph analyzes the principal studies of the fatigue of metals and presents the results in form for use by engineers and metallurgists. The theories of fatigue in metals, methods of testing, fatigue limits, the factors that affect fatigue and the resistance of welded and riveted joints are discussed. Bibliographies accompany the several chapters.

HYDRODYNAMICS.

By Sir H. Lamb. 5 ed. Dover Publications, New York, 1945. 738 pp., diagrs., tables, 9 x 6 in., cloth, $4.95.

This is a reprinting of the sixth edition of this standard work on the classical theories of the dynamics of liquids and gases. These important theories, which underlie many present-day practical applications, are dealt with thoroughly and with mathematical rigidity. Among the special topics considered are the motion of solids through a liquid, vortex motion, and tidal waves.

MARINE ENGINEERS' HANDBOOK, prepared by a Staff of Specialists.

J. M. Labberton, Editor-in-Chief, with the general engineering fundamentals reproduced from Mechanical Engineers' Handbook (L. S. Marks, Editor-in-Chief). McGraw-Hill Book Co., New York, 1945. 2013 pp., illus., diagrs., charts, tables, 7¼ x 4¾ in., fabrikoid, $7.50.

Designed as the successor to Sterling's "Marine Engineers' Handbook", this new compilation is intended especially for the use of design engineers and technical students. Operating engineers should find the design and construction details useful, but no attempt has been made to include instruction on the adjustment and maintenance of marine propulsion machinery. The section on reciprocating steam engines is virtually the same as in the older work, but all other sections are completely new or extensively revised. Many technical data of value to the marine engineer have been reprinted from Marks' "Mechanical Engineers' Handbook".

National Research Council, HIGHWAY RESEARCH BOARD,

Proceedings of the Twenty-fourth Annual Meeting, 1944, edited by R. W. Crum and F. Burggraf. National Research Council, 2101 Constitution Ave., Washington, D.C., 1945. 543 pp., illus., diagrs., charts, tables, 9¾ x 6½ in., cloth, $5.00.

Some fifty papers and reports are included in this annual volume, broadly classified under the following headings: economics, finance, administration; design; materials and construction; maintenance; traffic and operations; soils investigations; and special projects. A wide range of topics is covered with many examples from actual practice. The volume also contains brief information about the activities of the Highway Research Board.

Industrial News

Industrial development—new products—changes in personnel—special events—trade literature

TO MANUFACTURE HERE

Cockshutt Plow Co. has completed an agreement whereby Cockshutt will manufacture tractors, harvester combines, swathers, and tiller combines at Brantford for Canadian Co-operative Implements Limited.

Due to shortage of supplies resulting from labor and material difficulties, the supplies of machinery to Canadian Co-operative Implements Limited will be limited in 1946 to harvester combines and swathers. In 1947 and subsequent years Cockshutt intends to supply Canadian Co-operative Implements Limited with adequate supplies of all the machinery indicated above.

The Canadian announcement climaxes the finalizing of negotiations resulting in the signing of a contract with National Farm Machinery Co-operative, Inc., in the United States, under which Cockshutt will manufacture tractors, harvester combines and other lines for the United States Co-operatives. The arrangement involves several thousand tractors and harvester combines.

JOINS WAR ASSETS

War Assets Corporation has announced the appointment of senior officers in merchandising. Lt. Col. T. P. Sutton, M.M., E.D., formerly of Ottawa, becomes assistant sales manager in charge of regions and branches, with office at Montreal.

A. H. Boyle, previously of Toronto, has been named assistant director of the pricing and distribution divisions, with office at Montreal.

REFRIGERATION MEETING

The Refrigeration Service Engineers Society, under sponsorship of the Interprovincial Association, is holding its 7th Annual Educational Conference at the King Edward Hotel in Toronto on March 17th and 18th, 1946.

Prominent speakers, including several from the United States, are scheduled to give addresses on subjects dealing with refrigeration service in Canada.

JOINS ENGLISH ELECTRIC

Thomas Henry has joined the staff of the English Electric Co. of Canada Limited as sales engineer in their Toronto office.

Mr. Henry was graduated in 1931 from the University of Toronto with a degree in electrical engineering. Since then he has been associated with the Square D Company of Canada Limited and the Canadian General Electric Co. Ltd., where for six years he was sales engineer in the Toronto district office.

For the past three years Mr. Henry served as an electrical officer in the Directorate of Electrical Engineering, Royal Canadian Navy. During this period of service he held the post of resident naval electrical overseer for the Toronto area. It was from this appointment that Mr. Henry was retired in October with the rank of Electrical Lieutenant.

Mr. Henry is a member of the Association of Professional Engineers, an associate member of the American Institute of Electrical Engineers, and a member of the Electrical Club of Toronto and the Niagara District Electric Club.

Thomas Henry

BECOMES SALES MANAGER

R. G. Alison has been appointed sales manager, welding division of the Lincoln Electric Co. of Canada Limited, Toronto.

Mr. Alison has been with the company for the past nine years. Born in Toronto, Ont., in 1912, he obtained his college education at the University of Toronto, where he received a degree in mechanical engineering. He is a member of the Association of Professional Engineers of the Province of Ontario, American Welding Society and the Canadian Welding Society.

BUYS COMPANY

Joliette Steel Limited, producers of manganese and alloy steel castings, announces that complete control of the company has been acquired by American Manganese Steel Division (AMSCO) of American Brake Shoe Co., New York, N.Y.

AMSCO products such as manganese dredge buckets, dippers, frog and crossing castings, crusher parts and mill liners will now be produced in Canada. AMSCO will also produce other abrasion resistant alloy steel castings for construction, mining and general industrial applications.

The present personnel will be retained and AMSCO plans to report in the near future on promotions and staff additions in Canada.

MONTREAL BRANCH MANAGER

G. McLachlan, who has been acting manager, has been appointed manager, Montreal Branch of The James Morrison Brass Manufacturing Co. Limited. He joined the Company in 1940 after many years' experience in the mechanical field.

GEARS ON PRODUCTION BASIS

William & J. G. Greey Limited, Toronto, will manufacture in Canada the products of the Philadelphia Gear Works Inc. of Philadelphia, Pa., manufacturers of speed reducers, gears, couplings and valve controls. These two firms will combine their engineering knowledge and experience in the manufacture of these products for the Canadian requirements.

William & J. G. Greey Limited is setting up quantity production machines for the manufacture of gears on a quantity production basis. The production of washing machine gears in large quantities has been undertaken and are being produced at the present time.

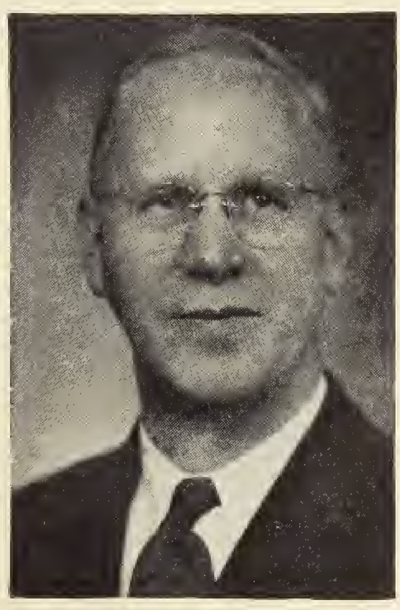
RECENT PROMOTION

Gordon F. McClay has been appointed assistant to manager of engineering by the Canadian Ingersoll-Rand Co. Limited, Sherbrooke, Quebec. Born in Foster Quebec, Mr. McClay was educated in the Eastern Townships and started his business career with the W. F. Vilas Co. of Cowansville, and the Norwood Engineering Co. in the United States. In May, 1913, he joined the staff of Canadian Ingersoll-Rand as a draftsman in the compressor engineering department.

On the outbreak of the First Great War, he was placed in charge of design of special tools for shell production used by the Company and other shell manufacturers. From 1917 to 1934 Mr. McClay served as a designer in various engineering departments of the Company.

From 1935 to 1944 Mr. McClay was in charge of compressor engineering, including production, testing and field engineering. In 1944 he was appointed assistant to the chief engineer, remaining in that capacity until his appointment as assistant to manager of engineering.

(*Continued on page 138*)



Gordon F. McClay

ASSISTANT TO PRESIDENT

Albert P. Craig, Jr., has been appointed assistant to the president of Canadian Westinghouse Co. Ltd. in Hamilton.

Born in Kaslo, British Columbia, Mr. Craig was graduated from Cornell University in Electrical Engineering in 1928, at which time he joined the Westinghouse Electric Corp. as a graduate student. Since then he has been salesman, assistant to the vice-president of the Steam Division at South Philadelphia and assistant manager of the Merchant Marine Works. He comes to his new appointment from the position of manager of the X-Ray Division, Westinghouse Electric Corp., at Baltimore, Maryland.

L. A. Hood

APPOINTED REPRESENTATIVE

L. A. Hood has been appointed Montreal representative for Chatco Steel Products Limited. His experience in the heating field is wide and varied. Since 1920, Mr. Hood has been associated with C. A. Dunham Co. Ltd., Pease Foundry and the Trane Company.

NEW SYDNEY MANAGER

The Canadian Ingersoll-Rand Co. announces the retirement of James P. Cotter, manager of the Sydney, Nova Scotia Branch, after 53 years of continuous service in various senior capacities.

Mr. Cotter entered the employ of the then Canadian Rand Drill Company in 1892 as an apprentice machinist. In 1894, before completing his statutory apprenticeship years, he became shop foreman. A year later he was appointed erecting and field engineer.

Acting on his knowledge of the coal miner's needs, Mr. Cotter found time during the next few years to work on an improved coal cutting machine with the result that in 1909 the first "Radialaxe" Coal Cutters were placed in service.

In 1910 Mr. Cotter was appointed branch manager of the Company's office in Sydney, Nova Scotia. In 1916 he returned to the Company's works at Sherbrooke to superintend the erection of marine engines and to assist in the management of shell production. At the end of the Great War he returned to Sydney as branch manager.

A member of the Mining Society of Nova Scotia since 1918, Mr. Cotter has presented several papers on compressed air to the Mining Society and to the Cape Breton Branch of The Engineering Institute of Canada.

George P. McCabe has been made manager to replace Mr. Cotter. Born in Toronto, Mr. McCabe attended Toronto University and then entered the mining industry, gaining underground experience in Northern Ontario and Western Canada.

Mr. McCabe joined the staff of Canadian Ingersoll-Rand in 1938 and entered the Student Training Course of the Ingersoll-Rand Company at Phillipsburg, New Jersey. In 1941 the mining, industrial and military developments in Newfoundland required the continuous services of a competent resident field representative and Mr. McCabe was transferred to Newfoundland with headquarters at St. John's.

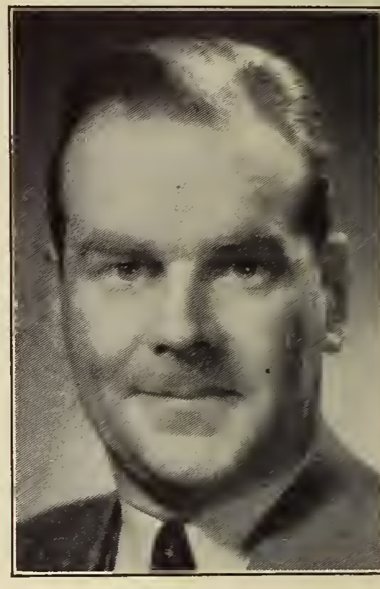
In January, 1945, he was transferred to the Sydney Branch as assistant to Mr. Cotter and was appointed Acting Branch Manager in the same year. In his new position Mr. McCabe will have charge of business in the Nova Scotia and Newfoundland districts.

Mr. McCabe is a member of the Mining Society of Nova Scotia and the American Institute of Mining and Metallurgical Engineers.

C.G.E. APPOINTMENT

B. J. Bourchier who has been appointed manager, Aircraft Equipment Section, Supply Department, Canadian General Electric Co., Limited, Toronto. A graduate in Mechanical Engineering from the University of Toronto, Mr. Bourchier undertook postgraduate study in the United States before joining the Air Conditioning Section of C.G.E. in 1936.

B. J. Bourchier



Tom Frame

PROMOTION

A. C. Wickman (Canada) Limited announce the promotion of Tom Frame to the position of field representative.

Prior to his joining this company when it was originally formed in 1941, Mr. Frame was responsible for tool, die and gauge engineering with Hayes Steel Products, McKinnon Industries and John Inglis Company. During the past four years he has been in charge of tool and gauge engineering with Wickman's.

OPENS OTTAWA BRANCH

Warren A. Jeffrey has been appointed manager of the newly-opened Ottawa Branch of Darling Brothers Limited. Mr. Jeffrey was a sales engineer for many years with Builders' Sales Limited (formerly Darling Brothers representative in Ottawa), prior to the establishment of the new branch.

NEW SALES ENGINEER

Handy & Harman of Canada Limited has appointed Donald W. Walker to their sales engineering staff. Mr. Walker, who held the rank of pilot officer in the R.C.A.F., has had a comprehensive engineering experience. Being graduated from the University of Toronto in 1941, following a special course in aviation and engineering, he was employed as a Government Inspector at De Havilland Aircraft and later joined Fairchild Aircraft Limited, at Longueuil, Quebec.

APPOINTED TREASURER

Appointment of W. C. Botkin as treasurer of Dominion Rubber Co. Limited has been announced. Mr. Botkin was formerly control manager of the United States Rubber Company's tire plant in Los Angeles, Calif., and control manager of U.S. Rubber ordnance plants at Milwaukee and Des Moines. A native of Winchester, Ky., he was educated there and at Los Angeles.

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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CONTENTS

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COVER PICTURE

The cover picture shows a "Dominion" 1200 ton hydraulic press, one of 63 installed during the war years at the Dominion Bridge Company's cartridge case plant at Toronto. Such presses are now engaged in turning out a host of articles for peacetime uses. (*Reproduced from an original drawing by J. S. Walsh, M.E.I.C.*)

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A MESSAGE FROM THE PRESIDENT

SIX YEARS OF STRIFE are over and now we turn to peace. The storm of war is past but the mountainous seas following the storm still beat on an uneasy and unstable world, and clouds continue to obscure the skies. The challenge that engineers met so ably in time of war commands us now with no less force. Our talents and abilities must be utilized to the utmost to restore order and normality in our country.

Many of us are in positions of professional activity, and the continuance of high standards of technical design and execution can be depended upon with confidence. Others of us who are in managerial or executive positions have a peculiar duty and opportunity in 1946. Industrial differences have disorganized sections of essential industry so that the prosperity of our nation and our continent is suffering. This is our opportunity to add tolerance and understanding to firmness and good judgment and to demonstrate as employers that we are sound at heart as well as in mind.

A vital necessity to the stability and happiness of our people is ample production of goods and services. If we can produce and distribute all the food, clothing, shelter and devices, hotel accommodation and railway and transit rides, and laundries and all the many things we now lack our troubles will largely be over. Increase in productivity seems to be artificially restricted by certain groups. Engineers should be natural leaders in improving productivity and establishing sound and progressive policies. First by our own example and then by leadership of others let us see to it that both machines and men are both put to work in the most efficient manner. Perhaps we should consider expanded activity in the field of political administration so that our training in factual appraisal may correct the less sound ideas of some politicians.

My predecessors have carried on our traditions in peace and for the last six years in war. Their successors, like myself, must devote our efforts to the re-establishment of those who have served us in the Armed Forces, the education of juniors, the maintenance of high engineering standards, and the prestige and welfare of the Institute and the profession.

I appreciate most sincerely the high honour that has been conferred upon me and I look foward with keen anticipation to widening my circle of friends among my betters and my equals in my calling.

President.

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PERFORMANCE, INSTALLATION CHARACTERISTICS AND DESIGN OF THE ROLLS-ROYCE 'NENE' AND 'DERWENT' GAS TURBINES

J. D. PEARSON

Chief technical services engineer, Rolls-Royce Group, England.

Paper presented at the Sixtieth Annual General and Professional Meeting of The Engineering Institute of Canada, at Montreal, on February 7th, 1946.

Introduction

There have been a considerable number of technical papers and articles in the press on gas turbines since the end of the war and the lifting of wartime secrecy regulations. Most of these papers have dealt with the theoretical thermodynamic aspects or have given only very general information on the design and performance of particular units.

In this paper an endeavour is made to present the performance and installation characteristics of the jet propulsion gas turbine from the point of view of the aircraft man, and in order to assist in this, comparisons are made of its performance and installation characteristics with those of the familiar piston engine-propeller combination. So as to make this comparison realistic and of technical value, it has been done in terms of two specific turbine engines, which are fully type and flight tested and are in production—the Rolls-Royce 'Nene' and 'Derwent V'.

For the benefit of those who may wish to make use of some of this data, I would state that it is all based on official Air Ministry type tests and subject to the usual guarantees.

A portion of the paper has been devoted to the design of these units, as although the subject matter has been released in an article in the technical press, I think that the more complicated features in the design are worth going over again in a paper such as this, as it provides an opportunity for questioning and discussion.

Brief reference is also made to the history of the development of the jet propulsion gas turbine.

History

The idea of using jet propulsion for aircraft is by no means new, and photographs appeared many years ago of an Italian aircraft with a jet propulsion engine, but as there is no record of any of these aircraft ever having been produced in quantity, it is concluded that these early Italian experiments were unsuccessful.

There was in England, however, a man with an unquenchable faith in the jet turbine engine, and despite all kinds of difficulties, he persevered with his ideas and finally produced a successful design. This man was Air Commodore Whittle of the R.A.F. and all of the jet propelled aero engines which are now in production in England and the United States owe something to his original design.

It was in 1938 that the Rolls-Royce Company first took an interest in jet-propulsion units for aircraft, and in 1939 the first design projects were made. In 1940 test work began to be carried out on various components; the great experience of Rolls-Royce engineers and facilities for manufacture at the Rolls-Royce plant in Derby were lent to the producers of the Whittle type engine, and the machining of such parts as supercharger casings and wheelcases, and the manufacture of turbine blades and oil pumps was undertaken.

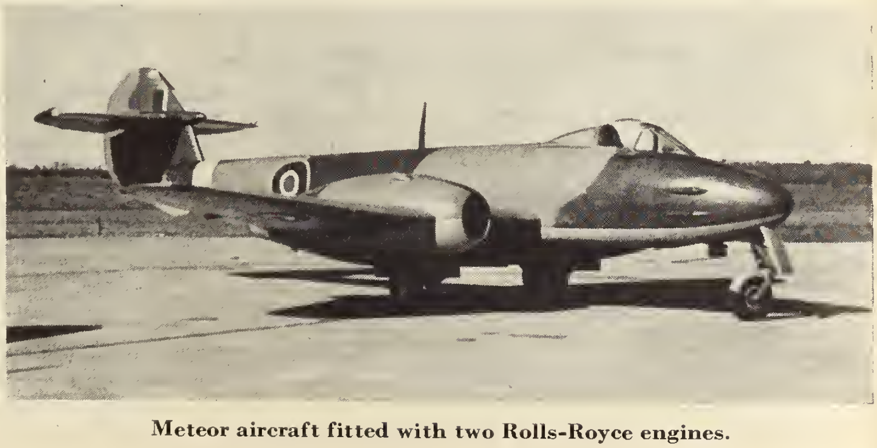
In June 1941, a test plant was set up at Rolls-Royce, Derby, for development work on compressors including a step-up gearbox capable of transmitting 2,000 hp. and running up to speeds of 17,000 r.p.m. This particular plant has been in operation ever since that date. At that time it was the only test plant in the world capable of handling the compressors employed in jet propulsion. At the same time, development was carried out on combustion chambers, and at the end of 1941, under instructions from the Air Ministry, the Rolls-Royce Company undertook the manufacture of the simple gas turbine unit of the Whittle type in conjunction with Power Jets Ltd. The limiting factor was the construction of the turbine blades due to limitations of temperature and r.p.m., but so much progress was made that Rolls-Royce was asked to take over the development and manufacture of the Whittle units.

Meanwhile one of the famous early wartime bombers, the Wellington or "Wimpey", as it was affectionately known, was turned into a flying test-bed for the first Rolls-Royce version which is known now as the "Welland", being the first of the Rolls-Royce "River" class of jet-propulsion units, this name being chosen to give the idea of flow associated with jet-propulsion.

While Rolls-Royce continued to supply these Whittle type units for test purposes in other aircraft, including the Meteor, they began in April 1943 to design a further development of an improved type which became famous as the Rolls-Royce "Derwent" which was the first British jet engine to go into quantity production, as well as the first jet engine to power British aircraft in operational service with the Royal Air Force. The first operational duties of the jet engined Meteor aircraft were to combat the grave menace of the Flying Bomb, against England in 1944.

Many thousands of hours test running both on the bench and in the air went to the perfecting of these early Rolls-Royce units and many 100-hour type tests were accomplished. The culmination of all these tests was a successful run of 500 hours on a "Derwent" engine without strip or major replacement of any kind.

To give some idea of the rapid development achieved by Rolls-Royce, the original Welland engine fitted to the Meteor aircraft gave 1,600 lb. thrust and weighed 850 lb. The Derwent V which is now being fitted to the same aircraft and which is of exactly the same overall diameter,



Meteor aircraft fitted with two Rolls-Royce engines.

gives 3,500 lb. thrust for weight of 1,250 lb. The specific fuel consumption per lb. of thrust has also been improved. It was the Derwent V engine which was fitted to the Meteor aircraft which recently established the world air speed record of 606 m.p.h.

During the same period, Rolls-Royce have developed a larger engine of similar design, the Nene, which gives 5,000 lb. thrust for a weight of 1,600 lb.

Performance

One of the difficulties in visualizing the performance of jet propulsion gas turbine engines is that it is expressed in the somewhat unfamiliar terms of lbs. thrust. Before dealing with the performance characteristics of the Nene and Derwent, an endeavour will be made to show why this is so by reference to the test bed performance curves and also to draw attention to the simple mathematical relation which exists between thrust and horsepower.

Test bed performance

The whole of the useful power on a jet propulsion gas turbine is in the propulsive effort of the jet. The performance of the engine on the test bed can only be measured by measuring the thrust from the jet as there is no shaft which can be coupled to a brake to measure horsepower. Thus, in the strict sense, the useful horsepower being developed by a jet engine on the test bed is zero as no measurable net work is being done. Actually the total energy in the jet is being dissipated in the form of kinetic energy and heat. It is most important to appreciate this point as it illustrates why the performance of a jet engine is expressed in terms of lb. thrust and also that the jet engine only begins to develop useful equivalent horsepower when it is moving forward, in other words when the thrust is multiplied by speed to give a rate of doing work which is normally expressed in horsepower.

Figures 1 and 2 show the test bed performance curves of the Nene and Derwent V engines. The maximum take-off, combat and climb ratings of the Nene are the same at 5,000 lb. thrust at 12,300 r.p.m. The corresponding figures for the Derwent V are 3,500 lb. thrust at 14,600 r.p.m. It

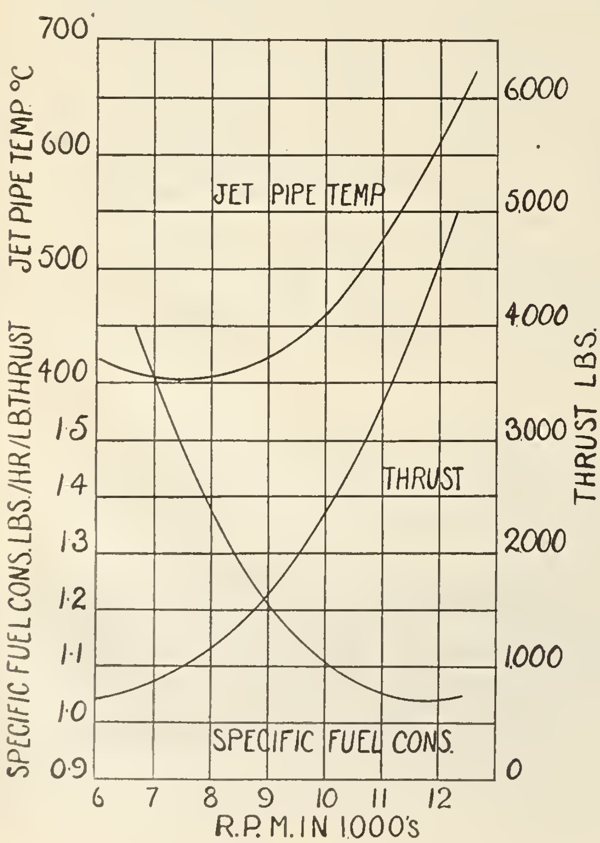


Fig. 1—Test bed performance curve; Rolls-Royce Nene.

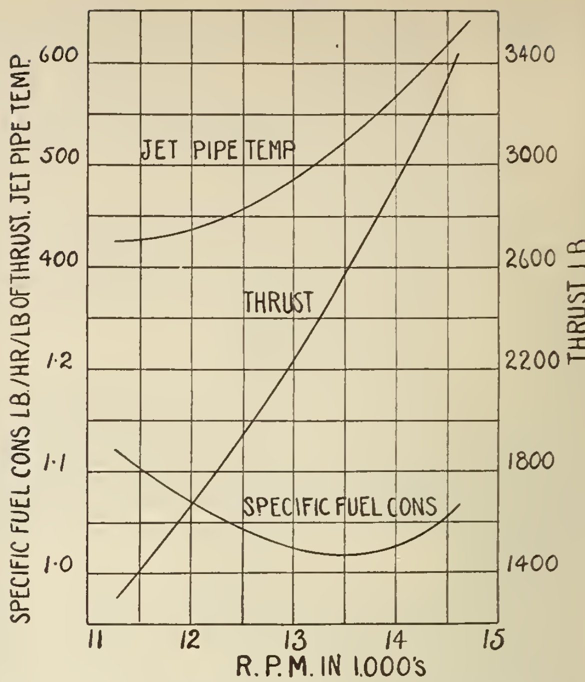


Fig. 2—Test bed performance curve; Rolls-Royce Derwent V.

should be mentioned again that the net dry weight of the Nene is 1,600 lb. and of the Derwent 1,300 lb. This weight includes all engine driven accessories but excludes the weight of the auxiliary gear box and aircraft accessories.

As the speed of the engine increases, the supercharger speed increases, which increases both the compression ratio and the weight of air passing through the engine. This is reflected in both increasing thrust and decreasing fuel consumption with increasing speed up to the optimum. At the same time the jet pipe temperature is increasing.

It will be noted from these curves that down from full thrust to half thrust, the fuel consumption rises only about 5 per cent, but that below half power the rise in specific consumption becomes greater. This characteristic differentiates the jet engine from the piston engine, in that the optimum specific fuel consumption occurs at close to maximum power.

Relation between horsepower and thrust

As the performance of the jet engine has to be expressed in terms of lb. thrust instead of the more familiar term of horsepower, it is worthwhile going over the mathematical relation between the two.

Basically, the thrust horsepower being used in the propulsion of an aircraft is obtained by multiplying thrust by the forward speed. Taking into account dimensions this gives:

$$\text{Thrust hp.} = \frac{\text{Thrust} \times \text{forward speed (in m.p.h.)}}{375}$$

The difference between the engine horsepower and thrust horsepower is determined by the propeller efficiency, so that:

$$\text{Engine hp.} = \frac{\text{Thrust} \times \text{Forward speed (in m.p.h.)}}{\text{Airscrew efficiency} \times 375}$$

which gives:

$$\text{Airscrew thrust} = \frac{\text{Engine hp.} \times \text{airscrew effic'y} \times 375}{\text{Forward speed (in m.p.h.)}}$$

This simple relation must be kept very clearly in mind when comparing jet and piston engines.

It is appreciated that the momentum drag of the intake air and the ejector thrust from the exhaust should be taken into account together with the propeller thrust in assessing the total net thrust exerted by the propeller-engine combination, but for the sake of simplicity in the comparisons which follow, both the momentum drag of the intake air and ejector thrust have been ignored for the piston engine,

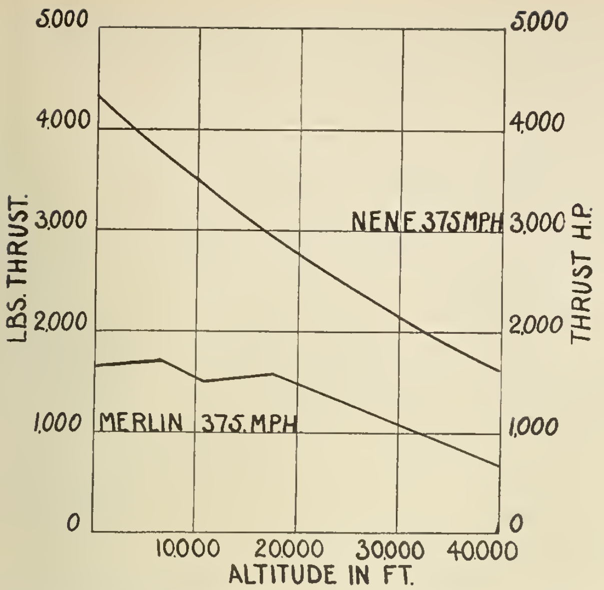


Fig. 3—Thrust and horsepower in function of altitude.

as the former is small in magnitude and the latter varies with the type of exhaust system.

COMPARISON OF THRUST AND HORSEPOWER AGAINST ALTITUDE

Figure 3 shows the maximum power output of the Nene and Merlin at 375 m.p.h. plotted against altitude. From what has already been said it will be appreciated that one horsepower is equivalent to one pound thrust at this speed and it will be noted that the abscissae are calibrated in terms of both.

One of the first things to note is that the thrust and horsepower of a jet engine fall off continuously with altitude, and as a first order approximation, this fall-off in power is proportional to the reduction of density with altitude. It will also be well noted as is well known, that the piston engine thrust and horsepower is artificially maintained by increasing the ambient density by supercharging up to the full throttle height after which the power falls off, again approximately in relation to the reducing density of the air.

Although the maximum Merlin thrust horsepower shown by this curve is only of the order of 1700, the maximum B.H.P. of the engine is 2,100, the difference being due to propeller losses. It is worth noting that there is no similar loss to be allowed for in the figures quoted by the jet engine manufacturer.

Under these particular conditions, the Nene is giving more than two and half times the Merlin thrust horsepower at sea level and just under twice its power at 40,000 ft.

THRUST HORSEPOWER AGAINST SPEED

Figure 4 shows the thrust horsepower of the Nene and the Merlin plotted against the forward speed. In calculating the Merlin thrust, a propeller suitable for high speed aircraft such as the Spitfire has been assumed. This curve illustrates the truly enormous powers developed by the jet engine at high forward speeds and also the deficiency of the piston engine-propeller combination at similar conditions. This difference is largely due to the difference in the efficiency characteristics of the jet and the propeller as shown in Fig. 5.

The fall-off in propeller efficiency with increasing forward speed is well known and is due to the compressibility effects of the outer portions of the propeller blades as they approach the speed of sound. In this connection, it is of course the true helical forward speed of the propeller tips which counts, which is the vector sum of the forward speed of the aircraft and the tip speed of the propeller due to rotation. The propeller of Fig. 5 is a typical high speed propeller and, whereas a little better than this might be done with a propeller especially designed for very high speeds, it is unlikely that any propeller could be designed to give reasonable efficiencies above 500 m.p.h.

The reason for this increasing propulsive efficiency of the jet with forward speed is a matter of simple mechanics. Theoretically, the maximum efficiency of any form of jet propulsion is obtained by dividing twice the forward velocity by the sum of the forward velocity plus the jet velocity, which shows that the efficiency increases with increasing relative speed of the aircraft and the jet, and reaches a theoretical value of unity when the aircraft velocity equals the jet velocity, but this is only attainable theoretically as at this point the thrust will have dropped to zero.

THRUST AND FUEL CONSUMPTION AGAINST FORWARD SPEED

Figure 6 shows thrust and fuel consumption of the Nene and Merlin plotted against forward speed at sea level. The fuel consumptions in terms of lb. of fuel per lb. of thrust per hr. against forward speed are also shown on the same curve All these curves refer to the combat rating of these engines and a high speed propeller has been assumed for the Merlin which accounts for the relatively low thrusts at low forward speeds.

The maintenance of the jet engine thrust with forward speed is apparent in comparison with the fall-off in thrust with the Merlin.

The increasing efficiency of the jet engine with increasing forward speed is reflected in the relatively small increase in fuel consumption per lb. of thrust per hour. In comparison, it will be noted how the piston engine fuel consumption expressed in the same terms begins to increase very rapidly over 450 m.p.h. due to rapid fall-off in propeller efficiency. At just over 500 m.p.h. the Merlin and the Nene consumptions run the same. It should be appreciated that, as far as the Merlin is concerned, the specific consumption is very dependent upon the choice of propeller, and it is probable that these figures do not represent the very best that could be done with a propeller design for optimum results at 500 m.p.h. The propeller used for this calculation is, however, a typical high speed propeller used on aircraft such as the Spitfire.

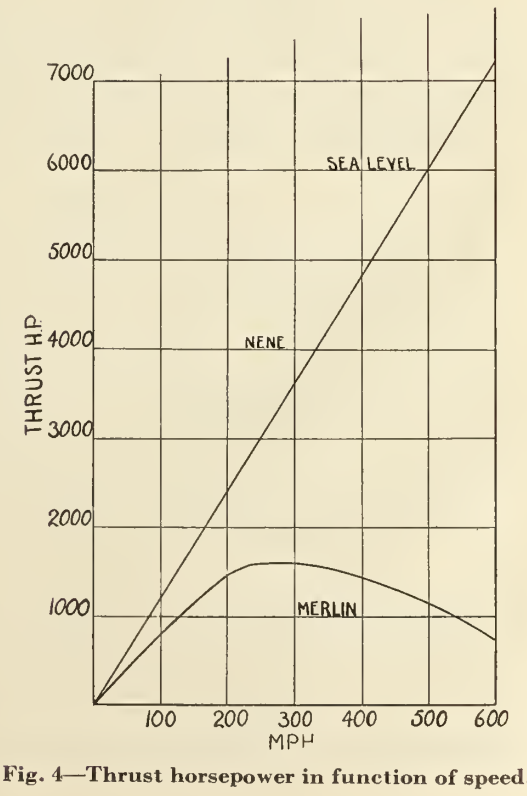


Fig. 4—Thrust horsepower in function of speed.

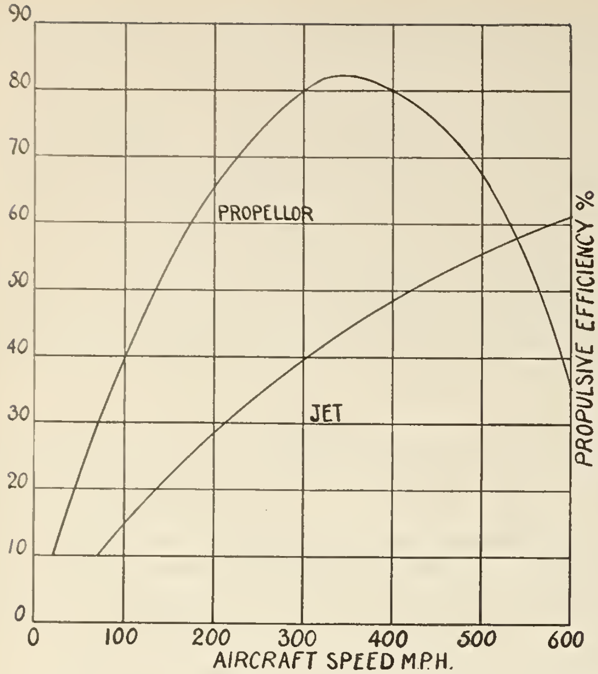


Fig. 5—Propulsive efficiency in function of aircraft speed.

VARIATION OF CRUISING THRUST AND FUEL CONSUMPTION WITH ALTITUDE AT 400 M.P.H.

The thrust and fuel consumption at the maximum permissible continuous cruising powers for the Nene and the Merlin at 400 m.p.h. are plotted against altitude in Fig. 7. The maximum continuous cruise r. p.m. on the Nene is 11,500 which gives a thrust of 3,120 lb. at 400 m.p.h. at sea level. The maximum permissible continuous cruising conditions of the Merlin are 2650 r.p.m., 48 in. boost which gives a maximum sea level horsepower of 1120, rising to 1250 at 14,000 ft. For the purpose of converting Merlin horsepower into thrust, a uniform propeller efficiency of 80 per cent has been assumed.

The Nene thrust falls off with altitude as previously mentioned, whereas the shape of the Merlin thrust curve is similar to that of the horsepower curve as the curve is drawn for thrust at constant speed.

This figure was drawn primarily, however, to illustrate the variation of fuel consumption per lb. of thrust per hr. with altitude for the jet engine and the piston engine-propeller conbination. It will be noted that, whereas the specific consumption of the Merlin falls off with increasing altitude, particularly after the full throttle height is reached,

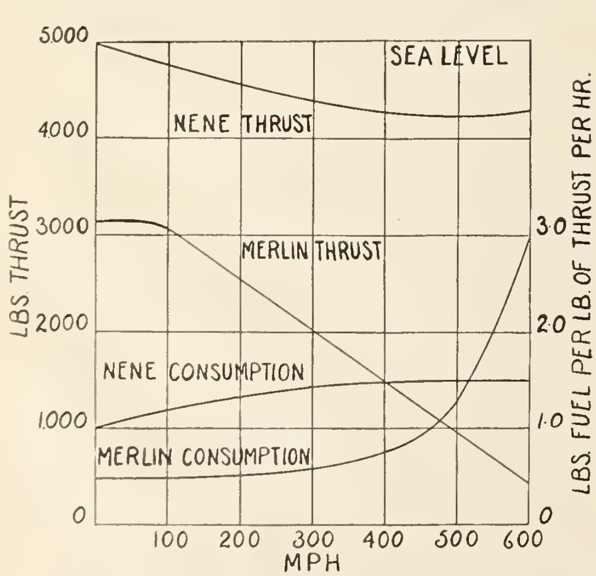


Fig. 6—Thrust and fuel consumption in function of forward speed.

the specific consumption of the Nene actually falls progressively with the increasing altitude. The reason for the reducing specific consumption of the jet engine is that the thermodynamic efficiency of the engine which, like the piston engine, is dependent on compression ratio increases with altitude due to the reduction in temperature as the centrifugal blower ration varies with the absolute temperature. Although in the illustration the fuel consumption curve appears as a straight line, there is in fact a slight discontinuity at 36,000 ft. and the specific fuel consumption above this altitude remains substantially constant with the air temperature.

The reason for the fall-off in specific consumption of the Merlin is that the mechanical losses in the engine remain substantially constant while the B.H.P. falls off with reducing density, so that the decreasing proportion of the total fuel is available as thrust horsepower.

This curve illustrates the fundamental advantage of flying high with jet engines from the engine efficiency point of view quite apart from the obvious advantages from the aircraft point of view of reduced drag.

Installation Characteristics

The basic installation requirements are comparatively simple. A forward facing air intake placed at the front of the fuselage or nacelle and opening straight into the chamber surrounding the engine is the most satisfactory arrangement.

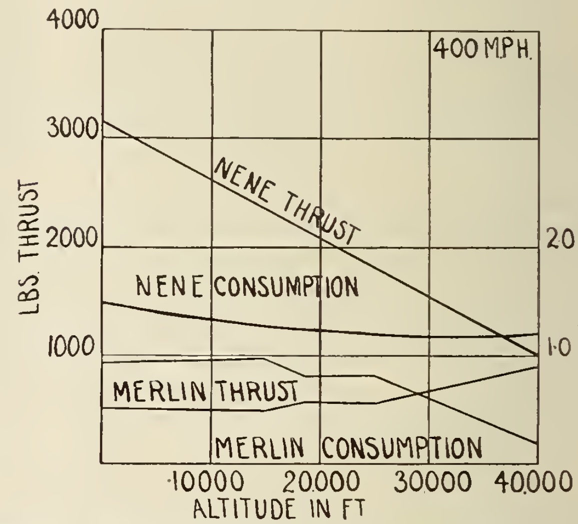


Fig. 7—Cruising thrust and fuel consumption in function of altitude at 400 m.p.h.

Air intakes on the side of the fuselage should be avoided owing to boundary layer effects. The jet pipe must of course, face rearwards but could if necessary be divided and can be inclined to the line of thrust up to about 15 deg.

Owing to the absence of anything but low amplitude high frequency vibration, the engine may be rigidly mounted and a variety of engine mounting attachment faces are provided in order to cater to various types of installation. There are a series of such faces on the outer diameter of the compressor casing and others on the front of the engine at the gear case at the rear. Any of these different combinations of pick-up points may be used.

ACCESSORIES

A self-contained wet sump type lubrication system is incorporated in the engine. No provision is to be made for oil coolers or de-aerators.

A 24-V electric starter motor, high pressure fuel pumps, an altitude control unit, filters and an oil pressure transmitter are mounted directly on, and supplied with the engine.

Three alternative drive positions are provided for driving the Rotol series of auxiliary gear boxes on which are mounted the aircraft accessories and, if required, the cabin supercharger. It is not considered practical to take the cabin supercharging from the engine supercharger, owing to the difficulty of excluding fumes.

Air heating jackets can easily be provided round the jet pipe for gun or cabin heating.

AIRCRAFT INSTRUMENTS

One of the advantages of jet propulsion gas turbines is the simplicity of control and the very few instruments required. The only engine instruments required are an r.p.m. indicator, the jet pipe temperature indicator, an oil pressure gauge and a burner pressure gauge.

The engine power is controlled by a single throttle lever.

Apart from the usual fuel supply cocks, a high pressure shut-off cock is required for stopping the engine.

For starting the engine, a single starter button only is required in the cockpit but provision must be made in the aircraft for an electric relay time panel which controls the starting cycle automatically.

FUEL SYSTEM

With Kerosene fuel systems, the fire and explosion risks are no less than in the case of petrol systems, therefore adequate self sealing and inert gas pressurising should be used wherever possible.

Tank mounted fuel booster pumps are essential, and they must be mounted either directly in or under the fuel tanks to ensure adequate venting of air. Considerable volumes of dissolved air and vapour are liberated from the fuel at altitude and, unless efficient and properly installed booster pumps are used, vapour locking of the pump and fuel pipe system will take place with a possible complete breakdown of fuel flow to the engine.

It is not necessary to provide a suction fuel filter in the fuel system. A coarse gauze filter is normally attached to the booster pumps and a fine mesh filter is fitted on the engine.

In addition to the normal tank selector cocks, shut-off cocks should be provided in the fuel pipe lines for the purpose of maintenance and fire prevention. A fuel pressure switch and warning light should be connected to the inlet of the accumulator housing on the engine fuel system and set to a pressure of 4 lb. per sq. in.

WEIGHT OF INSTALLATION

All the installations so far have been made by the aircraft manufacturers and no complete poweregg such as those designed by Rolls-Royce for the Lancasters have been supplied, so that is is difficult for us to give an accurate estimate of the installed weight.

Very roughly speaking, the total installation weight of the jet engine is 30 per cent of the net dry weight of the engine, which is very considerably less than a corresponding installation weight of either liquid or air cooled piston engines, so that when this factor is added to the extremely low weight of the engine itself, a very considerable weight reduction can be effected in comparison with piston engine propeller combination. It is this extremely low specific weight which makes the straight jet engine a possibility for applications where its high fuel consumption would on first sight rule it out, as the weight of the excess fuel can be balanced against the reduced installed engine weight.

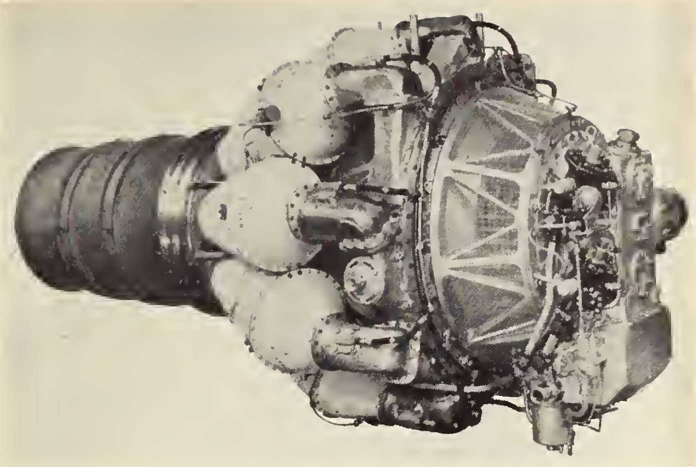
INSTALLATION DETAILS

The detail installation characteristics of the Nene and Derwent engines are given in Appendix I and II. As mentioned in the introduction, both these engines are fully type tested and the data given are based on such type test approval certificates.

Description of the Nene and Derwent Engines

The basic design of this engine is based on Air Commodore Whittle's original design as is the design of the American GEI-40 which powers the 'Shooting Star'.

Air is drawn in from the forward facing intake at the front of the engine and given some initial compression by the forward speed of the aircraft. This air is then led into the intake of a double-sided centrifugal compressor of the same basic type as that used for supercharging the conventional piston aero engine. The compressed air, which by virtue of its compression has also had its temperature raised, is then led into a series of nine combustion chambers. These combustion chambers are so arranged that some of the air enters the centre flame tube, into which paraffin oil is injected under pressure and burned. The remaining air flows around the outside of the flame tube and enters it through a series of holes to mix with the high temperature products of combustion and cools them down before they pass through the series of nozzle guide vanes to the turbine. The turbine consists of a single row of blades mounted on a disc and gases after passing through the blades are rejected rearwards through a jet pipe. The turbine disc and the centrifugal supercharger rotor are mounted on a common shaft so that the power taken out by the turbine is used to drive the compressor. The whole propulsive efforts comes from the jet and the only job the turbine has to do is to drive the compressor so the engine can truly be described as a hot air engine as the only function of moving parts is to enables quantities of hot air under pressure to be produced.



The Rolls-Royce Nene Engine.

Mounted on the shaft between the turbine and the compressor is a cooling fan whose function is to produce a flow of cooling air over the bearings and the turbine disc.

A wheel case is mounted on the front of the engine and driven from the main shaft. It drives the high pressure fuel pump and oil pumps and provides the drive for the gear box which is separate from the engine and on which are mounted the aircraft accessory units. The starter motor is also mounted on the wheelcase.

The main bearings of the engine are all of the anti-friction type. They are fed by oil under pressure which is drained back to the oil tank by means of scavenger pumps. Thus, the only oil which is directly consumed is that which leaks past the bearing oil seals. As this quantity is very small, the oil consumption of the engine is very low indeed and is specified as a maximum of less than 1 pt. per hour at all ratings. In general it is much lower than this and can be as low as 1 pt. per 50 hours. In view of this very low oil consumption, only a small quantity of oil has to be carried and this can be accommodated in a wet sump integrated with the engine. The heat to oil is also so low that no oil cooler is required so that the oil system is self-contained within the engine.

The engine power is controlled by regulating the pressure of the fuel to the burners by means of a needle type of valve which is operated by the pilot's throttle lever. Variations in fuel flow necessitated by changes of altitude are taken care of by means of an automatic unit known as a Barostat, so that the pilot's throttle gives a similar power at similar positions irrespective of altitude. A governor is incorporated in the fuel pump which automatically prevents the overspeeding of the engine, by controlling the fuel flow.

DESCRIPTION

A very comprehensive description of the Derwent engine together with exploded views of the various engine's components such as fuel pumps, fuel system and oil system, has already appeared in the technical press, and for this reason it is not proposed to go into any further detail on the engine design in this paper.

APPENDIX I

Installation Characteristics of the Rolls-Royce Derwent Engine

(1) *Overall Dimensions*

Maximum diameter..................... 43 in.
Diameter of compressor case..............42.5 in.
Overall length to exhaust cone flange......88.5 in.
Length with exhaust cone removed........60.15 in.
Length of jet pipe............To suit installation

(2) *Weights, Centre of Gravity, Gyro-couple*

Weight of engine including its auxiliaries but excluding aircraft accessories and jet pipe.............................1300 lb.
Weight of jet pipe...........15 lb. + 9 lb./ft. run
Distance of centre of gravity aft of the mounting trunions.....................15.94 in.
Gyro-couple at engine speed of 14,600 r.p.m. at 3½ radians/sec..................83,600 lb. in.

(3) *Performance*

The following table gives the leading performance data at sea level.

Rating	*R.P.M.*	*M.P.H.*	*Thrust lbs.*	*Fuel Consumption galls/hr.*
Take off Combat Max. Climb.......	14,600	0	3,500	462
		100	3,210	463
		200	3,010	465
		300	2,900	479
		400	2,850	500
		500	2,880	526
		600	2,970	562
Max. Cruising.....	14,000	0	3000	383
		100	2,720	385
		200	2,520	390
		300	2,400	397
		400	2,350	412
		500	2,360	440
		600	2,410	477

The static thrust at engine idling speed will not exceed 100 lb. at aircraft speeds below 100 m.p.h.

(4) *Lubricating Oil*

D.T.D. 44D.
Oil consumption less than 1 pt./hr. at all ratings
Oil tank capacity—10 pts.
The oil tank must always contain 2 pts. of oil for the purpose of circulation.
The oil tank is integral with the engine.
No provision is made for an oil cooler.

(5) *Accessory Gearbox*

Power available at gearbox drive............30 hp.
A single horizontal drive is provided at the front of the wheelcase to suit the Rotol SG series of accessory gearboxes.

(6) *Exhaust Jet Clearance*

Spread angle of exhaust jet. 15 deg.-20 deg. included.

APPENDIX II

Installation Characteristics on the Rolls-Royce Nene Engine

(1) *Overall Dimensions*

Maximum diameter.....................49.5 in.
Overall length to exhaust cone flange.......96.8 in.
Length with exhaust cone removed.........63.9 in.

(2) *Weights, Centre of Gravity, Gyro-Couple*

Weight of unit including engine auxiliaries but including aircraft accessories and jet pipe1600 lb.
Weight of jet pipe........35 lb. + 9.5 lb./ft. run
Distance of centre of gravity aft of centre line of impeller...................12.84 + .25 in.
Gyro-couple at an engine speed of 12,300 r.p.m. at 3½ radians/sec..................157,000 lb. in.

(3) *Performance*

The following table gives the leading performance data at sea level:-

Rating	*R.P.M.*	*M.P.H.*	*Thrust lbs.*	*Fuel Consumption Galls/hr.*
Take off and Max. Climb	12,300	00	5,000	660
		100	4,800	680
		200	4,620	702
		300	4,490	725
		400	4,390	755
		500	4,380	788
		600	4,450	825
Max. Cruise.......	12,000	100	4,360	612
		200	4,175	628
		300	4,040	650
		400	3,950	676
		500	3,925	705
		600	3,970	737
Cruise............	11,500	100	3,620	515
		200	3,380	520
		300	3,220	532
		400	3,120	552
		500	3,070	576

The static thrust at engine idling speed will not exceed 120 lb. at aircraft speeds below 100 m.p.h.

(4) *Lubricating Oil*

D.T.D. 44D
Oil Consumption less than 1 pt./hr. at all ratings.
Oil Tank Capacity — 10 pints.
The oil tank must always contain 2 pints of oil for the purpose of circulation.
The oil tank is integral with the engine.
No provision is to be made for an oil cooler.

(5) *Installation Details*

Entry area to nacelle.....................3 sq. ft.
Minimum nacelle diameter round compressor casing..........................50 in.
The exhaust cone is readily detachable if necessary for the purpose of installing the engine.

(6) *Accessory Gear Box*

Power available at gearbox drive............30 hp.
A single horizontal drive is provided at the front of the wheelcase to suit the Rotal S.G. series of accessory gearboxes.

(7) *Exhaust Jet Clearance*

Spread angle of exhaust jet. 15 deg.-20 deg. included

Acknowledgment

The author wishes to thank Rolls-Royce and the Ministry of Aircraft Production for permission to publish the information on the Nene and Derwent engines which is contained in this paper.

Thanks are also due to Mr. Agar of Canadair for his technical assistance and to Mr. Morrall of Rolls-Royce for preparation of the curves and for his general assistance.

COMBINED ACTION OF CONCRETE SLABS AND SUPPORTING STRUCTURAL STEEL BEAMS

R. C. MANNING, M.E.I.C.
Chief engineer, Canadian Institute of Steel Construction Inc., Toronto, Ont.

In spite of the fact that, as early as 1922, tests were conducted which indicated conclusively that a steel beam, completely haunched in concrete, was capable of carrying a much greater load than would the bare steel beam itself, little attention has been given to this feature in the building codes of our modern cities. The present general practice is to consider the steel beam as supporting the entire dead and live load without assistance from the surrounding envelope of concrete.

This practice led the engineer to seek for a method of protecting structural steel from excessive heat by means of some lighter form of covering.

Thus we find today that the steel floor beams and girders of our modern buildings are usually protected by some type of precast material which extends upward to the normal level of the concrete in the floor slab above.

Figure 1 indicated the changes in concrete section surrounding the steel beams which have resulted from these developments.

Figure 1(a) represents a section through a floor beam using the solid concrete fireproofing method when the floor slab is any type of concrete joisted floor, whether one or two-way construction.

Figure 1(c) shows the revised section using the newer method of precast fireproofing. Similarly, Figs. 1(b) and 1(d) show the change of section which has taken place when the floor slab is a solid poured concrete slab.

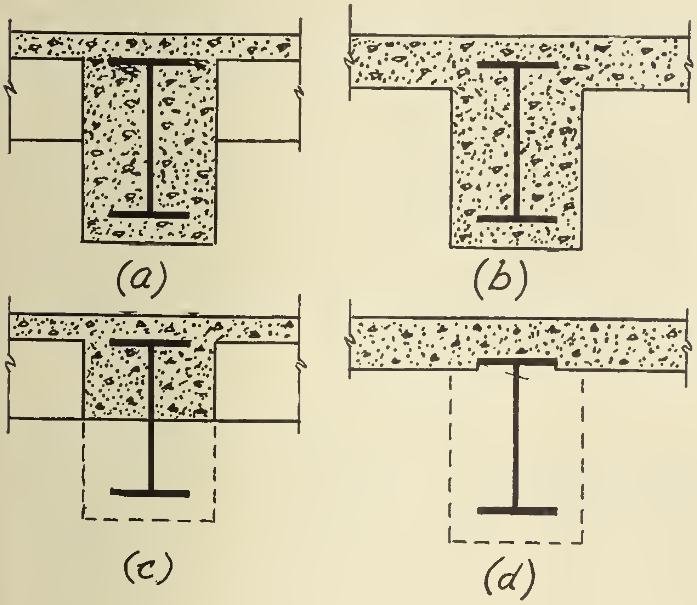


Fig. 1.

As it became more and more obvious that the practice of ignoring the load carrying value of the concrete surrounding a steel beam was wasteful, the Canadian Institute of Steel Construction has given serious thought to the idea of correcting the situation. Practically all the testing which had been done previously was based on the complete haunching of the steel beam in concrete. It was agreed that the extra weight involved in returning to this method of protecting the steel beam would sacrifice much of the potential saving to be made by figuring the combined action of the two materials. Moreover, it was felt that the concrete around the lower part of the web and around the bottom flange added little to this combined action.

Tests Undertaken

Early in 1937, a series of pilot tests were conducted under the auspices of the Canadian Institute of Steel Construction by Professor C. R. Young of the University of Toronto. Figure 2 shows the details of the specimens which were used. It will be seen that the sections of concrete used are similar to Figs. 1(c) and 1(d) as described above. Note that Specimen A in the test had welded cleats at one end only.

Some of the conclusions drawn by Professor Young as a result of these tests were:—

(*a*) Composite beams in which the top flange is augmented by a concrete slab, with or without haunching down to approximately the neutral axis, behave in substantial correspondence with the accepted theory of composite beams, so long as the bond between the concrete and the steel is not definitely broken.

(*b*) For the depth of beams tested, and for the grade of concrete employed, the capacity for third point loading, based on the extreme fibre stress in the bottom flange of the steel beam of 20,000 lb. per sq. in., and with intact bond is increased from 29 to 48 per cent, the larger figure being applicable to the shallower beam.

(*c*) For an extreme fibre stress of 33,000 lb. per sq. in., in the bottom of flange of a composite beam with intact bond the third point load capacity is increased from 13 to 36 per cent, the larger figure being for the shallower beam.

(*d*) The flexural stress in the top flange of the encased I-beam is moderate with intact bond. For the specimens investigated, the amount of concrete employed was relative-

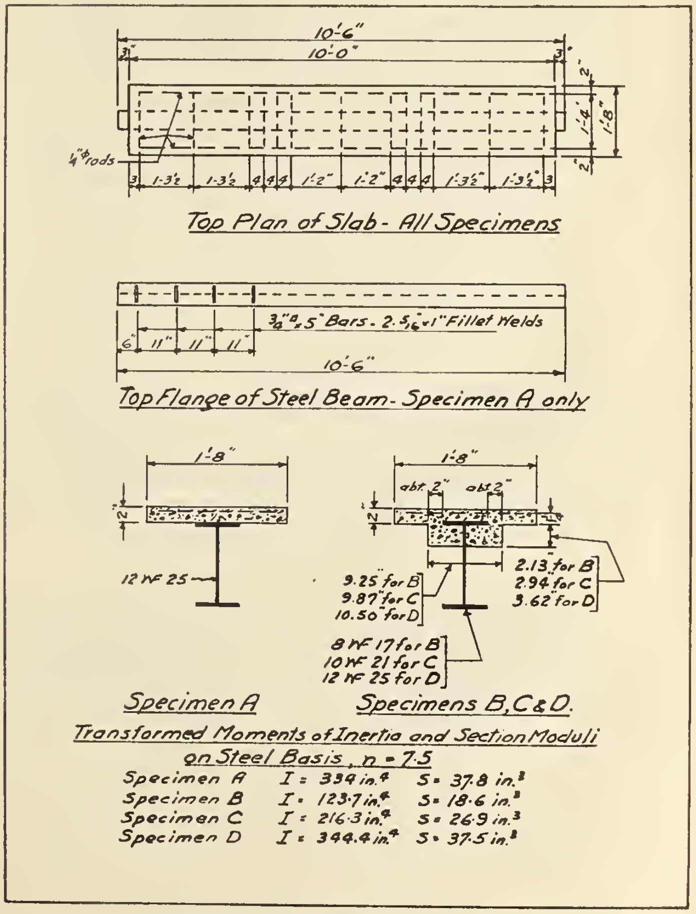


Fig. 2—Details of specimens.

ly large and consequently the extreme fibre compressive stress in the concrete was not a determining factor.

(*e*) Welded cleats, such as those employed at the left end of Specimen A (Fig. 2) provide an excellent security against early bond failure. A beam with attached cleats at both ends might be expected, even without haunching, to develop a capacity comparable with that developed by Specimen D with haunching.

(*f*) In continuous construction, where the slab abuts against steel columns, and where adequate reinforcement of the slab parallel to the steel girder in the neighborhood of the latter exists, it would appear that the capacity of the interior spans of composite beams might well be above that reported in the present pilot tests for the same grade of concrete. At the outer end of end spans, special need for providing adequate bond resistance would arise but it appears probable that the use of cleats similar to those employed in Specimen A would solve this problem.

Further Tests

In order to develop further conclusion (*f*) above relative to continuous structures, it was decided to carry on a further test at the University of Toronto.

Figure 3 shows the details of the specimen which was prepared.

The cross section of the three-span unit, was, for comparative purposes, made the same as that of Specimen C used in the pilot tests previously described. The haunching was, as in the previous case, carried down only to the neutral axis of the composite beam.

For the primary purpose of improving the resistance to slipping of the concrete slab and haunching on the top flange of the steel beam, continuity was provided at the two intermediate column supports by introducing four 5/8 in. dia. longitudinal top rods carried to the estimated points of inflection. The beams framing into these columns rested on stiffened brackets and were connected at the top by clip angles. The attachment of the beams was by means of turned bolts, the bolts in the bracket having roughly the same capacity as the four 5/8 in. dia. rods in the slab at the support.

While free support was provided at the north end of the unit, at the south end the steel beam rested on a column bracket and was provided with a clip angle similar to those at the intermediate columns. Further, a single 5/8 in. dia. rod was looped around the column in order to provide a small amount of restraint similar to that ordinarily found in building construction at wall columns.

In order to assist in bond resistance, three 3/4 in. square transverse cleats 5 in. long were welded to the top flange of the beam near the north end, as shown in Fig. 2 There were no cleats provided at the south end. The purpose of the cleats was to ensure bond resistance at the north end at least equal to that at the south end.

Conclusion from Tests

Based on the observations made during test and the theoretical analysis of the behaviour of the unit, the following conclusions were reached.

(*a*) Due to the combined influence of reinforcement of the top flange of the steel beam by haunching and slab incorporation, and the continuity arising from the end details, the maximum flexural stress on the steel at mid-span is substantially reduced. For loads that would produce flexural stresses of 15,500 lb. per sq. in. or over in a corresponding naked beam, the stress is reduced about 33 per cent. For loads that would produce flexural stresses of 13,200 lb. per sq. in. or over in a theoretical simply-supported composite beam, the actual stress in the steel at mid-span is about 21 per cent less.

(*b*) The flexural stress at mid-span increased according to a straight line law until a partial breakdown of bond and continuity took place at the supports. After the beam had reached a steady state due to the reloading, the acceleration of stress increase was found to begin at a flexural tensile stress of 20,000 lb. per sq. in.

(*c*) The effect of continuity was still important in the intermediate span from the point of sudden slip up to the maximum applied load and presumably had a substantial bearing on the observed stresses.

(*d*) Ordinary amounts of tensile steel in the slab at the intermediate supports do not materially improve the bond.

During these various tests, welded cleats on the top flange of the beams were found to greatly increase the bond between the concrete and the top flange of the beams.

Final Test

It was decided to conduct another test with a concrete slab on top of a steel beam as shown in Figure 4.

Since theoretical analyses and previous tests had indicated that the bond strength between the concrete and the steel would be the critical factor in determining the strength of the composite beam, it was decided to weld lugs to the top flange of the steel beam engaging the concrete, thus providing additional mechanical bond.

The beam was loaded with a single concentrated load at mid-span as shown in Figure 4. Measurements were recorded of the deflection of the beam at mid-span; the slips between the concrete slab and the top flange of the steel section at the two ends of the beam; the strains in the concrete and the steel at the points of the cross-section indicated in Figure 4. Since the load was applied at mid-span, it was not possible to measure the strains at this section but a section H one foot from mid-span, was chosen for the first six loadings, while another section K, two feet from mid-span, was chosen for loadings 7, 8 and 9. It will be noted that section H is at the location of a shear lug while section K is midway between two of the shear lugs. Since, for this type of loading, the bending moment and hence the strains would vary directly as the distance from the support, the measured strains at H were stepped up by the fraction 7/6 and at K by the fraction 7/5,

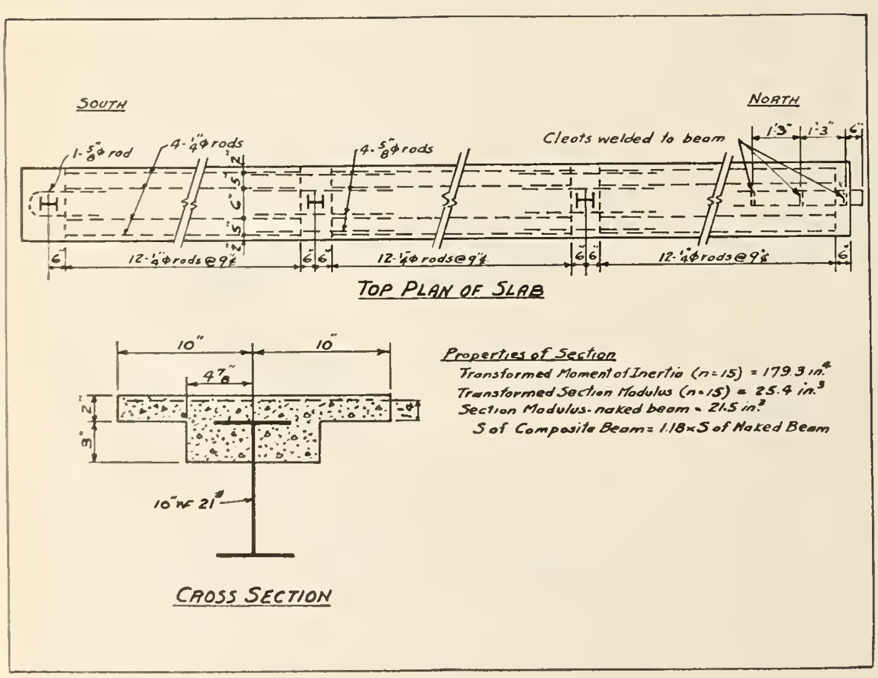


Fig. 3—Details of specimen.

so as to indicate the strains which would occur at the mid-span section.

In the second run, when the load reached 34 kips, there was a loud report and the load fell off to 32 kips. Inspection showed that sudden slip had occurred at the north end and it was concluded that the surface bond between the top flange of the steel beam and the concrete slab had broken through the north half of the beam. The bond stress accompanying the load of 34 kips, computed by the standard expression $\frac{V.Q.}{I.b.}$ was 182 lb. per sq. in. The measured stress in the steel was about 28,000 lb. per sq. in. when this first bond failure occurred. During the fourth run, when the load reached 38 kips, a similar occurrence indicated that the surface bond had broken throughout the south half of the beam, the intensity of bond stress being in this case 207 lb. per sq. in. Subsequently the shear lugs operated to transfer the stress into the concrete slab as was anticipated in the design of the composite section.

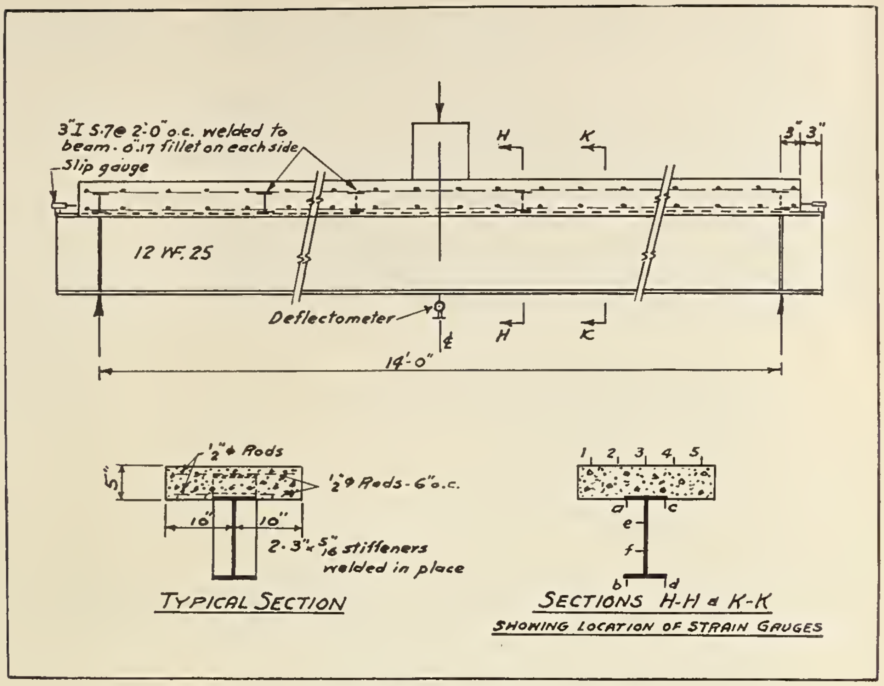


Fig. 4—Details and method of loading.

During the ninth and last loading, the instruments were left in position until a load of 50 kips was put on the beam after which they were removed and the beam loaded to failure. This failure occurred at a load of 75.5 kips as a result of crushing of the concrete at the edge of the loading block. The deflection of this load was 2 1/2 in. When the beam was taken from the machine and the slab removed, it was observed that the shear lugs were still in good condition. There was no evidence of failure in any of the welding.

Conclusion from Tests

(*a*) The reinforced concrete slab on the top flange of the I-beam has a marked strengthening effect. For a load concentrated at mid-span, the capacity is increased 46.5 per cent, approximately, over that of a corresponding naked beam.

This increase is indicated by a comparison of the respective safe loads for the naked steel section and the composite beam:

Permissible Stress in Steel lb. per sq. in.	Safe Load, Kips	
	Naked Beam	Composite Beam
20000	14.7	21.5
33000	24.3	35.5

(*b*) The composite beam behaves elastically for the fibre stresses and deflections developed up to a load of 35.5 kips. This load, as shown above, is the rated capacity of the composite beam for a permissible stress in the steel of 33,000 lb. per sq. in.

(*c*) Deflections mounted smoothly with applied load for loads not exceeding 40 kips. The observed deflections were less than those calculated for a naked beam, but larger than deflections calculated for the composite beam.

(*d*) The shear lugs were found to be in good condition after the test, with no evidence of failure in the welding.

Practical Application

The first practical Canadian recognition of the combined action of concrete slabs with steel beams will be found in the National Building Code which was prepared under the joint sponsorship of the National Housing Administration of the Department of Finance and the Codes and Specifications Section of the National Research Council of Canada.

The National Building Code, which was published in 1941, was the result of nearly four years of intensive work by a group of Committees made up of outstanding authorities in the various fields of construction.

Its purpose was to offer guidance to various communities which had no building regulations or whose codes were in need of modernization.

The following appears on Page 147 of the Code—3.5.10.11

Allowance for Concrete Encasement

(*a*) General—Allowance may be made, in accordance with the provisions of this Item, for the strengthening effect of concrete encasement or of a concrete slab on a beam, if the concrete has a minimum strength of 2000 pounds per square inch and the steel is not painted.

(*b*) Initial Stress—Allowance may be made only for the portion of the load that is supported by the beam after the concrete has set. If the concrete or any other loading causes stress in the steel before the concrete has set, such loads shall be assumed to be supported by the steel only.

(*c*) Method of Calculation—Allowance may be made for the strengthening effect of the concrete by assuming that the steel and the concrete act together elastically, in which case the stress in the steel shall not exceed that permitted in Article 3.5.4. If the horizontal shear stress on the upper surface of the steel beam exceeds .025 $f'c$ special provision shall be made to increase the bond between the steel and the concrete. Such provision shall be adequate to resist all horizontal shear stress on the upper surface of the steel beam in excess of .025 $f'c$ and may take the form of anchorage plates or angles rigidly attached to the top of the flange of the steel beam.

Preparation of Tables

Realizing that the busy structural designer will be helped by the preparation of printed tables giving the properties of composite steel beams and concrete slabs for the more common combinations of beams and slabs, the Canadian Institute of Steel Construction is preparing tables which will become available in the near future.

When completed, these tables will give the properties of all Canadian rolled beams from 8 I @ 18.4 to 15 I @ 55 combined with top slabs 3 in., 4 in., 5 in., and 6 in. in thickness (Fig. 1(d)), the properties being given for 2000 lb., 2500 lb. and 3000 lb. concrete.

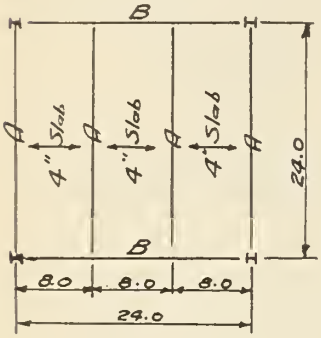
In like manner, the properties of the same thicknesses and grade of concrete slab will be given when combined with a large range of the more commonly used American wide flange sections.

The tables will also give the properties of all Canadian rolled beams from 8 I @18.4 to 15 I @ 55 combined with thin top slab and partial haunching (Fig. 1(c)) as used with joisted types of concrete floors. Here again figures will be given for 2000 lb., 2500 lb. and 3000 lb. concrete.

Similarly the tables will show the properties of thin top slabs and partial haunching combined with the commonly used American wide flange sections, using 2000 lb., 2500 lb. and 3000 lb. concrete.

Example of Calculations

LIGHT MANUFACTURING BUILDING



Live Load = 125 lb./sq. ft.
Concrete — 2500 lb. sq. in.
f_s = 20000 lb. sq. in.

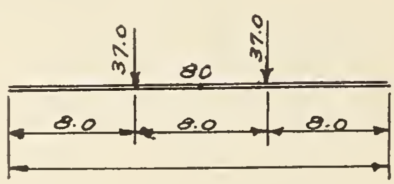
Ordinary Design Methods

Beam A LL = 125
DL = 50
Fin = 12 $R = 18500$

$$187 \times 8 = 1496$$
$$B_m = 45$$
$$\frac{1541 \times 24^2}{8} \times \frac{12}{20} = 66.2$$

Use 16 WF @ 45

Beam B 37.0
.9
37.9



Assuming 24 WF @ 80 $S = 185.8$

$$M = 37.9 \times 12.0 - 37.0 \times 4.0 - \frac{80 \times 12^2}{2}$$
$$= 455.0 \quad - 148.0 \quad - 5.8$$
$$= 301.2 \times \frac{12}{20} = 181.0$$

Use 24 WF @ 80

New Method—Assuming all concrete suspended from steel during setting period.

Beam A Assume 16 WF @ 36 Bare $S = 56.3$
Comb. $S = 81.9$
(from tables)

See Fig. 1 (d)

Stress in bare steel beam due to concrete load and weight of beam

$50 \times 8 = 400$ $R = 5220$ lb.
36

$$\frac{436 \times 24^2}{8} \times \frac{12}{56.3} = 6700 \text{ lb./ sq. in.}$$

Added Stress in Steel in Combined Section due to Live Load and Floor Finish

R = 13200 lb.

$$137 \times 8 = \frac{1096 \times 24^2}{8} \times \frac{12}{81.9} = 11600 \text{ lb./ sq. in.}$$

Total Steel Stress = 18300 lb. ok.
Use 16 WF @ 36 lb.

INVESTIGATION OF BOND AND MECHANICAL LUGS

Shear due to Live Load and Floor Finish only $R = 13200$

Max. Hor. Shear on Top Flange $= v = \frac{V.Q.}{I.B.}$

Where $Q = 744$ (from tables)
$I = 13480$ (from tables)
$b = 6.99$ (from tables)

$$v = \frac{13200 \times 744}{13480 \times 6.99} = 104 \text{ lb./ sq. in.}$$

National Building Code allows bond stress of $.025f'_c$ for concrete = 62.5 lb./ sq. in.

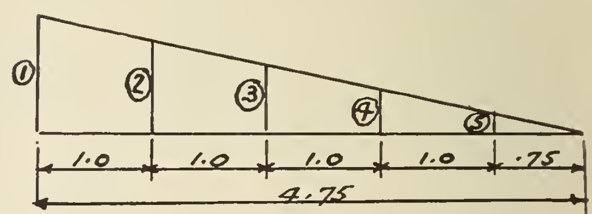
v to be taken on mechanical lugs = 41.5 lb./sq. in.

This represents a vertical shear of $\frac{41.5 \times 13480 \times 6.99}{744}$
$= 5250$ lb.

Shear lugs are required for $\frac{5250}{1096} = 4.75$ ft. from each end

Assume lugs — 1 in. sq. bar × 0 ft.—7 in. long.
Value in bearing on concrete = 7 sq. in × 2500 × .20
= 3500 lb.

Use 3/16 in. weld — 3 in. long



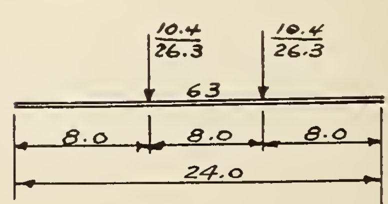
$$\text{Spacing at} \quad (1) = \frac{3500}{41.5 \times 7} = 12$$
$$(2) = 12 \times \frac{4.75}{3.75} = 15$$
$$(3) = 12 \times \frac{4.75}{2.75} = 20$$
$$(4) = 12 \times \frac{4.75}{1.75} = 32$$
$$(5) = 12 \times \frac{4.75}{.75} = 75$$

Space lugs — 6″, 15″, 20″, 20″
Total lugs per beam = 8 — 1″ sq. × 0′ — 7′ long

Beam B

Try 21 WF @ 63 Bare $S = 128.0$
Comb. $S = 171.5$ (from tables)

See Fig. 1 (d)



10.4
.8
11.2
26.3

Moment on *bare* steel $= 11.2 \times 12 - 10.4 \times 4 - \frac{63 \times 12^2}{2}$

$= 134.4 - 41.6 - 4.5 = 88.3$

$$\text{Stress} = \frac{88.3 \times 12}{128.0} = 8260 \text{ lb./ sq. in.}$$

Moment on combined section =
$26.3 \times 12 - 26.3 \times 4 = 210.4$

$$\text{Stress} = \frac{210.4 \times 12}{171.5} = 14750 \text{ lb./sq. in.}$$

Total Stress = 23010 lb./sq. in.

This stress is too great.

Try 24WF @ 74 Bare S = 170.4
Comb S=220.5 (from tables)

$$\text{Bare Steel Stress} = \frac{88.3 \times 12}{170.4} = 6200 \text{ lb./sq. in.}$$

$$\text{Added Steel Stress} = \frac{210.4 \times 12}{220.5} = 11450 \text{ lb./sq. in.}$$

Total Stress = 17650 lb./sq. in.

Use 24WF @ 74

INVESTIGATION OF BOND AND MECHANICAL LUGS

Shear due to Live Load
and Floor Finish only $R = 26300$

$Q = 1530$ (from tables)
$I = 47200$ (from tables)
$b = 9$ (from tables)

Max. Hor. Shear on Top Flange =

$$= v = \frac{V.Q.}{I.b} = \frac{26300 \times 1530}{47200 \times 9} = 95 \text{ lb./sq. in.}$$

Concrete Bond Allowable = 62.5 lb./sq. in.
v to be taken on mechanical lugs = 32.5 lb./sq. in.
Use 1″ sq. × 9″ lg. Comp. Value = 9 × .20 × 2500 = 4500 lb.

Use 3/16″ weld — 3″ long—

$$\text{Maximum spacing} = \frac{4500}{32.5 \times 9} = 15''.$$

Lugs required for entire 8′ — 0″
Space 7½, 15, 15, 15, 15, 15, 15
Total lugs per beam = 14 — 1″ sq. × 0′ — 9″ long

COMPARISON OF WEIGHTS (ignoring connections)

Weight per Panel—Ordinary Method

$45 \times 24 \times 3 = 3240$
$80 \times 24 \times 1 = 1920$

$$\frac{5160}{24 \times 24} = 8.95 \text{ lb./sq. ft.}$$

New Method

$36 \times 24 \times 3 = 2592$
$74 \times 24 \times 1 = 1776$
$3 \times 8 \times 3.4 \times 7/12 = 48$
$1 \times 14 \times 3.4 \times 9/12 = 36$

$$\frac{4452}{24 \times 24} = 7.74 \text{ lb./sq. ft.}$$

Saving = 1.2 lb./sq. ft. = 13½% on floor beams

CONCLUSION

The savings indicated above are obtained without the general contractor doing any part of his work other than in the usual manner.

In some cases, where the composite section is stronger in compression than in tension, it may be found advantageous to place temporary supports under the steel beam so that the entire load is carried on the composite section. Such procedure will reduce deflection to the minimum.

In all composite sections using a symmetrical steel beam, it will be found that the stresses in the top flange of the steel beam are low. This fact leads us to the idea of building up, out of Canadian plates or Canadian sections, a steel beam in which the top flange has a smaller area than the bottom flange. The savings thus obtained will go a long way toward neutralizing the extra cost of building up the sections. Such a procedure would make use of Canadian mill materials for sizes beyond their present maximum of 15 in. in depth much more practical than under the older design methods.

In our opinion, all Building Codes in Canada should take early steps to follow the lead of the National Building Code in recognizing the combined action of steel beams and supporting concrete slabs. The official recognition of this principle of design will not only eliminate waste of material but will also give the opportunity for a wider use of Canadian steel.

THE ENGINEER FAMILY IN THE BRITISH COMMONWEALTH

Dr. P. DUNSHEATH c.b.e.

President, Institution of Electrical Engineers (Great Britain) and Director and Chief Engineer of W. T. Henley's Telegraph Works Company Limited, London, England.

Address delivered at the Sixtieth Annual Banquet of The Engineering Institute of Canada held in the Mount Royal Hotel, Montreal, Que., on Friday, February 8th, 1946.

(As recorded verbatim by the stenotypist)

Mr. President, Ladies and Gentlemen:

I appreciate very highly the honour which you have done me this evening in inviting me to come here and be your guest speaker. I think of the remarks which were made by a speaker at the luncheon today who said how very pleased he was to come back to Montreal, to Canada, after an absence during which time he had retained many happy memories of former visits. I am not fortunate enough to have had former visits to this delightful country of yours but I am quite sure, after a space of only 36 hours, that I shall come back again at the earliest opportunity.

It so happens that the invitation from your Institute to The Institution of Electrical Engineers came at a very appropriate time. So far as I am personally concerned it arrived at a happy moment when, as president of that Institution in the first peace-time year, I was having opportunities which had not been available to any president for the past six years. Your invitation came, therefore, at a time when no president could possibly decline even if he had wished to do so.

It was also a happy coincidence that the other two chief Institutions of Engineers, the Institution of Civil Engineers and the Institution of Mechanical Engineers were both happy to allow me to represent them as well as my own Institution, at this most important gathering.

It also happened, Mr. President, that at the time of receiving your invitation my Institution, along with the other two bodies, were considering a subject which is of very great interest to your own Institute. We have had in mind for some time past the possibility of taking action to secure a better co-ordination throughout the Commonwealth, of engineering interests on all three sides, civil, mechanical, and electrical, and during the past few months those discussions have gone quite a long way, so that when your invitation came we said at once: "Here is an excellent opportunity to advance those relationships with the other parts of the British Commonwealth, the Dominions overseas, for which we are all seeking."

Commonwealth Conference

There would be many important questions to be settled in discussing this matter and I have very great pleasure today, therefore, in telling those of you who are not already aware, that during the coming summer we are arranging to hold in London a conference of the Commonwealth at which we are hoping to have delegates from every one of the Dominions. We have issued invitations and were very pleased indeed when the first acceptance came very quickly from The Engineering Institute of Canada. Not only did it come quickly but the enthusiastic terms with which you accepted our invitation gave us very great pleasure and inspired us for the work of the conference.

It is too early for me to attempt to outline the objectives which we hope to achieve in the summer when we all get together but we are hoping, Sir, that your representatives, while they are in London, will be the guests of our Institution. In this connection the three Institutions are operating together and, although no details can be proposed at this stage until we have more discussions, we can, I think, secure quick agreement on our general policy. Obviously the object of that conference will be to strengthen in every possible way the bonds of co-operation between the Dominions and the Mother Country in all matters which affect engineering. We shall hope to treat every matter in such a way that the individual societies in the different national groups will be able to fall in with a common policy which will bring interest to those separate groups and at the same time will be in the common interests. Naturally, we shall avoid taking any steps which would interfere with the government of the individual members.

Professional Organization in Great Britain

It may be that you would like to know at least something of the set-up which we have in our country carrying out the work which you are doing so admirably in your Institute here. Instead of having one body such as the E.I.C. which covers all branches of engineering, we have three separate institutions. They were formed at different times and have complete autonomy. They have also their separate buildings in which meetings and administration are carried on. The Institution of Civil Engineers was formed in 1818 and today has a membership of 15,000. The Institution of Mechanical Engineers was formed in 1847 and today has about 20,000 members. The Institution of Electrical Engineers is the baby of the three as it was formed in 1871 and now has a membership of 28,000.

Sometimes we have regrets that we are separate bodies. For many reasons it would be an advantage if we had joint administration and joint policy but in engineering bodies there seem to be schisms from time to time, breakings apart and reconnections and if we take a biological example we may say that is only a sign of really good health.

I am always reminded, when I refer to a biological example, of a speech I made when I was a very young man. In fact I think it was the very first time I spoke at a public gathering. This was at Liverpool University in the days when I, like many other young men, tried to prove the fallacies of socialism. I remember to this very day a question which I put to the audience: "What does the whole science of biology teach us?" I do not know now what answer I expected but I do remember that the theatre went up in serried ranks to the ceiling and that there was a lady in the back row, a very bright, young undergraduate, who immediately gave me the answer. It finished me for the day.

But although we have these three separate institutions and although we have complete autonomy, I am glad to be able to tell you that we are very happy in our relations with one another. In order to bring our common policies together as much as possible, we hold informal meetings of the three presidents. They meet under entirely informal conditions and in that way try to apply common sense to current problems and we are able to bring our common viewpoint to bear in such a way that perhaps we achieve much of what you get through your one body controlling all the different interests.

We also recognize, although we think we are the three main Institutions and cover the three main branches of engineering, certain other bodies which are quite strong, healthy, active, representative of engineers such as the Marine Engineers, the Aeronautical Society, the Institute of Naval Architects and the Municipal and County Engineers. It is interesting to note in connection with tendencies of administration how the approach of these Institutions is changing under modern conditions. I do not know whether you have noticed it with your body here but we have noticed quite definite changes in trend. We are being sought out by members of the engineering profession who have already established themselves. In the past, the distant past, the Institutions were approached by young men wishing to make a position in life but today more and more we are finding that those who in their youth did not take an interest in the Institution are now coming in and we feel that this is an example of what is being referred to at your conference here this week, the feeling that is getting abroad that the object of the engineering society or institute is to render service to the community rather than service to the individual member.

Service to the Community

These men who are now coming in to make application for admission are not coming in entirely for the sake of what they would get out of the Institution but because of a general wave of feeling throughout Britain that national bodies of this kind are worthwhile and should be supported. I hope that we shall see an increase in that attitude toward our national engineering bodies because I feel it is good for the profession.

That question of service to the community about which we are hearing so much, and quite rightly too, leads me to the general question that I have adopted for the title of this talk, "The Engineer Family in the British Commonwealth." There could be no closer tie between the different members of the Commonwealth than a tie such as we get in our common interests as engineers. Our three British Institutions each possess a charter and in the charter the objects of the institution are clearly laid down. In all three they are the same. The object of the institution is the advancement of science and its application for the good of humanity. If we live up to that charter we clearly are going to promote science and in applying this science we are going to benefit our fellow men. What better common ground could there be for co-operation throughout the Commonwealth than such a basis?

Engineer's Contribution to Allied Cause

The war has given us during the past six years many examples of the way in which the engineer is more and more being looked upon as the one profession, if I may say so, in which service to the community is the "be all and end all."

This afternoon I had the privilege of speaking at one of the professional meetings and outlined some of the activities of the engineer at home during the last six years. There is no time this evening to refer to more than a few of those activities but I think you probably would like to have me make a reference to them.

I want to tell you that it is my firm belief and the firm belief of many engineers in my country that the British engineer contributed very largely to the successful outcome of the Allied cause.

Civil Engineering

There were many things done in London which will never get into the newspapers because by now they are stale news from the point of view of the ordinary man in the street. I do feel, and this is one of my reasons for being in this country, that these things should be said over and over again. How many people appreciate today the extent to which the civil engineers devoted their professional ability to securing the safety of the millions of people who lived in London through the bombardment? Very few indeed. We had three underground citadels in London and, without going into the millions of tons of concrete and the millions of pounds they cost, I could give you an idea of one of them when I tell you it would house thousands of people who were concerned with the conduct of the war for at least three weeks without any outside communication at all. It had every possible requirement and was built during the war without the knowledge of the people in the neighbourhood. Many people who lived over that citadel, built 50 feet below the ground, never knew it was being constructed.

Shelters for the population were distributed to a very great extent on a basis of—"Here is the shelter. Put it up for yourself." We had what is known as the Anderson shelter and 2½ millions of these, taking many hundreds of tons of steel in their construction, were handed out to people who erected them, digging small holes in their back-yards and then having erected these shelters lived there the worst nights of the blitz as they came along. The accommodation provided in that way was, of course, not of a permanent nature but it resulted in a considerable saving of life because experience showed that people were not killed by a direct hit of a bomb but by houses falling on them. If, during an air-raid, they would go into their gardens and get under their shelters a little below the ground they were protected from the glass and, in that way, thousands of lives were saved.

Another contribution of the civil engineers which is known, but again not appreciated, is the extent to which they employed hundreds of thousands of workmen constructing airfields in Britain. There again one could mention millions of tons of soil that had to be moved but, to sum up the whole thing, the total area of runway that was provided for the British Commonwealth and American Air Transport flying from Britain to the Continent would represent a roadway in the neighbourhood of thirty feet wide and ten thousand miles long. I think that gives you a rough picture of the magnitude of that one task.

Mechanical Engineering

The mechanical engineers' contribution was a most spectacular one, in aircraft design and development, and particularly in jet propulsion. The latter work was done principally through the efforts of one man and has been referred to on many occasions. I mean, of course, Air Commodore Whittle, who from about 1930 to 1941 fought against technical difficulties and administrative apathy. However in a comparatively short time he produced the gas turbine. Practical trials began about 1935 and, in 1941, the first flight tests were made, and when the flying bombs were launched against us in 1944 the jet propelled aircraft provided a valuable weapon of defence for our island.

One of the things for which mechanical engineers deserve great credit was the development of the tank. We had an old fashioned tank in 1939 with which our soldiers had to go into war against the most up to date tanks. Its main armament was a .303 inch machine gun and it had an engine of 80 horsepower. Three years later we sent over our Churchill, 500-600 h.p. In four years our mechanical engineering designers caught up to the previous eight years' work of the German engineers. They did in four years what the German engineers had done in 12 years and beat them at their own game.

Electrical Engineering

A very great deal could be said, again, about radar and the contributions of the electrical engineer through this most spectacular device. Radar has now become a very popular study and some of the younger students know considerably more about the subject than I do. In 1939 we had started using radar, a few months before the war broke out, in providing coastal chain stations which ultimately were to become such a valuable defence against German planes flying across England. An experimental station had been built at Orfordness for floodlighting an area out to sea with radio waves and receiving reflections from ships and aircrafts some distance from the coast. The results were so successful that by the time the war broke out we were able to establish a complete set of stations at 50-mile intervals around our shores from South Wales and the South and East Coasts to Scotland.

However, the first station installed did not take into account the low-flying aircraft and, in order to spot these raiders, a group of shorter-wave transmitters with rotating aerials mounted on tall towers and synchronized were added to the floodlight stations. These were known as Chain Home Low Stations and were very accurate in catching those low flying planes coming in. This equipment gave our limited number of fighter machines and pilots information on position, speed and altitude of the raiders which enabled such spectacular results as when 185 enemy aircraft were destroyed in one day by pilots of our machines, inferior in numbers but so superior in courage.

I am old enough as an engineer to be able to look on new developments with a feeling that wonders never cease and that the days of miracles are not passed. The way in which ground-controlled interception and air interception could establish the position of a raiding machine, could send a signal to a two-man fighter plane in which we had a radar device, direct them through the thickest fogs and darkest clouds to fight until the enemy ceased to exist will ever be to me a source of wonder. I think on many occasions the German raider never really knew what had happened to him for it was all over so quickly.

When we consider that what these planes were guided by was not a single device or by actually seeing the ground below through the fog and mist but by using what is known as the H-2-S system, we must be filled with admiration for those men who worked so assiduously on development of designs and by their dauntless courage helped to overthrow the forces of barbarism. Those are the days in which the final results of the war were really settled. Except for the devotion of those men the war might have ended very differently.

The anti-aircraft control is a device with which anyone living in England in 1940-1941 was very familiar but it was a curious thing about these anti-aircraft guns, nobody ever talked about them. I had a daughter-in-law about 21. She used to go to some business or other about which I did not ask and about which she said nothing although I did know it was some sort of war job. Later I learned that her work was in one of the towers and connected with directing gunfire on aeroplanes. That is just typical of what was going on all the time.

Much of our work was more spectacular, particularly with the advent of the flying bomb, without interference of any human hand whatever. One device had a projecting mirror and was known as Cupid and is a small radar set operating in the centimetric band and designed to search for and follow automatically V-1 flying bombs. It is mounted directly above a close-range predictor. This apparatus made possible the good results against the flying bomb. It was a great occasion when we knew we could successfully combat that weapon. We remember that occasion very well because of the fact that 80 per cent of the docks were afire at that time. I remember it for a different reason, also. I have a picture of the chairman of my company, a very portly gentleman, and his secretary, a very portly lady, diving under the table at each new explosion and emerging very cautiously, about once every five minutes. It all seems funny now but it was not so funny at the time.

Pluto

One morning a representative of the Army came to us and said, " We want you to devise some means of getting a million gallons of petrol across the Channel daily. Not much of a job. Just get on with it." So one of the British oil companies and the cablemakers got together and very quickly we were able to devise a lead-alloy pipe about 3″ in diameter, with four steel tapes and longitudinally steel-wire armoured which could withstand an internal test pressure of 4000 lbs. per square inch. Between April 1942 and October 1944 a total of 570 nautical miles of this armoured pipe was made by five British firms and 140 miles to the same design brought over from the United States. A plain 3″ steel pipe welded into continuous lengths each of 70 miles and paid out from floating drums was also used for part of the work. That pipe was laid one very summery afternoon and it was a big installation. This operation was known as Pluto. The results that the Army wanted were achieved.

Magnetic Mines

A great deal could be said, again, on the way the engineers have handled the problem of defeating the magnetic mines. Trouble arose in the early months of the war and many ships were lost during September, October and November, 1939, but a party of engineers from *H.M.S. Vernon,* whose names should go down in history but I do not think anyone knows their names and they are not men who wanted any particular credit, approached this problem of mines and found out exactly the details of the magnetic properties of the mine. The antidote soon followed. Ships were protected in two ways, first by magnetic treatment at intervals by passing heavy currents for short periods through temporary coils rigged around the ship or, secondly, by the installation of permanent " degaussing " coils fed from the ship's supply. Ten thousand warships and merchant vessels were fitted in that manner.

This kept the cablemakers pretty busy. They produced large quantities of single-core cable which was made up into sausage coils with hessian strips and laid in the scuppers around the vessel. Previously the object was to blow up the mine rather than to protect the ship against a live mine and that was achieved but the double-L sweep method had been evolved and this system was destined to dispose during the next few years of many thousand magnetic mines.

The big problem with the cable was that all cables sink in water. Cables are not made like " Ivory soap, it floats," and so we had to get some means whereby the cable would stay on the surface. Various designs were achieved, one of which has brought me a good deal of discredit because so many of my friends have said " we ought to be able to get at least an afternoon's tennis " but the tennis balls were all being used to hold up the cable.

Engineers Under the Blitz

I do not want to go on detailing these technical things but I would like to pay a tribute, before I stop, to those men of the engineering profession, civil, mechanical and electrical, who maintained such splendid service in London during the blitz. Time and time again roads would be blocked, sewers would be burst, electric power was shut off and yet, immediately a raid was over, they would effect restoration of the various services as quickly as possible. I am tempted on this occasion to reminisce about one little incident which I think I shall always remember. It does not really apply so much to the engineer, though.

I was passing a fire station one day during an air raid and the firemen, as usual, were ready for anything to happen. A flying bomb was coming over and I heard one of the chaps say to another standing at the door " Start up, George," and they started running, chasing that bomb down the street and were on the spot ready to deal with it almost as soon as it landed.

Communications of course gave the engineers a headache. Thousands of long distance trunk circuits were destroyed time and time again by bombs and had to be repaired and it would have done your heart good to see some of those men making repairs with the bombs still flying carrying on with that most necessary work and being handed cups of tea from mobile canteens. From such things as that one ought to get a very good opinion of human nature.

Recognition of the Engineer

I would like before I sit down to refer to the lessons that one ought to learn from the very unusual experiences we have had during the past six years. There must be something fundamental in this question of engineering and the pride in the job which has kept men on the job, not because they were being compensated but because of a sense of duty, and I can see from your faces that you hold the same view of the essential results of education and training, the position of engineers as administrators and a recognition of engineering status. I would like to take part in your discussions on all these subjects but they are subjects which we could discuss for weeks and months and years before we arrive at the correct conclusions, and it is quite clear that all these things lead to one truth. The social status of engineers is not going to be achieved by engineers individually clamouring for social advancement. It is going to be achieved when the engineer is felt by the community to be worthwhile, and he is gradually—I would say rapidly—coming to the stage, and the war has helped along that stage, when he is being recognized by the manner in which he does a good job of work and therefore is worth a position in society, and that is far more valuable than any number of associations getting together and defining it. That is the conclusion we have come to in our country and I feel it is very much the same throughout the Commonwealth.

I am hoping that all these subjects will be discussed at our conference in London this summer. Naturally there are many other possibilities of subjects other than those I have mentioned, but whatever we do we must be quite sure that in that conference we do cement the friendship among all engineers which exists at present between engineers in my country and engineers in this great Dominion.

Greetings

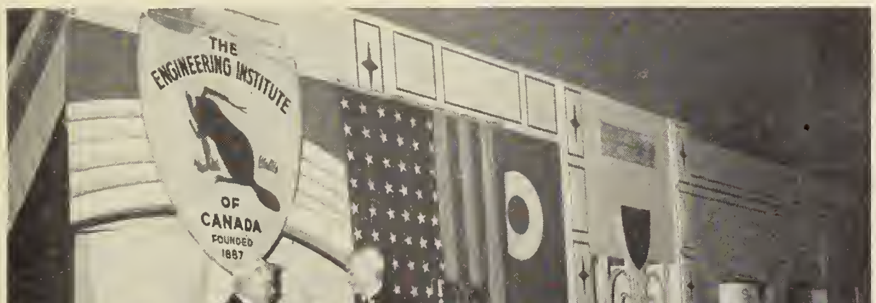
We still remember, Ladies and Gentlemen, the very noble gesture that your Institute made early in the war when it invited our children to come into your homes. We can never forget that gesture. You brought a great deal of thought over the ocean toward your own Institute, to think that you, with your own cares and difficulties, were willing to take our children and look after them as you did.

Not only that, but during the fall of France there is no doubt about it that the feeling we had in the Mother Country that the Dominions were behind us was a tremendous factor in maintaining the morale of our country. If we had not felt that the Dominions were there to strengthen and support us we would have gone down feeling that we were completely finished because otherwise we were all alone.

Mr. President, a few days ago I crossed the Atlantic in company with some 10,000 of your returning lads and lassies from their great enterprise over the water, an enterprise, an achievement unique in history. These men and women left their homes, gave up their youth, risked their lives to vindicate their belief in human right and freedom which in your country and ours we hold sacred. They sacrificed their youth to overthrow the greatest tyranny in history and they won.

I speak, I am sure, to some who have lost a son or a brother and I do so whose only son will never return, but with you I look for brighter days to come. During the trip on that great ship the *Queen Elizabeth*, I saw a symbol of hope, a symbol of certainty that Canada and Great Britain will stand shoulder to shoulder to preserve the sanctities of life.

To The Engineering Institute of Canada I bring the greetings of the civil, mechanical and electrical Engineers of Great Britain whom I am privileged to represent.



Dr. E. P. Fetherstonhaugh hands the reins of office over to the new president, J. B. Hayes, at the Annual Banquet. First head table (from left to right): Mrs. Fetherstonhaugh; J. G. Vail,, president, American Institute of Chemical Engineers; Dr. Percy Dunsheath, president, Institution of Electrical Engineers, London, England; D. R. Yarnall, president, American Society of Mechanical Engineers; Mrs. J. B. Hayes; Everett S. Lee, chairman, Engineers' Council for Professional Development. Second head table: Mrs. J. K. Wilson; Albert Deschamps, president, Canadian Construction Association; J. S. Cameron, vice-chairman, Canadian Standards Association; Mme J. A. Beauchemin; W. K. Brasher, secretary, Institution of Electrical Engineers; Dr. R. R. McLaughlin, president, Chemical Institute of Canada, Mme Albert Deschamps.

THE SIXTIETH ANNUAL GENERAL MEETING

Convened at Headquarters, Montreal, on January 31st, 1946, and adjourned to the Mount Royal Hotel, Montreal, on Thursday, February 7th, 1946

The Sixtieth Annual General Meeting of The Engineering Institute of Canada was convened at Headquarters on Thursday, January 31st, 1946, at eight o'clock p.m., with Vice-President J. E. Armstrong in the chair.

The general secretary having read the notice convening the meeting, the minutes of the Fifty-Ninth Annual General Meeting were submitted and, on the motion of F. L. Lawton, seconded by E. Baty, were taken as read and confirmed.

Appointment of Scrutineers

On the motion of J. A. H. Henderson, seconded by Walter G. Hunt, Messrs. L. C. Jacobs, G. N. Martin and G. E. Templeman were appointed scrutineers to canvass the officers' Ballot and report the results.

There being no other formal business, it was resolved, on the motion of S. F. Rutherford, seconded by A. Turner Bone, that the meeting do adjourn to reconvene at the Mount Royal Hotel, Montreal, at nine-thirty a.m. on the seventh day of February, nineteen hundred and forty-six.

Adjourned General Meeting at the Mount Royal Hotel, Montreal, Que.

The adjourned meeting convened at nine thirty a.m., on Thursday, February 7th, 1946, with President E. P. Fetherstonhaugh in the chair.

In opening the meeting, President Fetherstonhaugh welcomed all those present and expressed the hope that they would enjoy the meeting and find it very profitable.

Nominating Committee — 1946

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1946 as follows:

Chairman: C. G. R. Armstrong

Branch:	*Representative*
Border Cities	T. H. Jenkins
Calgary	D. P. Goodall
Cape Breton	J. H. Fraser
Edmonton	E. Nelson
Halifax	P. A. Lovett
Hamilton	Alex. Love
Kingston	S. D. Lash
Lakehead	W. L. Bird
Lethbridge	J. M. Campbell
London	R. S. Charles
Moncton	A. R. Bennett
Montreal	J. Benoit
Niagara Peninsula	C. G. Cline
Ottawa	G. H. Ferguson
Peterborough	H. R. Sills
Quebec	J. O. Martineau
Saguenay	W. J. Thomson
Saint John	F. A. Patriquen
St. Maurice Valley	H. J. Ward
Sarnia	J. W. MacDonald
Saskatchewan	I. M. Fraser
Sault Ste. Marie	R. A. Campbell
Toronto	J. G. Hall
Vancouver	T. V. Berry
Victoria	S. H. Frame
Winnipeg	T. H. Kirby

Awards 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 — J. M. R. Fairbain, D.Sc., M.E.I.C., Montreal.

Gzowski Medal

To — John T. Dyment, M.E.I.C., Winnipeg, for his paper "The Engineering Selection of an Airline Aeroplane."

Duggan Medal and Prize

To — H. L. Lexier, JR.E.I.C., for his paper "Metallurgy and Machine Design."

Leonard Medal

To — E. Cecil Roper, C.I.M.M., Britannia Beach, B.C., for his paper "The Raising of No. 7 Shaft at Britannia".

Ross Medal

To — Sidney T. Fisher, M.E.I.C., for his paper "Radio for Over-land, Long-distance Telephone Service."

Julian C. Smith Medals—"For Achievement in the Development of Canada."

To — Alexander Joseph Grant, M.E.I.C., St. Catharines, Ont.,—and—George Alexander Walkem, M.E.I.C., Vancouver, B.C.

Students' and Juniors' Prizes (Books or instruments to value of $25.00).

H. N. Ruttan Prize	(Western Provinces) to Robert Peterson, JR.E.I.C., for his paper "Soil Mechanics as Applied to P.F.R.A. Problems, with Specific Reference to the Proposed St. Mary's Dam."
John Galbraith Prize	(Province of Ontario) to F. J. McMulkin, JR.E.I.C., for his paper "Welding and Fabrication of Canadian Light Armour."
Phelps Johnson Prize	to J. T. Madill, JR.E.I.C., for his paper "Field Decay Characteristics of Large Hydro-Electric Generators."
Ernest Marceau Prize	(Province of Quebec—French) to J. B. Nobert, S.E.I.C., for his paper "Etude d'installation d'usine de defibrage du bois par le procédé mécanique à la vapeur à Pont Rouge."
Martin Murphy Prize	(Maritime Provinces)—to Fred W. Davidson, S.E.I.C., for his paper "Design of an Antenna for VE9AS."

Report of Council, Report of Finance Committee, Financial Statement and the Treasurer's Report

On the motion of deGaspé Beaubien, seconded by L. G. Trudeau, it was resolved that the report of Council for the year 1945, the report of the Finance Committee, the financial statement and the treasurer's report, as published in the February *Journal*, be accepted and approved.

Reports of Committees

On the motion of R. B. Jones, seconded by C. R. Lindsey, it was resolved that the reports of the following committees be taken as read and accepted: Professional Interests, Legislation, Rehabilitation, Publication, Board of Examiners and Education, Library and House, Engineer in the Active Service, Employment Conditions, Membership, Papers, Industrial Relations, Engineer in the Civil Service, the Young Engineer, Prairie Water Problems, Canadian Chamber of Commerce and Canadian Standards Association.

Branch Reports

On the motion of F. T. Julian, seconded by G. F. Layne, it was resolved that the reports of the various branches be taken as read and approved.

Amendments to the By-laws

Several amendments to the by-laws and one new by-law were submitted by Council. These related to a simplification and clarification of methods of transfer and admission to membership, to Institute fees and to branch finances. Some minor amendments were proposed by J. R. Dunbar and approved. Upon a motion of J. R. Dunbar, seconded by J. G. Hall, it was agreed that these proposals as amended be submitted to the corporate membership in accordance with by-law No. 80. (A copy of the proposals was mailed to every corporate member in January and a further copy with the revisions will be included with the ballot which will be mailed in April).

Election of Officers

The general secretary read the report of the scrutineers appointed to canvass the officers' ballot for the year 1946 as follows:

President:	J. B. Hayes	Halifax
Vice-Presidents:		
(Province of Ontario)	W. R. Manock	Fort Erie
(Province of Quebec)	G. F. Layne	Quebec
(Maritime Provinces)	C. M. Anson	Sydney, N.S.
Councillors:		
Cape Breton Branch	S. C. Mifflen	Sydney
Halifax Branch	G. J. Currie	Halifax
Moncton Branch	H. W. Hole	Moncton
Quebec Branch	Paul Vincent	Quebec
Montreal Branch	C. A. Peachey	Montreal
	J. B. Stirling	Montreal
Peterborough Branch	A. R. Jones	Peterborough
Ottawa Branch	Norman Marr	Ottawa
Toronto Branch	S. R. Frost	Toronto
Hamilton Branch	J. R. Dunbar	Hamilton
Niagara Pen. Branch	P. E. Buss	Thorold
Sarnia Branch	G. L. Macpherson	Sarnia
Sault Ste. Marie Branch	C. Stenbol	Sault Ste. Marie
Winnipeg Branch	D. M. Stephens	Winnipeg
Lethbridge Branch	C. S. Donaldson	Lethbridge
Calgary Branch	J. G. MacGregor	Calgary
Victoria Branch	Kenneth Reid	Victoria

On the motion of A. E. MacRae, seconded by B. E. Bauman, it was resolved that the report of the scrutineers be adopted, that a vote of thanks be tendered to the scrutineers for their services in preparing the report, and that the ballot papers be destroyed.

Retiring President's Address

In accordance with long established custom, the president delivered his retiring address which appears on page 168 of this issue of the *Journal.*

Vote of Thanks to the Retiring Officers

On the motion of G. M. Brown, seconded by D. Goldwag, it was unanimously resolved that a hearty vote of thanks be accorded to the retiring president and members of Council in appreciation of the work they have done for the Institute during the past year.

Vote of Thanks to the Montreal Branch

On the motion of H. N. Macpherson, seconded by L. M. Hovey, it was unanimously resolved that a hearty vote of thanks be extended to the officers and members of the Montreal Branch in recognition of their hospitality and activity in connection with the holding of the Sixtieth Annual General Meeting.

There being no further business, the meeting adjourned at twelve thirty p.m.

THE GENERAL PROFESSIONAL MEETING

As was to be expected, the attendance at the 1946 meeting established new records in every division. The facilities of the Mount Royal Hotel were taxed to their limit. With a banquet attendance of almost a thousand, augmented by an attendance of two hundred more at the dance the same evening, it is unmistakably apparent that hotel accommodation is becoming an increasing problem.

There were several features and innovations on this year's programme which of themselves would make the meeting outstanding. It was an ambitious programme but the results have justified the effort.

Distinguished Visitors

The principal feature was the presence of Dr. Percy Dunsheath, C.B.E., D.Sc., and W. K. Brasher, respectively president and secretary of The Institution of Electrical Engineers, who had come from London, England, on the invitation of the Institute for the sole purpose of representing the British institutions. Dr. Dunsheath, as the feature speaker of the entire meeting, made a great contribution to its success. Officers and members will long remember the honour done the Institute by the British institutions.

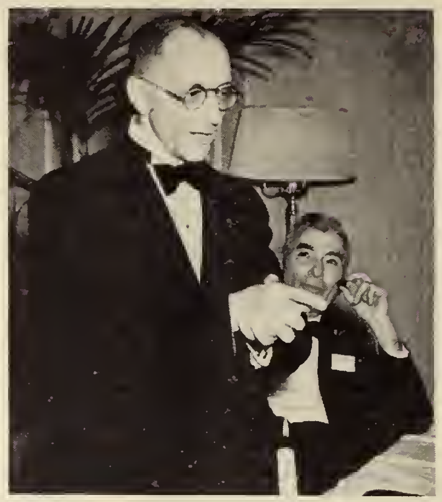
There were other distinguished visitors from outside Canada, whose presence added lustre to the occasion, such as D. R. Yarnall of Philadelphia, President of the American Society of Mechanical Engineers; James G. Vail, of Media, Pa., President of the American Society of Chemical Engineers; Dr. Harry S. Rogers, of Brooklyn, President of the Society for the Promotion of Engineering Education; Everett S. Lee, of Schenectady, N.Y., Chairman of Engineers' Council for Professional Development; Col. C. E. Davies, Secretary of the American Society of Mechanical Engineers; H. H. Henline, National Secretary of the American Institute of Electrical Engineers; Col. W. N. Carey, Secretary and Executive Officer of the American Society of Civil Engineers; George A. Stetson, Editor of *Mechanical Engineering.* The officers of the Institute are always happy to welcome these friends, and members join with them in expressing a warm appreciation of the compliment their presence pays the Institute.

Student Conference

For the first time the Institute invited each undergraduate engineering society in Canada to send its president to a student conference to be held during the meeting,

AT THE PRESIDENT'S DINNER

Past-President C. J. Mackenzie with Past-Presidents F. P. Shearwood and J. M. R. Fairbairn.



Past-President H. W. McKiel with Past-President T. H. Hogg on his left.

Incoming President J. B. Hayes of Halifax.

Past-President J. B. Challies of Montreal.

(On the left) J. M. M. Lamb, R. E. Heartz. (On the right) J. B. Stirling, J. A. Lalonde, Paul Vincent, Hector Cimon.

Past-President C. R. Young of Toronto.

E. O. Turner, Fredericton; N. B. MacRostie, Ottawa; J. A. Vance, Woodstock, Ont.; A. E. Flynn, Halifax; E. V. Caton, Winnipeg; G. J. Currie, Halifax.

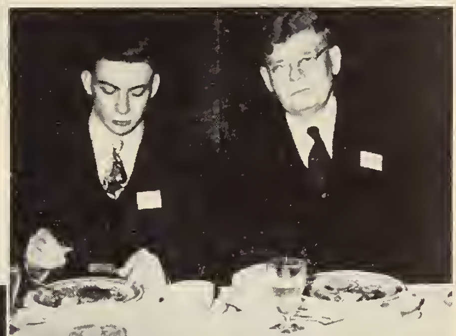
(Below) C. E. Sisson, Toronto; E. P. Muntz, Montreal; W. H. M. Laughlin, Toronto; P. E. Gagnon, Quebec; Wills Maclachlan, Toronto; R. E. Chadwick, Montreal; L. A. Duchastel, Montreal; Prof. Ernest Brown of McGill University.

The head table at the Thursday luncheon was occupied by authors and delegates to the Student Conference. Above: J. D. Pearson of Rolls-Royce; C. Macdonald (Halifax); Robt. Shore (Saskatoon).

H. M. Scott speaks on community planning.

W. K. Brasher, sec'y, Institution of Electrical Engineers (Great Britain) and Léo Sharry of Ecole Polytechnique who was elected chairman of the Student Conference.

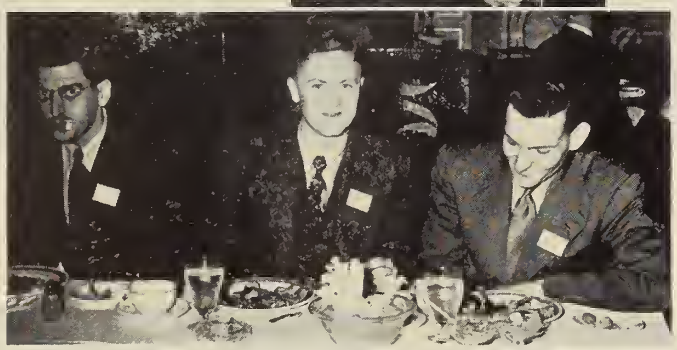
W. L. Hayhurst (Queen's), Gilles Perron (Laval), Murray D. McCulloch (Toronto), Eric Bergenstein (Winnipeg).



Thos. Scott of University of British Columbia and Professor J. A. Van den Broek of the University of Michigan.

Right: J. A. Beauchemin was chairman at the Thursday luncheon.

Dr. Harry S. Rogers president of the Society for the Promotion of Engineering Education speaks on engineering education.



Ottis I. Logue (University of New Brunswick), Jas. Clow (University of Alberta), Chas. J. Fox (McGill).

J. E. Armstrong was chairman at the Friday luncheon.

Head table guests at the Friday luncheon: S. R. Frost, V. S. Murray, Geo. A. Stetson, J. G. G. Kerry, Col. C. E. Davies, W. R. Manock, Col. W. N. Carey, A. B. Hunt, J. R. Dunbar, Paul Vincent, G. L. Macpherson, P. E. Buss.

J. A. Van den Broek discusses evaluation of light metal alloys.

J. G. G. Kerry's paper on winter navigation on the St. Lawrence raised an interesting discussion.

A. B. Hunt tells of the future of radio communications.

V. S. Murray was one of the joint authors of the paper on pre-stressed concrete.

W. A. Newman, head of the research department of the C.P.R., introduces J. D. Pearson.

J. D. Pearson describes the development of Rolls-Royce gas turbines.

The Montreal Branch Smoker on the Thursday night provided the necessary relaxation after an arduous day of technical meetings.

Student delegates chat with Lieutenant-Colonel L. F. Grant, chairman of the Committee on the Training and Welfare of the Young Engineer. Left to right: M. D. McCulloch (Toronto), Tom Scott (U.B.C.), Giles Perron (Laval), Jas. Clow (Alberta), Col. Grant, Leo Sharry (Polytechnique).

E. P. Murphy, Ottawa, deputy-minister of Department of Public Works, with Past-President A. J. Grant, St. Catharines.

René Dupuis, Quebec; E. V. Caton, Winnipeg; K. P. Billner, Philadelphia; Norman Eager, Hamilton; T. C. Creaghan, Montreal, discuss pre-stressed concrete.

Gordon D. Hulme, Montreal; Jas. McMillan, Calgary; Dr. C. A. Robb, Montreal.

At the registration desk: Captain A. C. M. Davy, Ottawa; Col. C. E. Davies, New York, secretary of the American Society of Mechanical Engineers; Col. W. N. Carey, New York, secretary and executive officer of the American Society of Civil Engineers.

T. R. Durley, with his father R. J. Durley, secretary-emeritus of the Engineering Institute.

The student conference sat for two days of arduous work. Above: The delegates are shown together with the observers under the chairmanship of Léo Sharry of Ecole Polytechnique and the guidance of Lieut.-Col. L. F. Grant of Kingston, chairman of the Committee on the Training and Welfare of the Young Engineer, and Major D. C. MacCallum, the Institute's Rehabilitation Officer.

starting on Wednesday, the 6th. Representatives were there from every university granting engineering degrees, in addition to which there were several observers. The conference opened under the chairmanship of vice-president J. E. Armstrong, who later was relieved by Lt. Col. L. F. Grant, chairman of the Committee on the Training and Welfare of the Young Engineer. Several members spoke to the group, but mostly the time was taken up with the specific items on the agenda.

It is planned to make a complete report on the conference in the April issue of the *Journal*, by which time the verbatim of the meeting will have become available as an accurate source of material. For the present, it can be said the conference was a genuine success. The students held three sessions on Wednesday, two on Thursday, and one on Friday. They have voted to request the Institute to make it an annual event.

Conference of Deans

Another innovation was a conference of deans of engineering organized by Dr. Fetherstonhaugh. This was held in the morning and afternoon of Saturday, February 9th. This conference was the outcome of proposals made before Council that the Institute should take some part in the discussions of engineering education that are going on in many places. Council was aware of the trends in these matters but felt the greatest good could be accomplished if the deans came together to discuss these problems among themselves. In this way, would best be disclosed any services that the Institute might render.

The conference was carried out entirely by the deans without any Institute officers participating. It is expected that eventually a report will be made by the conference that can be presented to the membership through the *Journal*. There were present representatives from thirteen universities. Because of the indisposition of Dr. Fetherstonhaugh, Dr. C. R. Young, Dean of Engineering at Toronto, presided.

Annual Meeting of Council

Although the official programme showed no events until Thursday the seventh, the preceding day was one of the busiest for officers of the Institute. At 10:00 a.m., there was the annual meeting of Council at which 59 attended—perhaps a new record. The meeting was not concluded until 5:30 p.m. Dr. Fetherstonhaugh presided.

At noon, those attending the Council meeting, and the student conference gathered together for lunch, thus affording excellent opportunities for expansion of professional contacts. Both meetings were resumed promptly at 2:00 p.m.

During the afternoon, the Committee on Professional Interests, under the chairmanship of J. B. Stirling, met with the several representatives of provincial professional organizations to discuss matters related to the cooperative agreements, and to the profession.

In the evening, as is the custom, the retiring president entertained at dinner the officers of the Institute, past officers, chairmen of committees and other guests to the number of seventy. Again following the custom, all past-presidents were called on to speak, thereby providing a delightful programme. Major D. C. MacCallum spoke on "Rehabilitation" with specific reference to the Institute's part in it.

The Ladies Committee entertained at dinner in the Samovar the wives of those out-of-town members who were attending Dr. Fetherstonhaugh's dinner.

Thursday, February 7th—The Annual General Meeting took place at 10:00 a.m. in the Ball Room with President Fetherstonhaugh in the chair. An account of the meeting appears earlier in this report.

Luncheon was held in the Normandie Roof, with J. A. Beauchemin, chairman of the Montreal Branch, presiding. Hew M. Scott, M.E.I.C., spoke on "The Engineers' Civic Responsibility in Community Planning", urging upon engineers a more active participation in the affairs of their country. There were five hundred and twenty in attendance.

In the afternoon there were two concurrent professional sessions—both exceedingly well attended. Prof. J. A. Van den Broek, M.E.I.C., Professor of Engineering Mechanics at the University of Michigan, spoke on "Evaluation of Light Metal Alloys", and J. D. Pearson, Chief Technical Services Engineer, North American offices of the Rolls-Royce Limited, spoke on "Performance, Installation Characteristics and Design of Rolls-Royce Nene and Derwent Gas Turbines".

Another event of importance which marks the beginning of a series of such meetings was the dinner meeting of the joint committee of the American Society of Mechanical Engineers and The Engineering Institute of Canada to consider a programme of cooperation for 1946, to be carried out under the cooperative agreement. Representatives of the American Society of Mechanical Engineers were D. R. Yarnall, Philadelphia, President of the American Society of Mechanical Engineers; James A. Parker, Detroit, past-president A.S.M.E., and President of Detroit Edison Company; Professor A. E. White, University of Michigan; Col. C. E. Davies, Secretary, American Society of Mechanical Engineers; and George Stetson, Editor of *Mechanical Engineering*. Representatives of the Institute were vice-president J. E. Armstrong, Chief Engineer of Canadian Pacific Railway; J. G. Hall, Combustion Engineering Corporation, Toronto; W. A. Newman, Director of Research, Canadian Pacific Railway; J. B. Stirling, chairman of the Institute's Committee on Professional Interests; L. Austin Wright, General Secretary, and Louis Trudel, Assistant General Secretary.

At 4:30 p.m., Dr. Dunsheath and Mr. Brasher visited a combined group of McGill and Ecole Polytechnique students at McGill, where Dr. Dunsheath described some of the work done during the war by British engineers. This meeting was under the chairmanship of Charles Fox, president of the McGill Engineering Society.

Another event on the supplementary programme for this afternoon was a meeting of the Committee on the Training and Welfare of the Young Engineer, with the chairman, Lt. Col. L. F. Grant, presiding.

Smoker

Each year the Montreal Branch includes in its programme a special social event—usually a smoker. It has been the custom to incorporate this function into the annual meeting programme when the meeting is in Montreal. This year the Ball Room was the " locale " and six hundred and twenty-two enjoyed an excellent variety programme, plus community singing and refreshments. Such an event, as staged by the Montreal Branch, is an important asset to any programme. The out-of-town members were particularly pleased to participate.

Friday, February 8th—During the morning two professional sessions were held concurrently. J. G. G. Kerry, M.E.I.C., presented a most interesting paper under the title of " The Winter Temperature Cycle of the St. Lawrence Waters—A Plea for more Data ". Mr. Kerry suggested that the possibility of keeping navigation open all winter on the Great Lakes and the St. Lawrence warranted a further study and the securing of additional data necessary to such a study. This paper appeared in the January *Journal,* and the discussions will be published shortly.

A comprehensive and significant paper " The Future of Radio Communications in Canada " was presented by A. B. Hunt, M.E.I.C., manager, Electronics Division of the Northern Electric Company Limited. It covered a very wide field and provided material for discussions that was almost limitless.

The first meeting of the new council, with President J. B. Hayes in the chair, was held at 10:00 a.m. Several routine matters were dealt with as is the custom for this meeting, but in addition there was a broad discussion promoted by the Ontario councillors relative to means for expanding cooperation in the province of Ontario. No decisions were reached but the matter is to be brought up again at later meetings.

The luncheon speaker was Dr. Harry S. Rogers, President of the Society for the Promotion of Engineering Education, and President of the Polytechnic Institute of Brooklyn. The chairman was J. E. Armstrong, vice-president of the Institute. Dr. Rogers gave a stirring talk on " What the War Has Done to Engineering Education ". Perhaps no one in the United States is better qualified to speak on engineering education and certainly no one could have done it more acceptably.

In the afternoon, Dr. Dunsheath, officially representing the British Institutions of Civil, Mechanical, and Electrical Engineers, spoke on "The British Engineers' Contribution to the Allied Cause ", using some interesting slides to illustrate his narrative. In Canada, it has been difficult to get the story of the British engineers' performance, due to censorship, and preoccupation with succeeding matters of great urgency. Dr. Dunsheath's talk was the most informative that has been heard here but even at that, due to limitations of time, disclosed only part of the story.

At the same time a meeting dealing with " Pre-Stressed Concrete " was in session before a capacity audience in the Convention Room. Contributors to the topic were T. C. Creaghan, M.E.I.C., president of Creaghan and Archibald, Montreal; V. S. Murray, Engineer of Bridges, Department of Highways of Ontario, Toronto; and K. P. Billner, president of Vacuum Concrete Company, Philadelphia. The discussions indicated clearly that the subject of pre-stressed concrete is far from being exhausted but that great progress has been made in its study. The talks were supplemented by tests and exhibits of considerable interest.

The Banquet

The climax of an annual meeting is the banquet. The colourful Normandie Roof afforded a gay background for a spectacular event, that excelled in every detail. It is true there was over-crowding, but that was taken as indicative of the success of the event. Not all the guests could be seated in the one room, and many tables were set up in the Ball Room for the late comers. In all, there were over nine hundred in the two rooms. This number was augmented later by about two hundred and fifty who came for the dance only.

The programme followed the usual form, including the presentation of prizes and awards, the feature address, and the induction of the new president. This was the occasion for which Dr. Dunsheath had journeyed all the way from London, the occasion for which the officers and members of the Institute had been waiting. Dr. Dunsheath's address fully met the expectations of his audience, and if his reception was as gratifying to him as his address was to his listeners, he will feel well rewarded for the trouble he had taken to be present.

Dr. Dunsheath chose as his title " The Engineer Family in the Commonwealth ". He told of the war work of British engineers, but he dwelt principally on the values to be gained by engineers through empire cooperation. He told something of the forthcoming conference in London next September, between the engineering societies of Canada, Australia, New Zealand, India, Africa and England.

Seldom has an annual banquet speaker charmed his audience as did Dr. Dunsheath. Speaking as the president of a great professional society, as the technical head of a great industry, and as an active participant in the war achievements of his people, he gave to his words a ringing force and an unmistakable sincerity that illuminated his every sentence. The life of the Institute has been greatly enriched by his message and his presence.

The Dance

Within the memory of members who have participated in this event for years, there has been no occasion upon which so many attended and so many remained to the end. The huge floor of the Ball Room was crowded from the first dance to the last, and not only with young folks either! The spirit of the whole evening was one of camaraderie and gaiety, as befits the occasion of a huge family party.

" Muriel's Room "

Once again this pleasant feature was made possible by friends of the Institute. With such a rendezvous available at luncheon and dinner time, it was possible to keep members and guests together throughout the day and evening. Such social amenities go a long way towards the success of a meeting, and the Institute is greatly indebted to the industries and their committee for the excellent results obtained under difficult circumstances.

Col. W. N. Carey, New York, secretary and executive officer of the American Society of Civil Engineers; C. E. Sisson, Toronto, vice-president of the Engineering Institute; Everett S. Lee, Schenectady, chairman of the Engineers' Council for Professional Development.

Gordon McL. Pitts, Montreal; J. G. G. Kerry, Port Hope; Councillor J. R. Dunbar, Hamilton.

T. R. Durley of Montreal with a group of former mates of the R.C.N.V.R.

Mrs. Fairbairn; Dr. J. M. R. Fairbairn; Mrs. E. V. Buchanan; Mrs. R. J. Durley; E. V. Buchanan, London.

S. Tremblay, Mrs. H. Oatway, H. Lamb, Mrs. Lamb, H. Oatway.

Councillor Paul Vincent, Quebec; Quebec Branch Chairman J. O. Martineau.

AT THE ANNUAL BANQUET

J. B. Hayes, the new president, takes over from Dr. Fetherstonhaugh. In the centre Dr. P. Dunsheath.

Dr. Fetherstonhaugh presents Dr. J. M. R. Fairbairn with the Sir John Kennedy Medal.

President J. B. Hayes acknowledges the honour of the presidency.

Dr. Percy Dunsheath brings greetings from sister societies of Great Britain.

Past-President Alex. J. Grant receives the Julian C. Smith Medal.

The Normandie Roof provided a spectacular setting for the head tables arrangement.

Dr. Fetherstonhaugh presents the Gzowski Medal to a fellow-resident of Winnipeg, J. T. Dyment.

ADDRESS OF THE RETIRING PRESIDENT

DR. E. P. FETHERSTONHAUGH, M.E.I.C.

Delivered before the Sixtieth Annual General and Professional Meeting of The Engineering Institute of Canada, at Montreal, on February 8th, 1946

It has been an interesting and inspiring experience to have been your president through a year of great activity, and when it comes to deciding what aspects of the year's progress should be referred to, I find so much material that a process of elimination must be put into effect.

The steady growth of the membership, the authorization of two new branches, problems of rehabilitation, the gradual evolution of policies in important matters, the establishment of committees, community planning, all these and many more matters might form topics for an address, but as most of them are recorded in the report of Council or in those of committees, I shall confine my remarks to a few subjects which are of special interest at the present time.

But before entering on that phase of my address, I cannot refrain from expressing my great appreciation of the honour you have done me in giving me the privilege of representing The Engineering Institute of Canada as its president for the past year.

I realize more fully now than I did before, that the president is much more of a symbol of the Institute than a director of its policies or a conductor of its affairs. The policies are evolved through the loyal and sometimes very arduous duties of your Council and committees, whose work in the past year and whose valuable advice call for the grateful acknowledgment of the president and every member of the Institute. I therefore take this opportunity of expressing sincere thanks on my own and on your behalf for the time and work they have freely given for the benefit of the profession and of the Institute of which we are so justly proud.

As to the conducting of the Institute's affairs, this as you know is in the capable hands of our general secretary and to him and to all the members of the staff at headquarters I wish to express my appreciation of the efficient manner in which the business of the Institute has been conducted.

In accordance with the custom established by my predecessors, I have endeavoured with the general secretary to visit all the branches of the Institute. It was with great pleasure that I succeeded in visiting all those in the Maritime Provinces and Quebec (if I may regard this meeting as a visit to the Montreal Branch), all but Kingston and Sault Ste. Marie in Ontario, and the Winnipeg and Saskatchewan branches in the West. It was also my privilege to visit and speak to the students at six of the universities where engineering instruction is given. I deeply regret that an exceptionally busy session at the University of Manitoba prevented my completing the programme.

The kindness and courtesies extended to me as your president by our members in all the branches, and by the staffs and students of the universities visited will remain a most pleasant memory for the rest of my life. I could not fail to be impressed with the feeling that the many courtesies extended to myself, my wife and the members of our party, wherever we went, was evidence of the esteem and the prestige enjoyed by the Institute not only in the hearts of its members, but also in those of many prominent people in other walks of life.

Engineers Share in Victory

In the year that has passed we have experienced some of the greatest events in the history of the world, the final collapse of Germany, the deeply regretted death of our great ally, President Roosevelt, the development of the atomic bomb, the conclusion of the war with Japan, and the defeat in the British elections of Winston Churchill, that great and inspiring leader of the people throughout the darkest days of the war; and now we have passed from the days when the flower of our youth was pouring into the maelstrom of that great conflict, to the time when most of those who survived are again with us and established, or seeking to be established, in their peace-time occupations.

We all knew that engineers and scientists had been making a remarkable contribution towards victory. But now that the stories of their achievements are being told, we are amazed to find how much more they had accomplished than the need for secrecy had made it possible previously to reveal. The Lieutenant-Governor of Manitoba, in opening the Mulberry exhibit in Winnipeg, put it aptly when he said, in substance, that the courage and unflagging determination of the British peoples had enabled them to win the wars of the past, but in this war they had shown that they also possessed the technical knowledge, experience and ingenuity needed to defeat the enemy in the most scientific war in the history of the world.

There is sorrow in our hearts at the loss of our members whose lives have been given in this great struggle for the safety of the world. And we know too that the lives of some of our members have been given in undertaking in the industrial effort more than human endurance could withstand.

But our sorrow is rightly mingled with pride in the knowledge that the traditions of our profession have been honourably maintained and enhanced in the face of a ruthless enemy.

Re-establishment is Under Way

In the past year we have made a beginning towards helping our members, who have served in the armed forces, to become re-established. The appointment of Major MacCallum to direct this work was made possible by your generous response to the call that was sent out for funds. And now, definite and encouraging results from this undertaking are in evidence.

But much remains to be done in many aspects of re-establishment. In addition to those who are already qualified to assume engineering responsibilities, and whose placement is an immediate problem, there is the very large body of young men who, having seen, during their service, the notable accomplishments of engineering and science, are now returning to civilian life fired with a great enthusiasm to qualify as engineers.

The provisions that have been made by the government for completing their education removes the financial problem in many cases. The immediate responsibility for the training of these young men is on the doorstep of the universities, and the magnitude of their task can be understood to some extent by a scrutiny of the figures published in the December issue of *The Engineering Journal.*

Our Responsibility Towards the Future Engineer

Towards these future engineers, the Institute, the profession and industry have a responsibility as well as have the universities. Ways and means should be devised whereby they may be assisted in obtaining engineering employment in their vacations, as we all recognize the importance of such work in the proper training of the young engineer. The Institute, the profession and all government and private organizations who employ engineers should also be looking forward to the time two or three years hence when the students now at the universities will be graduating in numbers far in excess of anything Canada has previously experienced. Are we going to be able to retain these men for the development of the industries and resources of our country, or are we going to witness a stream of potentially valuable engineers and scientists drawn into the vacuum now apparently developing in the United States? This is not a problem to which the answer is obvious as many economic and other factors are involved. But it is one to which all organizations must direct their early and careful thought if the tide is to be stemmed before it reaches serious proportions. A great deal of money will have been spent by the country in assisting these men to obtain their educational training, and so far as we have been able to judge, they are on the whole men of good calibre, and serious in their desire to avail themselves of the opportunities they have. Is it not then one of our problems as engineers and employers to see that all possible steps be taken to ensure that on graduation they will be absorbed into the classes of work in Canada for which their training will have fitted them? I urge your most careful consideration of this problem.

Mulberry Exhibit

An outstanding event of the year was the arrangement for co-operating with the Hudson's Bay Company in the showing of "Mulberry", the model of the prefabricated port designed and built by British engineers to afford a means of landing food and supplies for the troops in France following the invasion. The Institute has been glad to co-operate with the Hudson's Bay Company in this most interesting and informative enterprise. The interest taken in the exhibit by the public is evidenced by the great numbers who have attended. On the day of its opening in Winnipeg, for instance, 20,000 people were present. I need hardly say that to members of the Institute a visit to this exhibit will prove of intense interest, showing as it does what our brothers in the engineering profession in Great Britain were able to accomplish under conditions of great urgency and crippling shortages in material and labour.

Conference of Deans

An accumulation of problems relating to engineering education has led your Council to suggest that a meeting of Deans of Engineering Faculties might be arranged, to take advantage of the fact that a number of them would be present at this meeting of the Institute.

A meeting of Deans has accordingly been planned for Saturday morning and it is hoped that, out of their discussions, profitable suggestions may arise in matters that are of common interest to all the universities.

These matters are related not only to the best methods of dealing with the greatly increased number of students, but also to the general problems of entrance requirements and undergraduate curricula.

Institute Expanding Steadily

The steady and continued growth of the Institute membership over the past years is a matter to be noted with great satisfaction by all who are interested in its welfare. Looking back a few years we find that in 1936 the membership was 4,213, and with steady increase this figure has risen to 7,500.

The very size of our membership leads one to realize the great responsibility placed on the council and officers of the Institute. It suggests also the importance of maintaining the closest possible contact between councillors and branches in order that decisions reached may be in accordance with the wishes of the majority. Regional council meetings, visits of councillors and chairmen of committees and of the president and general secretary to the branches will all contribute to this end.

In the past year there have been several evidences of increased activity that justify a brief reference.

For the first time in a number of years there has been an increase in the number of branches. The authorization of the new Sarnia and Kootenay branches indicates an expanding interest in those areas and brings the total number of branches to twenty-seven.

As a result of the Annual Meeting held in Winnipeg last year, a renewed interest in the Institute has been noticeable in this locality. A new electrical section of the branch has recently been organized. Its first meeting was held in January and the large attendance and enthusiasm displayed would indicate that this section will prove of definite value to the branch members having a special interest in the electrical engineering field.

Another result has been the formation, at the University of Manitoba, of a students' section which has held its first meeting and is now in process of organizing and electing officers.

Still further evidences of the effects of the Annual Meeting are the increased applications for membership and an apparent renewal of interest among the members of the Association of Professional Engineers of the Province of Manitoba in the question of a co-operative agreement.

It was the first time in over thirty years that the Annual Meeting had been held in Winnipeg, and the results seem to indicate that the more frequent holding of annual meetings in western and eastern centres would have a pronounced effect on the membership and activity of the branches.

I hope this matter may receive the careful consideration of our Council when hotel accommodation becomes more normal.

In conclusion I feel that I should emphasize very strongly to this audience particularly the fact that our Institute has attained a position of great importance in the life of Canada. This is our heritage left by the wise policies and untiring devotion of those who have preceded us.

To those of us who now compose its membership there remains the task of upholding the prestige which the Institute now enjoys, and of doing all that lies within our power to plan for its growing responsibilities, and its increasing value to the profession and to all that pertains to engineering in Canada.

And now may I offer my good wishes to our incoming president, and express the hope that he may find his term of office as interesting an experience as I have found mine.

From Month to Month

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

YOU ARE URGED TO VOTE

The most important questions ever placed before the membership will be found in the ballots which are to be distributed in April. Upon these decisions will rest for many years the policy of the Institute. It is essential to progress and to acceptance of responsibilities that the results be favourable.

With the ballots are detailed accounts of why the proposals are made. Council is confident that a study of these will assure support for the amendments. It is important that members understand the issues, and have an appreciation of the study put on the problems by the various committees that make the recommendations. In your own and the profession's interest, please read these carefully.

In its 60th year the Institute has outgrown many of its limitations. It is necessary to revise some procedures and to provide additional income. The cost of doing business has gone up about 30 per cent, in addition to which many new opportunities and responsibilities face the organization. The opportunity for improved and increased services to the profession has never been so great.

For many years the fees of the Institute have been too low. A comparison with similar organizations elsewhere shows that none operate with so low a per capita income. There seems to be no reason why the Institute should be restricted to a fee one-half or less of that paid by engineers in England, Australia, the United States, and elsewhere. Even with the proposed increase of $5.00 per year per Corporate Member, the fee is still lower than that required by most societies. There seems to be no reason to believe that society business can be conducted in Canada for less than elsewhere.

The Engineering Institute of Canada is the only national professional all-embracing body in Canada. Its record since 1887 proves that it has served the profession diligently and intelligently. It has earned and received through steadily increasing membership acknowledgment of its attainments and its potential. Council believes it will continue to be worthy of the support of the profession. Upon these considerations, Council bases its approval of the amendments, and its solicitation of your support.

Remember, a two-thirds majority is essential for success. Do not hobble the Institute by your failure to complete your ballot. Vote for progress; vote for widening horizons; vote for the amendments.

A CORRECTION

In the article "A Break in the Clouds" appearing in the February *Journal*, it appears there were some inaccuracies in the tabulation of present salaries, in the Civil Service. Several members have written to point this out, but even they are not agreed as to what the figure should be. The trouble is that salaries are not uniform between departments.

Inquiries at Ottawa indicate that for the Department of Public Works the present salary scale should have been shown as follows:—

Grade 1—$1800—$2160
Grade 2—$2220—$2700
Grade 3—$2820—$3300

Beyond this grade the published scale seems to be reasonably close for at least two departments. However, no matter which figures are used, it is clear they are disgracefully low.

The new scale is still not adequate. After all the years of privation experienced under the present scale, the Government surely does not have to be penurious when recommending increases. It would take a lot of overpay to make up for the long record of underpay.

RECOGNITION OF ENGINEERING

There is still a lot to be done before many government officials appreciate that engineering is a profession—and an important one. Many documents from different departments deal with the professions without listing engineering. There are instances where the signature of school teachers, police officials, bankers, as well as doctors, lawyers etc., are accepted as authentication by departments of government, but those of engineers are not. Another case has come to light recently, this time in the Department of Munitions and Supply.

The Motor Vehicle Control Order No. 29 sets out the conditions under which new motor cars may be obtained. The priority schedule mentions many groups that undoubtedly have the right to be there, but there is no mention of the engineer unless he be a "Dominion, Provincial or Municipal official or employee" or engaged in "Public Services and Public Utilities". There is no specific mention of engineering, and no provision for anyone in private practice.

The Institute's attention was called to this condition by a member in the west who states "I would mention as an instance my own case. In spite of being 66 years of age, I have been obliged during these years and still have to carry on a considerable amount of engineering work, due to the scarcity of professional men in private practice as far as Western Canada is concerned. I am engaged in work for surface coal mines, water supply, rural highways etc., and I have been worrying along during the war years with a 1934 car, entailing regularly very heavy expenses in an endeavour to keep same in a working condition. It has now reached the limit of its usefulness, wherefore I submitted yesterday the regular application forms for Passenger Car Priority to the Local Motor Vehicle Rationing Officer here. I was quite surprised when he called my attention to the fact that engineers in private practice, no matter what important work they are engaged in, do not seem to fit into any of the classifications."

On February 15th the following letter was sent from Headquarters to the Motor Vehicle Controller at Ottawa. His reply follows, also a further letter from Headquarters.

February 15th, 1946.

Motor Vehicle Controller,
Department of Munitions and Supply,
Ottawa, Ontario.

Gentlemen:

In your order No. M.V.C. 29, dated November 10th, 1945, you make no provision for engineers obtaining a priority other than those engaged by government or public services.

There are many engineers whose work requires the use of a motor car and it is not only a serious matter for them but for the industries involved that they are not on the priority schedule.

As an example, I have a complaint from a member of the Institute that he has applied for a priority and been declined. This gentleman is a consulting engineer doing work in connection with surface coal mines, water supply, rural highways, etc., and he has been carrying on this class of work for many years using a 1934 car as his means of conveyance. It seems unfair that his case should not be considered simply because his classification is not included in the quite restricted groups shown in the class of A and B priority.

I noticed that in Class A you have included dentists. It seems to me inconsistent that a dentist, who, so far as I know has no professional use for a car, should have this privilege when a practising engineer, whose work absolutely requires the use of a motor car, is excluded.

I am sure that this omission is a pure oversight and I am hopeful that instructions may be issued immediately to your regional officers giving them authority to grant a priority to cases such as I have mentioned which are quite prevalent in the western provinces.

Yours sincerely,

L. Austin Wright,
General Secretary.

Department of Reconstruction and Supply
Ottawa, Canada

February 19th, 1946.

The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, P.Q.

Attention Mr. L. Austin Wright

Gentlemen:

This will acknowledge your letter of February 15th with reference to the failure of Schedule A of Order M.V.C. 29 to provide a category which would enable engineers who are engaged in private practice to secure Priority Certificates to purchase new passenger cars.

When Order M.V.C. 29 and the Schedule thereto was drawn, it was anticipated there would be an acute shortage of passenger cars in the early stages of reconversion. This has been borne out by subsequent events. In view of the anticipated limited supply, it was considered necessary to hold the categories in Schedule A to those whose operations were most closely allied with the general welfare of the people of Canada. When cars become available in greater supply, it is proposed to either broaden the scope of the categories or make provision for a dealer to make retail deliveries when he had filled all Priority Certificates on hand.

As you are no doubt aware, there has been a continual interruption of production since reconversion commenced. Notwithstanding the end of the steel strike in the United States, it will probably be some time before sufficient steel will be in transit to Canadian manufacturers to enable them to resume production. When new passenger cars are available in sufficient supply to justify such action and the broadening of the categories is being considered, your representations will be kept in mind. In the meantime, Rationing Officers must, of necessity, adhere to the categories in the Order.

We note your reference to dentists being included in Class A. This category is, of course, subject to need being established in accordance with the provisions of Section 4 of the Order, that is, a dentist will be required to establish that the vehicle for which he is making application will be used not less than 75 per cent of its mileage in his profession. Dentists were included only to provide for those who have branches or are attending the Armed Services.

Yours truly,

(Signed) E. T. Milne,
Motor Vehicle Controller.

February 27th, 1946.

E. T. Milne, Esq.,
Motor Vehicle Controller,
Department of Munitions & Supply,
Ottawa, Ontario.

Re: Your File 138-33

Dear Sir:

Thank you for your letter of the 19th, dealing with my inquiry as to car purchase priorities for engineers.

There is no argument with your statement of facts, but I do think " the general welfare of the people of Canada ", which you describe as the basis of the priority schedules, does not exclude engineers. Are not coal mining, highways, water supply, construction work essential to " the general welfare of the people ", just as much as many of the activities included in the schedules?

In replying to my comment on the need of dentists for motor cars, you say these cases are " subject to need being established ". Naturally, but on the other hand, they at least have the privilege of presenting proof of the need. Engineers have not.

Why couldn't engineers be included in the list, subject as the others are to proof of need? Wouldn't this be in " the general welfare of the people "? Isn't there some way in which your regional offices can be given the authority to issue permits or at least to submit cases to a higher authority when the public need justifies a permit?

Yours sincerely,

L. Austin Wright,
General Secretary.

Department of Reconstruction and Supply
Ottawa, Canada

March 1st, 1946.

The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal 2, Canada.

Attention: Mr. L. Austin Wright

Gentlemen:

This will acknowledge your letter of February 27th having further reference to the inclusion of civil engineers in the list of eligible consumers entitled to make application for priority certificates to purchase new passenger cars.

As stated in my letter of February 19th, the reason for priority certificates only being available to those listed in the schedule to Order M.V.C. 29 is the acute shortage of passenger cars due to difficulties in the industry. Just as soon as cars are available in sufficient quantity to justify such action, it is proposed to widen the scope of the Order, at which time the representations you and many others in a similar position have made will be considered.

Yours truly,

(Signed) E. T. Milne,
Motor Vehicle Controller.

ALBERTA ASSOCIATION NOMINATES OFFICERS

The Nominating Committee of the Association of Professional Engineers of Alberta has selected the following officers as official nominees of the Association:

President:	L. C. Stevens	Edmonton
Vice-President:	J. S. Irwin	Calgary
	J. G. Spratt	Calgary
Councillors:	Eric Avery	Calgary
	Wesley Crook	Brooks
	Alex Frame	Edmonton
	R. M. Hardy	Edmonton
	R. C. McPherson	Edmonton
	Harold Randle	Calgary

A unique development exists at the University of British Columbia which deserves to be better known to engineers across Canada. The students of U.B.C. have built with their own funds several of the university buildings. This most unusual departure is described modestly in the following article which was supplied by Dean Finlayson in response to the *Journal's* request. The college paper recently announced that the Student Council has plans underway for the expansion of Brock Memorial which may require the floating of a bond issue of not less than $100,000.

To many people this programme will be fantastic, and yet at U.B.C. such matters seem little more than commonplace. Is there any other university in Canada where similar contributions have been made?

Gymnasium

With the erection, in 1929, of a gymnasium on the campus, students at the U.B.C. realized the fulfilment of a seven year dream. The entire $35,000 needed for the construction of the building was raised by the students.

Interest in the erection of a campus gymnasium had been dormant since the march from the Fairview Shacks in 1922, but it took on new life in September 1926, with the announcement that a committee had been busily engaged throughout the preceding summer months investigating and gathering information on the cost of erection and the raising of money to pay for the building. Chief solution for the problem of raising the necessary money seemed to be the assessing of students through the Alma Mater Society fee.

On October 19, 1926, J. C. Oliver, president of Students' Council and chairman of the Building Committee, sent a letter to the Board of Governors asking that the students be allowed to negotiate a $90,000 loan for the construction of a gymnasium of semi-permanent design, and a Women's Union building, the loan to be paid by the money raised in increasing the A.M.S. fee by three dollars. This plan fell through, however, as being a far too ambitious one for the students to adopt, and it wasn't until 1929 that the gymnasium dream became a reality. Through the energetic work of the committee, and with the active co-operation of the faculty, the students of U.B.C. floated a $30,000 bond issue, bonds yielding 4½ per cent.

Work on the building started during the summer of 1929, with the grand opening of the $35,000 edifice scheduled for homecoming. As far as possible, student labour was employed during the building operations, and the gymnasium was finished and ready for use by homecoming.

The gymnasium, although not of imposing architectural design, is a living monument to the enthusiasm of U.B.C. students who sacrificed so much to ensure its erection.

The bond issue was retired in the fall of 1935, the same year that the stadium campaign began agitating for the erection of spectator stands and properly drained playing fields.

Stadium

The second building financed by the students was the stadium. "The new stadium is a monument in concrete and steel to the foresight of the undergraduates of the University. It is a monument to them personally, because the stadium was not donated as a gift nor erected by the Board of Governors, but was planned and paid for by the concerted efforts of the students themselves." So spoke Jay Gould, former president of the Students' Council at the opening celebrations of the $40,000 student-built stadium and playing fields, on October 2, 1937, before 4,000 University undergraduates.

Although many moves had been made since the erection in 1929 of the gymnasium to secure well-drained playing fields and adequate seating facilities for spectators on the campus, all efforts had met with failure until 1935 when Murray Mather, James Malkin, and Fred Bolton produced a two-page report on behalf of the Students' Council, recommending the floating of a bond issue not to exceed $40,000, the debt to be paid off with the money obtained from an increase of three dollars in Alma Mater fees.

Previous to this, however, the students had voted an expenditure of $19,000 for the laying out of playing fields and a cinder track on the site of the proposed stadium. In 1933 the student body sustained an increase of one dollar in fees for the installation of a modern drainage system.

At present, the stadium has a seating capacity of three thousand. The original plans, however, call for the erection of a similar grandstand on the east side of the field. Underneath the grandstand seats are located two dressing rooms, equipped with showers, strip rooms, and a large, dirt floor room soon to be used by the Boxing Club upon completion of their boxing ring.

Brock Memorial Hall

Like the other two great achievements of the undergraduates, the gymnasium and the stadium, the building of the Brock Memorial Building was made a success only by the foresight and grim determination of the student body.

It is an impressive tribute to the lives and work of deeply respected and revered Dean of Applied Science, Reginald W. Brock and his wife, who were killed in an aeroplane accident in 1935.

The first important drive for funds was launched on February 5, 1936. The sum of $30,000 was set as the student objective; pep-meetings were held, subscription forms printed in thousands, lists of potential donors prepared and people ' approached '. But for some unaccountable reason the student body of 1936 lacked the tireless energy and enthusiasm of their leaders, and by the end of the session the fund stood at less than $7,500. For

Brock Memorial Hall. Union College is shown in the background.

almost two years the matter appeared to be closed.

The intervening years saw the question of a Student Union building give way to that of a student stadium. 1938, however, gave rise to a revival of interest in the sleeping Brock Memorial issue. In February 1939, the possibility of a Union Building became a probability when the Government of British Columbia gave permission to the Board of Governors of the University to grant the Alma Mater Society ten annual instalments each of $2,500.00. In addition to this sum of $25,000, the Brock Memorial Trustees possessed a sum in the neighbourhood of $30,000. Consequently at the Alma Mater Society meeting of March 15, 1939, Students' Council was authorized to borrow $80,000, part of which was to retire the outstanding stadium bonds and part to finance the Student Union building. Of the $80,000 borrowed by the Alma Mater Society, some $30,000 went to retire the outstanding Stadium bonds. The remaining $50,000 was placed in the hands of the Permanent Brock Memorial Trustees. $10,000 of this latter sum, however, was earmarked by the students for furnishings, leaving a sum of $40,000 for the building proper. Since $25,000 had been guaranteed to the A.M.S. by the Board of Governors of U.B.C., the actual Alma Mater contribution will be in the neighbourhood of $15,000. The money which had been collected from subscriptions from the public, the faculty, the alumni and Summer Session amounted to almost $25,000 and the single donation of the Women's Undergraduate Society was on the generous side of $10,000.

Throughout the summer of 1939, students laboured over the plans. Plans were presented for approval by the Final Plans Committee of the Brock Memorial Committee, and the contract for the building was awarded. The building was opened January 31st, 1940. Planned to be a centre for the social and cultural activities of the students, the Union building is indeed a dream come true.

Armoury

This building, costing about $53,000 was officially opened by the Lieutenant-Governor on November 22, 1941. When the C.O.T.C. was re-organized in 1927-28, a precedent was set that all officers and cadets should contribute their local headquarters training pay to Corps Funds to be used for the benefit of the Unit. It had always been accepted that an Armoury was needed and should be the first objective for the Corps funds. With the exception of a grant from the Provincial Government of approximately one-seventh of its cost, the new structure was built entirely from funds raised by members of the corps. In April of 1941 the fund had reached the total of approximately $48,000 and it was decided to proceed with the construction of an Armoury. During the war, it was enlarged to meet the increased demands.

R.C.E.M.E.

The creation of the corps of the Royal Canadian Electrical and Mechanical Engineers out of the Ordnance Corps was a step forward in the utilization of engineers in the active services. In the minds of many interested people it was unnecessarily long in coming, but, now the war is over, attention should be directed to the future and not to the past.

Not long ago, the general secretary had an opportunity to examine the plans of the Corps for its peacetime establishment. In view of the frequent criticisms of the Corps personnel in these columns in the past, it is only fair to state that the existing situation shows great improvement. It is apparent that the present officials intend to make the corps one of engineers in fact and not only in title. Of the existing senior personnel and proposed additions to it, the proportion of university graduates in engineering is high, there being only three who are not so qualified, and they having other qualifications that suit them to their special appointments.

The establishment is not yet complete, and there are openings for qualified engineers who are interested in the permanent force as a life work. The *Journal* is happy to present the following article which has been furnished by the R.C.E.M.E. itself. Inquiries for further information may be made to the nearest Deputy Electrical Mechanical Engineer (D.E.M.E.) or direct to the O.C. at Ottawa, Col. J. W. Bishop, Director of Mechanical Engineering.

The Royal Canadian Electrical and Mechanical Engineers as a Career for Young Graduates

The rapid increase in the use of mechanical and scientific equipment for military purposes resulted in the formation of the Royal Canadian Electrical and Mechanical Engineers in May 1944. Subsequent progress and operation of the new Corps, during the campaigns in Italy and Northwest Europe, proved that it was formed on a sound basis for co-ordination of maintenance and repair and recovery of army equipment, as well as the investigation of equipment faults and the development of the necessary modifications.

RCEME, having now emerged from successful wartime activity, has a tremendous task to perform in Canada during the post-war period. In addition to the functions performed in operational theatres it will be required to provide skilled technicians for research, design and development so that the Canadian Army may have the finest and most efficient military equipment. It is fully intended that RCEME will maintain the same high standard that it achieved during active warfare.

RCEME, which is officered predominantly by graduate engineers, plans to recruit almost all future officers from universities. It follows, therefore, that a large number of attractive careers will be open to energetic and ambitious graduates who are interested in army activity. From present indications it would appear that the financial status of officers serving with the RCEME will compare favourably with that of engineers employed by large and progressive industrial and engineering organizations.

In addition to attractive remuneration and pension arrangements a proportion of young officers will be given every opportunity to further their technical advancement at both army and civilian educational establishments. Not only will they be employed in mass production repair organizations and administrative and technical appointments across Canada but also in research and development establishments. It is planned also that officers showing the necessary aptitude and inclination will be given opportunities to serve temporarily in the United Kingdom and with the armies of other Dominions of the Empire.

It is anticipated that further information regarding RCEME as a career will be available prior to the completion of the university term in 1946.

THE ENGINEER IN THE CIVIL SERVICE

Committee Reports to Annual Meeting of the Council of the Institute

A feature of the annual meeting of Council was a report from N. B. MacRostie, chairman of the Institute's Committee on The Engineer in the Civil Service. Reference to this report is made in the abstract of Council minutes published in the *Journal,* but its importance is such that the attention of the whole membership should be called to it.

To some extent, the plans of the Civil Service Commission, disclosed to N. B. MacRostie, seem to have received a blow by the announcement of the appointment of a Royal Commission to examine civil service salaries and other conditions of employment. If the newspaper announcements mean what they seem to, the plans of the Civil Service Commission will be held up indefinitely. This is regrettable because these plans were far advanced, and it was beginning to look as if relief were in sight.

Evasion

The *Journal* has already expressed an opinion on the necessity or desirability of a Royal Commission. To the outsider there appears to be no need for it. The whole situation is better known to many civil servants than it will ever be known to a group of outsiders, no matter who they may be. It isn't more commissions that are needed. It is action, fair play and commonsense.

Royal Commissions in this country are not distinguished for producing effective results. This does not seem to be the fault of the commissioners but of the politicians who, under no circumstance, will accept a commission's recommendations on their merits. One has no alternative but to believe that such procedures are adopted solely to delay action or to sidestep responsibilities. The conditions in the Canadian Civil Service will hardly withstand much more delay and evasion.

There is no use commenting on the qualifications or lack of qualifications of the appointed commissioners. It doesn't really matter who gets these jobs, because their report will be disregarded anyway. Under such circumstances, it is probably a mark of wisdom and efficiency to choose as many persons as possible who have retired from active life, rather than divert manpower from essential occupations.

A Concrete Proposal

But to return to the Institute's committee and Mr. MacRostie's report. The following proposals are offered as the plan of the Civil Service Commission. This is not an official statement, but it is an outline of the proposals as the committee believes they have been or were to be presented to the Minister of Finance. The information comes from the usual "unimpeachable source".

The proposals offer four main points as the basis of establishing government employment as a career service for professional, scientific and technical employees. They are—

1. Adequate entrance salaries sufficient to attract the best applicants.
2. Adequate ranges of compensation sufficient to retain the best of those who enter the Service.
3. Regular yearly increases, subject to satisfactory service, up to an adequate figure.
4. Additional increases in compensation for those who increase their value and add to their responsibilities most quickly. These can best be secured by means of periodical surveys made by the Civil Service Commission, commonly called "unit surveys".

It is believed by those who have been studying the situation that these four steps can be accomplished readily, provided the Treasury Board does not refuse the necessary financial support, etc. So far, support appears to be available for No. 1, and satisfactory progress is being made in applying more generous salary scales in connection with No. 2. Of the 2,700 professional, scientific and technical officers, duties investigations have been completed by the Commission in 2,000 cases. Of these, over 1,400 have already been recommended for increased compensation under the provisions of the Treasury Board directive allowing reclassifications in cases of gross injustice, and recommendations in connection with an additional 300 will be made shortly. None of the Commission's recommendations in this regard have so far been refused by the Treasury Board. The total amount to date of the immediate increase for the officers concerned is $350.000. and the total amount of the ultimate increase which they will receive is $625,000.

Add to these proposals another recommended by the committee and approved by Council, whereby the interest of the professional worker will be protected for the future, and the picture is complete. The committee's proposal is that the Civil Service Commission be enlarged by the addition of a professional technical member or that a technical panel be set up as in Great Britain, "to maintain a uniform standard for promotions and special advancements" and to keep "under review the well-being and efficiency of the Government Scientific Service". What more can a Royal Commission discover or recommend?

The committee is grateful to the Civil Service Commission for the friendly and frank manner in which the proposals of the Institute have been received, and for the helpful discussions that have taken place on this vital topic over the last few years. Surely something good will come out of it all before it is too late.

ENGINEERING BY CORRESPONDENCE

A member in Shawinigan Falls sends the *Journal* a newspaper clipping from the *Shawinigan Standard* of February 18th. It provides another example of confusion in thinking where professions are concerned. The careless use of the word "profession" is not infrequent, but the mention of "degrees" is not so common. It is something new to discover a society that can grant degrees and, at that, based perhaps on nothing more than its own correspondence courses. The clipping has been forwarded to the Corporation of Professional Engineers of Quebec, as the matter seems to lie specifically in that field.

Herewith are some quotations from the *Standard*:—

"One of the best attended and most enthusiastic organization meetings of the Canadian Society of Cost Accountants and Industrial Engineers was held at the Cascade Inn on Monday evening for the purpose of forming a St. Maurice Valley Chapter of the Cost and Management Institute of Quebec, which is affiliated with the Dominion Society".

Among the objectives of the Society was included — "To advance the profession of Cost Accounting and Industrial Management by granting degrees to qualified members and licensing the use by them of titles and initials signifying the possession of standard qualifications".

"As the Association grew they realized the necessity of a uniform course of study so that a young man could attend university, or through a correspondence course, obtain a degree or certificate similar to other professions".

"Mr. Patton, chairman of the Educational Committee, outlined the educational plans and said that degrees were given in each province where a division exists."

POLISH ENGINEERS IN CANADA

The Institute has had close contact with many Polish engineers who have been working in Canada during the war. These contacts began when the general secretary was assistant director of the Wartime Bureau of Technical Personnel, in the early days of that organization, at which time negotiations were under way between the Canadian Government, the British Government and the Polish Government representatives in England, to bring to Canada many highly experienced engineers and scientists who could assist in the war work in this country.

Subsequently, about two hundred and fifty of these gentlemen came here and set up their own technical society, calling it the Association of Polish Engineers in Canada. This society has met regularly, and has done a lot towards improving the situation for these highly trained specialists who so unhappily were forced out of their homeland.

Several branches of the Institute extended to the Polish engineers all the privileges of the branch on a complimentary basis, and from Headquarters *The Engineering Journal* was sent to over eighty of them on the same basis as to members of the Institute.

Recently, due to increased membership in the branches, it has been necessary to curtail these privileges. It is a matter of pleasure and gratification that so many of these guests have spoken so highly of the Institute's interest in them. Two letters are published on page 177, one of them from the president of the Association, in which considerable information of interest to Canadian engineers is given.

Engineers in Canada have some appreciation of the difficulties which this small band has survived. Each member has a story to tell that, although fascinating in interest, is very sobering in its effect. Such accounts more than ever impress upon us how lucky most of us have been to be living in Canada during those awful years.

From employers in many places have come expressions of praise for the services rendered by these gentlemen. Most of them were experts on subjects which, at that t me, were little known to Canadian engineers. They had just fled from a country where industry had been very highly developed, and their knowledge of æronautics, metallurgy, machine design, ballistics, etc. was of in-
and their ambitions.

Now that it is clear that they may remain in Canada, it is the wish of the Institute to greet them as Canadian citizens, and express the hope that in their new home they will find a ready outlet for their skill, their knowledge and their ambitions.

NEW OFFICERS FOR A.I.E.E.

The Headquarters of the American Institute of Electrical Engineers announces that the report of its Nominating Committee selects the following candidates for offices which become vacant on August 1st, 1946. These are to be voted on in the spring, but, as there is only one nominee for each position, it is not likely that the election will make any changes in the proposals of the Nominating Committee.

For President: J. Elmer Housley, district power manager, Aluminum Company of America, Alcoa, Tenn.

For Vice-President:

(North Eastern District) Ernest W. Davis, chief electrical engineer, Simplex Wire & Cable Co., Cambridge, Mass.

(New York City District) O. E. Buckley, president, Bell Telephone Laboratories, Inc., New York, N.Y.

(Great Lakes District) T. G. LeClair, supervising development engr., Commonwealth Edison Co., Chicago, Ill.

(South West District) R. F. Danner, general superintendent, Oklahoma Gas & Electric Company, Oklahoma City, Okla.

(North West District) Charles Foster Terrell, vice-president, Puget Sound Power & Light Company, Seattle, Wash.

For Directors: J. F. Fairman, vice-president, Consolidated Edison Co. of New York, Inc., New York, N Y.

Raymond T. Henry, chief electrical engineer, Buffalo, Niagara & Eastern Power Corp., Buffalo, N.Y.

E. P. Yerkes, engr. of equipment & buildings, Eastern Area, Bell Telephone Co. of Pa., Philadelphia, Pa.

For Treasurer: W. I. Slichter, professor emeritus of electrical eng., Columbia University, New York, N.Y.

SASKATCHEWAN ENGINEER

Under the above title the Engineering Society of the University of Saskatchewan is launching a new publication this year. It will be an annual publication, appearing about April 15th.

During the course of the general secretary's visit to the University of Saskatchewan last fall, he had an opportunity of meeting with the editorial staff to discuss the enterprise, but it was only recently that the final details of the publication have come to hand.

The proposal is quite an ambitious one, and speaks well for the society and for the individuals who are personally responsible for it. The Editorial Board is as follows:—

Editor-in-chief	Creighton W. Bildstein
Associate Editor........	Hugh Fraser
Managing Editor.......	Doug. Thierman
Advertising Manager ...	Mervin Pierce
Humour	Bob Thorvaldson
Photography	Ron Thompson
Art	George Cross, Joe Wise

There will be twelve separate papers in the publication, covering a very wide variety of subjects, the authors in each instance being graduates of the University. Following is the table of contents:—

1. The Young Engineer in the Electrical Industry, by L. C. Sentance, M.E.I.C., Director Manufacturing Methods, Canadian Westinghouse Co. Hamilton.
2. Aluminum Industry at Arvida, by E. H. Sangwine, Assistant Supt., Aluminum Plant, Arvida, Que.
3. Manufacture of Optical Components of Gun-Fire Control Instruments, by F. Feiffer, JR.E.I.C., in charge of optical machinery supervision, Research Enterprises Ltd.
4. The Geological Engineer in Canadian Metal Mines, by L. S. Trenholme, Belleterre Mines, Quebec.
5. Consulting Engineering in Canada, by C. F. Morrison, M.E.I.C., Prof. Civil Engineering, University of Toronto.

6. Electronics Past and Present, by Dr. Mackay, Prof. Eng. Physics, Univ. of Sask.

7. Petroleum Refining by E. C. Hurd, Manager of Toronto Refinery, B.A. Oil.

8. An Engineer in the Farm Implement Business, by D. S. Horne, Cockshutt Plow Co., Brantford, Ont.

9. Farm Machinery Engineering, 1946 Model, by Geo. E. Pickard, Massey Harris Co.

10. Problems of Natural Phenomena in Hydro-Electric Engineering, by J. K. Sexton, M.E.I.C., Montreal Engineering Co. Ltd.

11. The Engineer in the Air Force, by Air Commodore J. G. Bryans, R.C.A.F., Ottawa, Ontario.

12. Designing for Large Scale Production, by S. M. Young, Chief Engineer, International Harvester Co., Hamilton, Ontario.

Everyone will wish the students success. Their courage and enterprise in tackling such a difficult proposition is an encouraging sign of the calibre of students at Saskatchewan. Persons who desire copies had better write immediately to the Graduate Society or to any one of the editors. Early notification of interest will be helpful in determining the number of copies to be printed.

WARTIME BUREAU OF TECHNICAL PERSONNEL

Controls Affecting Technical Personnel as of January 1, 1946

Employment

The permit system which has applied to the engagement of technical personnel since March 23, 1942, has now been done away with and in its place there has been substituted what might be called a recording system. This change was outlined in a special notice appearing in the daily press throughout Canada on December 28, 1945, and as it is of interest to all technical personnel, it is assumed that the advertisement in question has been duly noted by the people affected.

As long as there was in existence the requirement that the engagement of a technical person was subject to approval of the Minister of Labour (through the Bureau) *before* the services of the technical person could be used, certain factors necessarily had to be subjected to scrutiny before action could be taken on an application for a permit. The principal considerations involved were the priority of the proposed work and the availability of the proposed employee. The need for applying for such permits now having disappeared, such matters as priority and availability are naturally not brought under any scrutiny. In other words, the engagement of technical personnel is not subject to manpower control in any way whatever.

The need for recording movements of technical persons, however, obviously still exists. Only by having a reasonably accurate picture of such movements, with related data as to supply and demand, can the Department of Labour intelligently render assistance not only in the immediate employment problems of both employers and individuals, but also in the planning and organizing of employment as a service to employers, to individual technical persons, to professional bodies, and to universities.

To this end, the regulations as now administered require the recording of needs and engagements by employers and the recording of cessations of employment, both by employers and employees. There is every reason to believe that full co-operation can be expected in this regard from those concerned. There has been no lack of such co-operation in the past and it is interesting to note that some months ago the Canadian Manufacturers' Association went on record as holding that, when the war was over, employers should have restored to them the right to engage and discharge employees as they saw fit, subject, however, to the obligation on the part of employers to register with the Employment Service both their requirements and their lay-offs.

To sum up on the question of employment, the actual business of engaging a technical person, or of leaving or entering employment, is no longer subject to scrutiny or approval but those concerned are expected to co-operate to the extent of providing notification of such movements *after* the necessary arrangements have been made.

At the same time, the Bureau is enabled to increase its efforts along the lines of a simple employment service for technical persons. The practice of referring the records of suitably qualified people to employers who register their needs with the Bureau is being continued and technical persons who are seeking employment are being assisted in every way possible to find a suitable connection. This applies particularly to those who are leaving the armed forces to return to civil life and to those who have served in war industry and whose employment is being terminated due to cessation of war production.

Labour Exit Permits

Some misunderstanding has been apparent as to the Bureau's connection with Labour Exit Permit Regulations. These regulations were put into effect in October, 1942, as a war measure and are still in force. While there is no reason to believe that Exit Permit controls were ever intended to be a permanent feature of manpower legislation, it should be distinctly understood that their revocation, like their implementation, is a matter of Government policy on which the Minister of Labour has, from time to time, kept the public informed. They apply to citizens generally with all types of skill and there is no limitation on the right of any citizen to apply for such a permit. The administration of the controls involved is naturally not vested in any of the officers of the Bureau as those affected include in their numbers only a comparatively small proportion of technical persons. When an application is being dealt with by the appropriate officials in the Department of Labour, normally on the basis of supply and demand as outlined in the original order setting the regulations up, the Bureau may be consulted if the applicant is a technical person, but its only function is to present such factual data as may apply to the individual case.

In order that any applicant whose application is not favourably dealt with may feel assured that the fullest consideration has been given to his case, provision exists for an appeal against an adverse decision, thus ensuring that no claim to consideration will be overlooked.

Salaries

Another question with which the Bureau has no official connection but which constantly comes up in discussions between Bureau officers and technical persons across the country is that of remuneration. Even while employment controls were in effect, the Bureau's function was merely to consider only whether the services of the individual technical person should be used in the capacity proposed. Such matters as salaries, working conditions, etc. were details of the individual employment contract which necessarily had to be left to the two parties concerned to deal with.

Actual amounts of remuneration are, of course, subject to control through the appropriate War Labour Board or through the Salaries Controller. It is only from these authorities that information as to any limitations on salaries should properly be sought.

As part of its operations, however, the Bureau has gathered a considerable amount of factual information as to salaries which has been made available as requested by various authorities, particularly in cases where doubt has arisen as to the adequacy of proposed rates, either in individual cases or where groups of technical personnel are concerned. In actual practice, this has had the effect of limiting to some extent the possibility of overlooking what might be called the current " market ".

Students

The necessary steps are being taken to furnish to universities lists of summer employment openings for undergraduates and of opportunities for employment of graduating students in 1946. While it is true that the war-time goal of increasing war production may happily be disregarded, stress is being laid on the necessity for combining with the student's academic work the most useful experience in activities related to his theoretical training. In this respect, employers who will find it necessary to engage young graduates in the future will benefit from a comprehensive scheme of summer training no less than the undergraduates themselves.

D. C. PRINCE AWARDED LAMME MEDAL

The 1945 Lamme Medal of the American Institute of Electrical Engineers has been awarded to David C. Prince, vice-president, general engineering and consulting laboratory, General Electric Company, Schenectady, N.Y.

For his distinguished work in the development of high voltage switching equipment and electronic converters.

The medal will be presented at the Summer Convention of the Institute to be held in Detroit, June 24-28.

The Lamme Medal was established through a bequest of Benjamin Garver Lamme, who was chief engineer of the Westinghouse Electric and Manufacturing Company from 1903 until his death in 1924. Beginning with 1928, the medal has been awarded annually for high achievements in the development of electric apparatus or machinery.

Dr. Prince will be well remembered by Institute members when, as president of the American Institute of Electrical Engineers, he attended the annual meeting of 1942 in Montreal.

CORRESPONDENCE

Polish Engineers in Canada

Association of Polish Engineers in Canada,
671 Belmont Street,
Montreal, February 6th, 1946.

L. Austin Wright, Esq., M.E.I.C.,
General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Dear Sir:

I have the privilege to reply to your letter of January 23rd, 1946, not personally but in behalf of the Association of Polish Engineers in Canada. On January 20th, 1946, I was elected the new President of the Association, and I wish to inform you that the Polish Engineers are entirely in accord with your opinion as to the necessity of providing a new base for our mutual relations; also that they highly appreciate the invitation to join The Engineering Institute of Canada as members.

When the Polish Engineers came to Canada some years ago, their aim was to help Canadian industry in order to contribute to the common victory.

They found this opportunity—and far more; in the difficult task of adjusting themselves to the new and sometimes different manner of life, they received all the friendship and support of their Canadian fellow-engineers as well as that of their various Associations. Therefore, I would ask you to accept on behalf of all your members the sincere thanks of the Polish Engineers associated in this organization.

However, and this is to explain our present situation—our status in Canada was for some considerable time quite uncertain, for our residency in this country was based only on " for duration of war " visas. So, we could make no plans; we had to stick to our Association, because this Association was the sole justification for our presence in Canada. Now, as the Canadian Government has granted us the status of permanent residents,—the distribution of visas taking place in December, 1945—many elements of our previous considerations have become evidently obsolete. For this reason, the aims of our Association—in fact the very *" raison d'etre "* of the Association—were vigorously discussed at the Annual Meeting on January 20th, 1946. The new board has received instructions to review the whole situation and to prepare the necessary amendments to the by-law at the next General Meeting.

It would be premature for me to make at this time a statement as to the aims of the Association of Polish Engineers in Canada. However, the following developments may be foreseen probably.

1. This Association does not intend to support its members beyond what seems necessary to prepare and introduce them to the professional organizations of the country. And this applies to present members as well as to other Polish engineers who may come in the future to Canada.
2. This Association wishes to refrain from any interference in the social or political issues of the day. But, as there are still many Polish engineers dispersed over the world; sometimes held in camps without social standing and with no hope of getting suitable work, this Association wishes to help them by providing material means, technical information and references.
3. The Association proposes to extend membership to other classes of Polish intellectuals, especially to university-trained forestry and agricultural engineers.
4. The Association will be glad to see friendly relations between Canada and Poland maintained and developed.

These outlines would seem to prove that our aims in Canada are rather limited. I hope to be able to visit you soon in your office in order to discuss some problems concerning the admission of Polish engineers to The Engineering Institute of Canada.

At this moment I would ask you to accept my thanks for your good will and kindness to our Association both of which you have proved on so many occasions.

Cordially yours,

(Signed) A. Grzedzielski,
President.

3210 Maplewood Ave., Apt. 11,
Montreal, Que., Feb. 9th, 1946.

L. Austin Wright, Esq., M.E.I.C.,
General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Dear Mr. Wright:

I wish to acknowledge with thanks receipt of your letter of January 23rd. It was a real pleasure to read about your appreciation of the work of Polish engineers. Your favourable personal opinion and the opinion of the other members of the Institute is very precious to us. We enjoyed it very much as we believe that it is not only an act of courtesy on your part, but the expression of your true friendly feelings.

I believe I can say in the name of my fellow-engineers and my own, that Canada is the only country in the world where not only true hospitality was given to us, but also the opportunity to work was extended to us. In the life of a technician this means more than words can express.

Canada has understood the problems of our emigration from our Motherland and the Institute has contributed in making us like this country.

We are sure that in this post-war period, our co-operation with our Canadian fellow-engineers will be still more efficient. On our part, we hope to be able to participate in the development of Canadian technical life in all its aspects.

I shall be delighted to become a member of the Institute and I shall be very anxious to return the form as soon as I find five members to introduce me.

Yours very truly,

(Signed) M. B. Szymanski, P.Eng. (Civil).

Rehabilitation Service Appreciated

The E. I. Dupont De Nemours & Co.,
Wilmington, Del., U.S.A.

Dr. L. Austin Wright,
2050 Mansfield Street,
Montreal, Que.

Dear Dr. Wright:

Thank you for your friendly letter of October 26th, in which you advise me on transfer to Junior. I am pleased to say that I have taken your advice, and have secured the necessary references.

I would like to add that down here I find it very pleasant to read *The Engineering Journal,* and to hear of the many graduates with whom one has worked or trained, and also to keep in touch with the engineering development in Canada. (With reference to this, might I suggest a column devoted to news of the month's new contracts let, or expansions planned).

Although I look with a little dismay at the large numbers of civilian non-members and civilian members who have made use of the employment service of the Institute, I would like to congratulate the Institute for its progressive policy in this regard. In the limited dealings I had with it, I found it most efficient, and ahead of anything existing in the United States that I have seen. I hope that industry will grow to lean on it more in the future.

Yours very truly,

(Signed) John F. Pink, Jr.E.I.C.

45 St. Clair Ave. West,
Toronto, Ontario.
January 18th, 1946.

Mr. L. Austin Wright,
General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal 2, Quebec.

Dear Sirs:

In response to the appeal of the Finance Committee, I am glad to enclose my cheque for Twenty Dollars and Fifteen Cents ($20.15) to cover my annual dues, subscription to the *Journal,* and a $9.00 contribution for Rehabilitation Purposes.

We who stayed in Canada and saw the war through in comfort certainly owe a debt which we will never repay to those who served overseas and I hope that the Institute will consider ways and means of acknowledging this indebtedness to each individual. This should be prepared by a master hand in the style and spirit of Kipling.

Yours sincerely,

(Signed) A. E. K. Bunnell, M.E.I.C.

MEETINGS OF COUNCIL

The annual meeting of the Council of the Institute was held at the Mount Royal Hotel, Montreal, on Wednesday, February 6th, 1946, at ten o'clock a.m.

Present: Dean E. P. Fetherstonhaugh (Winnipeg) in the chair; Past-Presidents deGaspé Beaubien (Montreal), and C. R. Young (Toronto); Vice-Presidents J. E. Armstrong (Montreal), E. V. Gage (Montreal), and C. E. Sisson (Toronto); Councillors H. E. Brandon (Toronto), A. Cunningham (Saguenay), H. W. L. Doane (Halifax), representing the Association of Professional Engineers of Nova Scotia, R. S. Eadie (Montreal), R. C. Flitton (Montreal), A. E. Flynn (Halifax), P. E. Gagnon (Quebec), G. G. Henderson (Border Cities), J. A. Lalonde (Montreal), W. H. M. Laughlin (Toronto), Alex. Love (Hamilton), G. L. Macpherson (Sarnia), C. A. Peachey (Montreal), P. E. Poitras (Montreal), H. R. Sills (Peterborough), C. Stenbol (Sault Ste. Marie), E. O. Turner (Fredericton), representing the Association of Professional Engineers of New Brunswick, J. A. Vance (London), J. F. Wickenden (St. Maurice Valley), and W. S. Wilson (Toronto); Treasurer R. E. Chadwick (Montreal), Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—President-Elect J. B. Hayes (Halifax), Vice-President Elect W. R. Manock (Fort Erie, Ont.), Councillors-Elect G. J. Currie (Halifax), J. R. Dunbar (Hamilton), S. R. Frost (Toronto), Norman Marr (Ottawa), J. B. Stirling (Montreal), and Paul Vincent (Quebec); Past-Presidents J. B. Challies (Montreal), T. H. Hogg (Toronto), C. J. Mackenzie (Ottawa), H. W. McKiel (Sackville), and F. P. Shearwood (Montreal); Past Vice-Presidents Hector Cimon (Quebec), and E. P. Muntz (Montreal); Branch Chairmen B. E. Bauman (Saguenay), J. O. Martineau (Quebec), S. C. Montgomery (Trail-Kootenay), C. F. Morrison (Toronto), F. J. Ryder (Border Cities), H. G. Stead (London), H. K. Wyman (St. Maurice Valley); Committee Chairmen J. G. Hall (Membership), Wills Maclachlan (Industrial Relations), N. R. MacRostie (Engineer in the Civil Service); J. A. Beauchemin, chairman, J. M. Crawford, vice-chairman, M. S. MacGillivray and G. N. Martin, members of the executive of the Montreal Branch.

In extending a cordial welcome, Dean Fetherstonhaugh invited all guests to take part in the discussions.

Harry Bennett Memorial Fund: Mr. Vance, Chairman of the Committee on the Harry Bennett Memorial Fund, reported that following the last meeting of Council he and Past-President Beaubien had interviewed government officials in Ottawa with a view to meeting tax requirements in the establishment of this fund.

Mr. Vance presented the following memorandum which, after some discussion, on his motion, seconded by Mr. Gage, was approved and adopted unanimously as the constitution for the Harry Bennett Memorial Fund:

1. The fund shall be known as the Harry F. Bennett Educational Fund of The Engineering Institute of Canada.
2. The purposes of this fund shall be to promote and advance the study of engineering sciences, more particularly the establishment of scholarships and fellowships to deserving persons; to encourage the establishment of departments in schools and colleges for the study of engineering and science; to make loans to deserving students under regulations primarily for the purposes of enabling them to pursue advanced study in engineering sciences, and generally do any matter which will advance and assist in the growth and development of such engineering sciences.
3. The rules and regulations governing this fund may be amended from time to time by the Council of the Institute not inconsistent with the purposes for which the fund is established.

Mr. Vance was planning to hold a meeting with Mr. Buchanan, of London, and Mr. R. E. Heartz, of Montreal, the other two members of his committee, during the annual meeting, and hoped to have the material for the campaign ready for submission to the branches at an early date.

Conference of British Engineering Societies: The general secretary reminded Council of the letter which had been received some time ago from the three leading British institutions asking if the Engineering Institute would be interested in receiving an invitation to meet with officers of similar British engineering societies in London in June, 1946. He now presented a letter from the three institutions advising that it has been decided to proceed with the arrangements for the meeting with representatives from engineering societies in the Dominions and in India, but that in view of the difficulties of travel and of obtaining accommodation in London during the early summer, the meeting had been postponed until September.

A cordial invitation was extended to the president and general secretary of The Engineering Institute of Canada to attend this conference and be the guests of the three British institutions during their stay in London. For this purpose accommodation has been provisionally booked for the delegates from the 14th to the 28th of September inclusive.

Following some discussion, on the motion of Dr. Gagnon, seconded by Mr. Brandon, it was unanimously resolved that the invitation be accepted and that the president and general secretary represent the Institute at this conference.

Amendments to the By-Laws: At the last meeting of Council attention had been called to the situation which, because of the proposal to increase fees, might develop in regard to the compounding of fees if a number of members decided to compound their fees under the present regulations. After consultation with the Institute's legal counsel, it had been suggested that the regulations regarding the compounding of fees, if approved, should be made retroactive to this date.

Following some discussion, on the motion of Dr. Turner, seconded by Mr. Lalonde, it was unanimously resolved that a sentence be added to the proposed amendment making the new regulations retroactive to the date of this meeting, such amendment to be made from the floor at the annual general meeting.

The general secretary reported that after the proposed amendments to the by-laws had been circulated to corporate members of the Institute, he had received from Mr. J. R. Dunbar, of Hamilton, a letter suggesting several amendments to the proposed amendments. These suggestions, with some explanations and further suggestions by the general secretary, had been passed on immediately to Mr. Hall, the chairman of the Membership Committee, the committee through which the original amendments had been made.

Each suggestion made by Mr. Dunbar was presented by him to the meeting and discussed in considerable detail, and it was finally agreed, with Mr. Hall's approval, that at the annual general meeting the following amendments should be proposed to the amendments which have already been approved by Council:

Section 10. At the end of the first paragraph add—

"or shall be required to write examinations as prescribed by the council."

Paragraph 2 (b) change to read—

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

Section 9. Third paragraph after the word "graduation" add—

"or if a non-graduate before attaining age twenty-nine"

Section 28. Add at the end of the 1st paragraph—

"and the rebates to the branches."

add—"The above schedule shall be made retroactive to February 6th, 1946."

Community Planning: For the benefit of those members not familiar with the situation, the general secretary outlined briefly the events leading up to the formation of the Central Mortgage and Housing Corporation and reviewed the action already taken by the Council of the Institute as described in the minutes of the last Council meeting. Since then he had been in Ottawa and had had an interview with Mr. Mansur, the president of the newly established Corporation, who had stated that although he did not know at the moment who else was to be appointed to the Board, it would be of great value to him to have, as vice-president, some person who was familiar with the engineering features of community planning and housing. At the present time there was nothing further to report.

Proposed Series of Lectures: The general secretary reported that following the last meeting of Council he had been in communication with Mr. Ross Dobbin, the chairman of the Institute's Committee on Community Planning, regarding the suggestion that the Institute might establish a course of lectures on community planning, possibly to be given through the branches in the larger centres such as Toronto, Montreal and Ottawa. He read to the meeting a letter from Mr. Dobbin making certain suggestions which would be followed up in due course. This was noted as a progress report.

A.S.M.E. Joint Committee: Mr. Stirling, as chairman of the Committee on Professional Interests, reported that a meeting of the A.S.M.E.-E.I.C. Joint Committee would be held during the course of the annual meeting, at which the following items would be discussed:

1. Permanent organization of the committee.
2. Completion of plans and assignment of responsibility for participation by Canadians in the programme for the semi-annual meeting of the A.S.M.E. in Detroit.
3. Detailed review of research projects which permit of joint participation.

It was expected that something very useful would develop and that a report would be ready for submission to the next meeting of Council.

As Mr. Robert C. Wiren, of Toronto had been unable to accept membership on the joint committee, it was unanimously resolved that Dr. O. W. Ellis, of Toronto be asked to serve as the Institute's third representative. The membership of the joint committee would then be as follows:

A.S.M.E.	A. G. Christie
	J. W. Parker
	A. C. White
E.I.C.	O. W. Ellis
	J. G. Hall
	W. A. Newman

Meeting with Association Representatives: Mr. Stirling reported that the Committee on Professional Interests was planning to meet later in the day with representatives of the provincial associations with which the Institute has co-operative agreements, with a view to discussing the question of the proposed increase in Institute fees and its application to members in provinces where the Institute has co-operative agreements. A report on their deliberations would be presented to Council in due course.

Proposed Amendment to New Brunswick Agreement: The general secretary presented the following resolution from the executive of the Moncton Branch:

> " Be it resolved that the Executive of Moncton Branch request the Council of the Institute to take such steps as may be necessary to have the phrase " if qualified for Institute membership " inserted immediately before the word " unless ", in Section 1(b) of the Co-operative Agreement between the Institute and the N.B. Professional Association.

Section 1(b) would then read as follows:

> "Any person resident in The Province of New Brunswick registering as a professional engineer in the Association subsequent to the date of this agreement, who is not a corporate member of the Institute, shall upon such registration become a corporate member of the Institute, if qualified for Institute membership, unless he notifies the Secretary of the Association of his desire to the contrary."

Following some discussion it was unanimously resolved that the resolution be referred to the Committee on Professional Interests for consideration and recommendation to Council.

Committee on Employment Conditions: The general secretary asked Council for instructions with regard to a matter that was considered at the September meeting of Council. At that time the committee reported that in the *Bulletin* of the Corporation of Professional Engineers of Quebec, the minutes of the last meeting of the Committee of Fourteen had been reported but in one instance the Institute was recorded as voting against a motion which actually it had supported, and in another instance, a very significant motion, proposed by the Institute which had been defeated at the meeting, was not mentioned at all.

At the previous meeting it was agreed that the Corporation should be asked to make the proper corrections and that, failing this, the complete story should be told in *The Engineering Journal.* The general secretary now asked Council to reconsider this ruling as he thought it unwise to print an account that would be critical of a sister organization. He reported that Mr. Heartz, the chairman of the Institute's Committee on Employment Conditions, had discussed the subject recently and had agreed that it would not be in the best interests of the profession to make such a report in the *Journal,* but at the same time he thought Council should conclude the subject, perhaps by a further statement of the facts of the case and a decision in the form of instructions to the general secretary to withhold the story from the *Journal.* Both Mr. Heartz and the general secretary felt that in view of Council's previous instructions the matter should not be allowed to drop without a further and final declaration.

Mr. Stirling expressed regret that the Institute's attitude should have been misrepresented by the minutes and he agreed that nothing would be gained by publishing the story in the *Journal.* He did think, however, that something should be done which would indicate that the Institute's position had not changed and that the facts were still as originally represented.

Mr. Brandon suggested that it might be helpful to have a careful statement of the facts prepared and circulated to the executive committees of the branches. In this way the officers of the branches would be fully informed without making any public display of the subject.

Mr. Poitras reviewed at length the events which had been recorded in the minutes. It was his impression that the Institute had opposed the resolution which the Institute claimed it had supported.

The secretary showed the meeting photostat copies of documents which proved the Institute's position but Mr. Poitras said the whole matter had been reviewed by certain members who had attended the meeting and several of them were of the opinion that the Institute's position was contrary to that claimed by it. He also described some of the developments which led to the formation of the new overall Council, expressing his opinion that the Institute had been wrong in not supporting the new organization.

Mr. Lalonde expressed his regret that this difference of opinion should have developed. He, too, reviewed some of the history, pointing out that the Institute's Committee on Professional Interests had endeavoured to reach an amicable understanding with the Corporation outside of Council meetings, and have a proper rectification made. He still thought that the Institute's representatives and the Corporation should get together and should jointly publish something in the *Bulletin* and in the *Journal* that would clear up the situation satisfactorily.

The general secretary stated that it had been reported to him from different parts of Canada that the incorrect minutes, as published by the Corporation, were being used as a basis of criticism of the Institute. In view of the documentary proof of the corrections of the Institute's position, he thought an effort should be made to remedy the situation.

Mr. Muntz said that in spite of the exhibits shown by the general secretary there were still differences of opinion as to what had occurred. He suggested that it would be better if the whole matter were dropped.

Dean Young agreed with others who had spoken, that there should not be any attempt to spread this story on the pages of the *Journal.* He thought the Institute should take a very dignified position and drop the matter without any further publicity. In conclusion, he moved that the directions given previously to the secretary to print the story in the *Journal* be rescinded. This was seconded by Mr. Poitras and carried unanimously.

Wartime Bureau of Technical Personnel: The general secretary reported that at the last meeting of the Advisory Board of the Wartime Bureau of Technical Personnel he and Mr. Jacobs had presented the Council's resolution as shown in Minute 4252. Other organizations represented on the Board had expressed opinions—some that the Bureau be continued in modified form, principally the register of technical personnel, and others thought that it should be dropped as soon as possible.

Due to the differences of opinion it was agreed that the chairman of the Board, and at least two other Ottawa members of it, should call on the Minister of Labour to see if he was prepared to announce any further plans for the Bureau. It was agreed that the matter would be left at this point until the committee reported back.

Dr. Gagnon read a portion of the report of the Chemical Institute of Canada which he had presented at the meeting of the Advisory Board. In this they recommended that the Bureau be continued in modified form, but restricted principally to the maintenance of the register. He expressed his opinion as to the possible attitude of the Department of Labour with regard to the record of the movements of technical personnel. He pointed out that the regulations would still require employers to report openings, new employees and dischargees, even if the Bureau were abolished. This was noted but no action was taken pending further word from the Board.

Proposal from Toronto Branch: The general secretary presented the following recommendation from the Toronto Branch, which had been passed by Junior and Senior Sections of the Branch:

> "We recommend that, on the employment page of the E.I.C. *Journal,* a graph or table incorporating the schedules of engineering salaries, as and when approved by the association of professional engineers in the various provinces, be published each month, to discourage advertisers offering positions at salaries below these figures, and as a guide to engineers seeking positions."

In the discussion which followed it was pointed out that there is a wide variation in the schedules of salaries adopted by the various associations, and that it was not feasible to publish all of them every month. It was suggested that this recommendation should be referred to the Committee on Employment Conditions for consideration and report.

Mr. Poitras pointed out that the schedule prepared by the Quebec Corporation applied mostly to government employees, but that the Ontario schedule applied to all engineers. He suggested that the Ontario schedule, which has been adopted recently by the Dominion Council, might be used in the *Journal.*

Mr. Sills reminded Council that the Institute had a Committee on Job Evaluation, under the chairmanship of Mr. G. R. Langley, of Peterborough and he thought this committee should be consulted.

Mr. Maclachlan pointed out that the Committee on Industrial Relations has also been discussing the question of job evaluation. Mr. Laughlin thought that some basic schedule could be worked out and published in the *Journal* which would give young engineers some idea of the salary they should receive. Some of the advertisements in the *Journal* offer salaries considerably below any acceptable scale and he thought that some action should be taken as soon as possible. Mr. Doane agreed with Mr. Laughlin and he thought it would be an excellent idea if some schedule could be worked out and published regularly in the *Journal.*

Following further discussion, on the motion of Mr. Sills, seconded by Mr. Love, it was unanimously resolved that the matter be referred to the Committee on Employment Conditions with authority to consult other committees and with a request for a report at the earliest possible date.

The Engineer in the Civil Service: Mr. MacRostie, as chairman of the Committee on the Engineer in the Civil Service, reported that he had been in touch with certain groups in Ottawa with regard to the Institute's proposal that the Civil Service Commission should be enlarged to include at least one professional technical employee and that a technical panel be set up by the Commission. His inquiries indicated that this proposal would be well received by the Professional Institute of the Civil Service and not unfavourably by the Civil Service Commission itself.

He had been informed from within the organization that the pressure from the Institute had had its effect and that an increase in salaries to the engineer in the Civil Service was on its way. He outlined some of the reforms that the Civil Service was reported to be advocating. These included:—

1. Adequate entrance salaries sufficient to attract the best applicants.
2. Adequate ranges of compensation sufficient to retain the best of those who enter the Service.
3. Regular yearly increases, subject to satisfactory service, up to an adequate figure.
4. Additional increases in compensation for those who increase their value and add to their responsibilities most quickly. These can best be secured by means of periodical surveys made by the Civil Service Commission, commonly called " unit surveys ".

Mr. MacRostie reported further that of the 2,700 professional, scientific and technical officers a re-classification survey had been completed by the Civil Service Commission in about 2,000 cases. Of these 1,400 have already been recommended for increased compensation under the provisions of the Treasury Board directive allowing reclassification in cases of gross injustice.

Recommendations for an additional 300 are going forward almost immediately. So far these recommendations have resulted in an immediate increase of over $350,000.00 and it is expected that the ultimate increase will be about $625,000.00.

Mr. MacRostie reported that the main obstacle to improvements for professional workers in the Civil Service had been the Treasury Board. He expressed the hope that the Board would not throw out or hold back the progressive recommendations which he understood the Civil Service was to present shortly.

In conclusion, the president thanked Mr. MacRostie for the work he had been doing and asked him if his committee would continue with it, following up in whatever way was thought necessary.

Memorandum from the Toronto Branch: The president called on Mr. Morrison, the chairman of the Toronto Branch, to present to Council the memorandum which had been sent to headquarters.

Mr. Morrison explained that fifty copies of the memorandum had been sent for distribution to councillors and that he did not think that this was the time to read such a lengthy document The general secretary pointed out that the fifty copies had been insufficient because no allowance was made for the new councillors taking office in 1946. However, he explained that the fifty had been distributed and that most of the councillors present had had copies.

Mr. Stirling referred to a previous and similar memorandum, prepared by the Toronto Branch, which had been discussed in Toronto by the Committee on Professional Interests with the executive of the Toronto Branch. He appreciated that the present memorandum was modified considerably but he pointed out that it contained some inaccuracies in the statements of facts. He did not like to make any comments on behalf of his committee as it had not yet been referred by Council to the committee.

Considerable discussion followed as to whether the memorandum should be read now or if it should be left to the Committee on Professional Interests for a report to Council. However, in view of the request of the Toronto councillors the president called on the general secretary to read it. At the conclusion of the reading the president asked the meeting for an open discussion.

Many councillors participated and several expressed surprise at some of the contents. Others referred to developments in these matters during the period of time in which they were officers of the Institute.

Mr. Stirling believed that the question was being approached from the wrong angle. He thought that the matter should be introduced by the Toronto Branch with the proper proofs of its statements and then be discussed by the councillors.

Considerable discussion followed with regard to the creation in Canada of sections of American societies, and the opposition which it was alleged in the memorandum had been offered by the Institute. Messrs. Young and Challies indicated that no opposition had come from the Institute as an organization but that there was some opposition from members of the American organizations themselves resident in Canada who were also members of the Institute. Mr. Challies described at length experiences he had had when president of the Institute and he expressed also the opinions of the various American organizations as disclosed around the table at the meetings of the Engineers' Council for Professional Development. He was of the opinion that several of the specific charges in the memorandum could not be proven but he felt that Council owed a debt of gratitude to the Toronto Branch for having raised the points and for having caused Council to review its position.

Mr. Eadie also described his experience when chairman of the Montreal Branch and the co-operation with the American Institute of Electrical Engineers was being discussed.

Mr. Morrison explained that he did not think the criticism in the memorandum was related to recent years but was based on actions of fifteen or twenty years ago. From such actions there had been left the unfortunate impression that the Institute was actively opposing the establishment of Canadian sections of American societies. At least, he explained, that is the impression held by the members of the Toronto Branch and of other societies in Toronto.

Further discussion was carried on by Messrs. Hall, Shearwood and Hogg, the latter suggesting that the report should be studied in a sympathetic manner. He thought the wording of the memorandum was unfortunate in certain spots but that it contained some helpful suggestions.

Mr. Frost, as past chairman of the Toronto Branch, stated that the memorandum represented almost three years of deep thinking on the part of the Toronto Branch. He recommended that the memorandum be laid on the table but that it should be submitted to branch executives.

Messrs. Sills, Flitton and Muntz added to the discussion, each pointing out the good features of the memorandum and recommending that it be given serious consideration by Council. In conclusion, Mr. Laughlin moved that the memorandum be tabled and that copies be sent to the various branches of the Institute asking for a study of its contents and a report to Council. This was seconded by Mr. Love.

Professor Turner thought it would be helpful to the branches to have a copy of the discussion at this meeting sent along with the memorandum. Mr. Armstrong was of the opinion that the memorandum should be submitted to the Committee on Professional Interests before it went to the branches and that in its accompanying statement the committee should point out any inaccuracies contained in the memorandum and emphasize other points which it thought helpful. He thought the memorandum in its original form should go to the branches but that the committee should submit to Council its report which, under Council's instructions, could accompany the memorandum. These recommendations were agreed upon and were included in the original motion, which was carried unanimously.

Institute War Memorial: The general secretary reminded Council that from time to time there had been discussions as to the possibility of erecting a new headquarters building. It is recognized that the space available in the present building is not adequate for present needs. Additional space is required for the library, for office files and for desk space for the staff.

Attention has recently been called to the amended federal legislation covering the War Charities Act which makes it possible to include buildings, as war memorials. The Institute is definitely interested in a war memorial of some kind and it would be most appropriate if it could be combined with a new headquarters building.

On the motion of Dean Young, seconded by Dr. Gagnon, it was unanimously resolved that the matter be referred to the House Committee for consideration and report.

International Engineering Congress: The general secretary reported that it seemed that some of the members of the Institute had been misinformed with regard to the proposed International Congress of Engineers in Paris next June. He explained that the International Federation which was sponsoring the congress had not yet been formed itself. Apparently it was one of the purposes of the congress to get the new federation inaugurated. He reported further that the three principal British institutions of engineering and the founder societies in the United States were not supporting the new federation or the congress.

Before adjourning the meeting, President Fetherstonhaugh expressed his thanks to councillors and guests for the assistance which they had given him at this meeting, and also for the assistance which he had received throughout the year. It had been a most interesting year for him and he was looking forward to meeting the various members at future meetings.

The Council rose at 5 o'clock p.m.

A meeting of the Council of the Institute was held at the Mount Royal Hotel, Montreal, on Friday, February 8th, 1946, convening at ten o'clock a.m.

Present: President J. B. Hayes in the chair; Past-President E. P. Fetherstonhaugh; Vice-Presidents J. E. Armstrong, W. R. Manock and C. E. Sisson; Councillors P. E. Buss, G. J. Currie, J. R. Dunbar, R. C. Flitton, A. E. Flynn, C. A. Peachey, P. E. Poitras, W. L. Saunders, J. B. Stirling, E. O. Turner, J. A. Vance and Paul Vincent; Past-Councillors R. E. Chadwick, J. A. Lalonde, James McMillan and H. R. Sills; H. G. Stead, immediate past-chairman of the London Branch; General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

Appointment of General Secretary: On the motion of Mr. Stirling, seconded by Mr. Vance, it was unanimously resolved that L. Austin Wright be re-appointed general secretary of the Institute.

Appointment of Treasurer: On the motion of Mr. Stirling, seconded by Mr. Armstrong, it was unanimously resolved that J. A. Lalonde be appointed treasurer of the Institute for the year 1946.

Appointment of Committees: On the recommendation of the Striking Committee, it was unanimously resolved that the chairmen of Institute committees for the year 1946 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 March meeting:

Finance .... J. E. Armstrong
Library and House.............. C. A. Peachey

Papers	C. E. Sisson
Publication	R. S. Eadie
Legislation	P. E. Poitras
Board of Examiners	R. DeL. French
Membership	H. R. Sills
Professional Interests	J. B. Stirling
Employment Conditions	R. E. Heartz
Industrial Relations	Wills Maclachlan
Rehabilitation	Howard Kennedy
International Relations	M. J. McHenry
Engineer in the Civil Service	N. B. MacRostie
Prairie Water Problems	G. A. Gaherty
The Young Engineer	L. F. Grant
Institute Prizes and Awards	E. P. Muntz
Harry Bennett Memorial Committee	J. A. Vance
H. N. Ruttan Prize	R. A. Spencer
John Galbraith Prize	W. R. Manock
Phelps Johnson Prize	J. E. Armstrong
Ernest Marceau Prize	G. F. Layne
Martin Murphy Prize	C. M. Anson

Thanks to Retiring Councillors: As chairman of one of the Institute committees, Mr. Stirling had had the privilege of attending a number of Council meetings during the year, and a real appreciation of the great volume of work which had been carried on during the year. It gave him much pleasure to move a hearty vote of thanks and appreciation to the retiring president, vice-presidents and councillors. The motion was seconded by Mr. Flitton and carried unanimously.

Past-President Fetherstonhaugh stated that it had been a great privilege and a matter of great interest to him to have been president of the Institute for the past year, an experience which he would value throughout the rest of his life. He could not emphasize too greatly the value of the work which had been done by the Council and the various committees, and in thanking Council for their kind resolution, he wished the Institute every success in the coming year.

Thanks to Montreal Branch: As a member from a distant part of the Dominion, Mr. McMillan of Calgary expressed his great pleasure in being able to attend this annual meeting, and on behalf of himself and other guests, he moved a hearty vote of thanks be extended to the officers, members and ladies of the Montreal Branch for the splendid arrangements which had been made and for the many courtesies and gracious hospitality received. Dr. Turner, as a member from a distance in the other direction, Fredericton, New Brunswick, had very much pleasure in seconding the motion. No one had experienced the slightest inconvenience which might reasonably have been expected in these days of congested travel and hotel conditions. The motion was carried unanimously.

Thanks to Hotel Staff and Management: Mr. Wright commented on the splendid co-operation which had been received from the hotel staff and management. In spite of extremely difficult circumstances, he had never had so many people remark on the good hotel accommodation received. On the motion of Mr. Armstrong, seconded by Mr. Vance, it was unanimously resolved that a message of thanks and appreciation be sent to the management and staff of the hotel for the excellent arrangements which had been made for the comfort and convenience of the guests.

In the discussion as to the time and place for the next Council meeting, it was pointed out that the president planned to visit the western branches in April and that a regional meeting should be held there. It was also suggested that an early meeting in Toronto would be desirable. Eventually it was left with the president to determine these points.

President Hayes thought that this might be a good opportunity for the chairmen of some of the committees which had been meeting during the course of the annual meeting to make an informal report if they cared to do so.

Committee on Professional Interests: Mr. Stirling commented briefly on the meeting with the representatives of the provincial professional associations. It had been in the nature of an exploratory meeting. They had considered how the proposed amendments to the by-laws could best be put before the membership for a vote. He had also had some very interesting talks with the young men attending the students conference. His committee had also met with representatives of the American Society of Mechanical Engineers and had explored the possibilities of the co-operative agreement which had just been signed. The proposed joint meeting in Detroit had been discussed and other means of implementing the agreement. A complete report would be made to the next meeting of Council.

Papers Committee: Mr. Sisson noted that he had again been nominated for the chairmanship of the Papers Committee. In the past year he had found it very difficult to accomplish what he had thought the Papers Committee should be able to do for the branches. Apart from a few papers which they had been able to provide, and a considerable time spent on Mulberry, very little had been accomplished. He would be glad to receive suggestions from members who had served on this committee or from any one as to ways and means whereby the Papers Committee could better serve the branches. The committee had not been able to give proper assistance to the western branches and to the smaller branches, which, in his opinion, were the ones that needed the assistance.

Mr. Vance, speaking as a past-chairman of the Papers Committee, thought that many of the smaller branches felt that travelling members of the Institute passed through their towns without stopping to visit with them. If more members could be induced to stop off and speak to such branches, either at a luncheon or a dinner meeting, it would be a great boost for them. He also emphasized the desirability of encouraging an interchange of speakers between branches.

Mr. Wright pointed out that one of the purposes for which the Institute needed additional revenue was to provide speakers for the smaller branches. He emphasized, too, the desirability of prominent members of the Institute visiting remote communities where there were perhaps a number of members of the Institute but no established branch. Visits of this kind would be good for the members and also good for the Institute.

Mr. McMillan stated that members of his branch would be greatly pleased if members passing through Calgary would stop off and talk to them either at a branch meeting or at a meeting of the executive. If such members could advise the branch in advance it would be greatly appreciated. The same thing applied in Edmonton to members passing through on the C.N.R. The general secretary undertook to publish an item covering this suggestion in an early number of the *Journal*.

Circulation of Council Minutes: Mr. Armstrong drew attention to a remark made at the recent meeting with the provincial associations, to the effect that the associations and branches were not kept well informed of what is going on at Council meetings and at Headquarters. He thought the Institute, through the wide circulation of Council minutes, had made a real effort to keep them informed, but that the minutes would have to be read and not just filed away. Minutes now go to councillors, past councillors for one year, past presidents, branch chairmen, committee chairmen and officers of provincial associations. He urged that all these people make certain to read them, so that Council's desire to give a widespread distribution to news of policy and events could be realized.

From the discussion which followed it appeared that in spite of the broad distribution, the minutes were very often apt to be filed without being read. It was suggested that councillors in the various branches and the branch chairmen might read these minutes in detail and extract from them the items of particular interest to their own branch and present them at a branch meeting for the information of the members of the branch. Any major project under consideration by Council appears in the minutes of three or four meetings before it is acted upon, and if the branches do not know anything about it, it means that the councillors are not performing one of their duties. Mr. Armstrong knew of no other organization that broadcasts its minutes so widely. In his opinion they should definitely be brought to the attention of the branch committee members so that they would be informed, and so that the branches could, in turn, keep Council informed of their reaction to the various matters under consideration.

Legislation Committee: Mr. Poitras, as chairman of the Legislation Committee, outlined some of the actions of the Corporation of Professional Engineers of Quebec in its proposal to have the Professional Engineers' Act amended. He referred to the joint committee of the Corporation and the Institute which had been set up to deal with the appeal of the case of Brian Perry and to negotiate for changes in legislation. He was encouraged to believe that the appeal would be successful and that the legislation would be amended as proposed.

Co-operation in Ontario: Mr. Buss thought that Mr. Vance's remarks regarding co-operation between the smaller branches were very timely. There were a number of medium sized branches in Ontario, not very far apart, which could co-operate very effectively, particularly in regard to speakers. He also hoped that something was being done with regard to co-operation with the Association of Professional Engineers of Ontario. A great many members belonged to both organizations and in his opinion there should be a co-operative agreement. With a proposed increase of fees in both organizations it might very well mean that some members would be resigning from one body or the other.

Mr. Stirling reported that progress in connection with a co-operative agreement in Ontario was not very encouraging. The most difficult situation was in the Toronto area. However, he thought if the members of the Ontario branches wanted to do some additional ground work, Mr. Buss' objective might be accomplished.

The general secretary reported that various members and officers in Ontario were of the opinion that an agreement might be reached in almost all parts of Ontario except the Toronto area. One member, a past-president of the Ontario Association, had suggested that the possibility of making agreements with separate sections of the province should be considered. He thought it was unwise to hold up all progress just because the situation seemed difficult in Toronto.

A past officer of the Institute in Ontario had also suggested that it might be advantageous to establish a provincial division of the Institute in Ontario in accordance with By-Law No. 69 in order to set up within the province a comprehensive organization that would survey the situation and take whatever action seemed most desirable.

Mr. Buss stated that he was going to initiate some action along these lines to see what could be accomplished.

Mr. Vincent suggested that it would be helpful if the Institute took more steps to make its relationships with the provincial associations perfectly clear. The fact that the Institute had sponsored these in the first instance and was solely responsible for the model act is not known to a great many engineers. He thought that even in the provinces where there were co-operative agreements the relationships would be improved if the Institute's position were made clear. He hoped that the relationships in each province might continue to improve so that eventually the work of both organizations would be thoroughly coordinated.

Dr. Turner suggested that when the Toronto memorandum, which was presented to Council on the 6th, goes out to branches, the inaccuracies in it be corrected. For instance, he noted that the report of attendance at Council meetings was not correct so far as he was concerned. He had been present at meetings beyond those shown in the tabulation. Other councillors pointed out that the same thing had occurred in their cases as well. This was noted by Mr. Stirling on behalf of the Committee on Professional Interests.

The Council rose at eleven fifteen a.m.

ELECTIONS AND TRANSFERS

A number of applications were considered, and the following elections and transfers were effected:

Members

Baxter, Andrew, Cert., Mech. Engr., (Royal Tech. Coll., Glasgow), engr., Dominion Bridge, Riverside Iron Works, Calgary, Alta.

Berger, Stephen Etienne, diploma civil engrg., (Univ. of Berlin, Germany), 234 St. George St., Toronto, Ont.

Busby, Arthur Henry Wilson, B.Sc., (Mining Engrg.), (Univ. of Birmingham, Eng.), supt. physical research, Consolidated Mining & Smelting Co. of Canada, Trail, B.C.

Byrn, James Charles, Graduate, (Royal Military Coll.), supt., dredging, Marine Industries Ltd., Montreal, Que.

Chipman, Samuel Gerard, B.Eng., (Mining), (McGill Univ.), sales engr., E. Leonard & Sons, Ltd., London, Ont.

Helliwell, Alfred Lloyd, B.A.Sc., (Univ. of Toronto), supvr., testing engine laboratories, Imperial Oil Ltd., Sarnia, Ont.

Irvine, Daniel John Sylvester, Lt. (E), R.C.N.V.R., B.Sc., (Chem. Engrg.), (Univ. of Saskatchewan), Montreal, Que.

Klawe, Czeslaw H., Elect. Engr., (Univ. of Grenoble, France), chief inspector, Prenco Progress & Engineering Corporation, Toronto, Ont.

MacLeod, Gordon Ross, B.Eng., (Mech.), (McGill Univ.), British Air Commission, Washington, D.C.

McLellan, John Gilmore, B.A.Sc., (Univ. of British Columbia), sales engr., power apparatus dept., Northern Electric Co., Ltd., Montreal, Que.

Milne, Frank Eric, B.Sc., (Univ. of Edinburgh), elect. engr., order, engrg., & specifying divn., service dept., Otis-Fensom Elevator Co., Ltd., Hamilton, Ont.

Moon, Clifford Leslie, B.A.Sc., (Univ. of Toronto), forest products engr., Forest Products Laboratories of Canada, Ottawa, Ont.

Parish, Charles Ernest, Lt. Col., O.C. No. 2, C.A.C.T.R., B.Eng., (Civil), (McGill Univ.), supt. genl. constrn., J.L.E. Price & Co., Ltd., Montreal.

Publicover, Lloyd David, B.Sc., (Chem. Engrg.), (Univ. of Alta.), engr., Canadian Stebbins Engineering & Manufacturing Co., Ltd., Montreal, Que.

Tomlinson, Walter John, Jr., B.Sc., (Chem. Engrg.), & Chem. Engr., (Lehigh Univ.), tech. director, Bezt Laboratories Ltd., Montreal, Que.

Turner, Gordon Chester, B.Aero Engrg., (Univ. of Detroit), Aero. Engr., with R.C.A.F., now demobilized, Simcoe, Ont.

Swan, David, B.Sc., (Mech. Engrg.), (Univ. of Saskatchewan), chief engr., Kipp-Kelly Ltd., Winnipeg, Man.

Juniors

deWitt, George Harding, B.Eng., (Elect.), (McGill Univ.), elect engr., Shawinigan Water & Power Co., Shawinigan Falls, Que.

Ford, William Rex, Lieut., Canadian Army, B.Eng., (Civil), (McGill Univ.), St. Johns, Que.

Jeffrey, Alexander, B.Sc., (Mech.), (Queen's Univ.), jr. engr., St. Clair Processing Corporation, Sarnia, Ont.

Salmon, Kenneth Waterbury, B.Sc., (Elect. Engrg.), (Univ. of New Brunswick), New Brunswick Telephone Co., Ltd., Saint John, N.B.

Schmidt, Donald Victor, B.A.Sc., (Chem.), (Univ. of Toronto), inspection chemist, Imperial Oil Limited, Sarnia, Ont.

Sloan, John Luxton, S/L., R.C.A.F., (Louborough Aero. Coll., Liverpool Univ.), Calgary, Alta.

Smith, Ian, Lieut., R.C.E., B.Sc., (Civil), (Univ. of Alberta), Calgary, Alta.

Willmot, Richard Stewart, B.A.Sc., (Mech.), (Univ. of Toronto), at Univ. of Western Ontario at present, Toronto, Ont.

Affiliate

Hughston, James Franklin, Q.M.S., R.C.E., Overseas, awaiting demobilization.

Transferred from the Class of Junior to that of Member

Kellam, George D., B.Sc., (Elect. Engr.), (Univ. of Manitoba), asst. engr., Canadian West Natural Gas, Light, Heat & Power, Calgary, Alta.

Transferred from the Class of Student to that of Member

Lombard, Robert Alexander, Capt., R.C.E., B.Sc., (Elect. Engrg.), Nova Scotia Tech. Coll.), now demobilized, St. Lambert, Que.

Transferred from the Class of Student to that of Junior

Burgess. Basil Arthur, Lieut. (E), R.C.N.V.R., B.Eng., (Mech.), (McGill Univ.), 4334 Harvard Ave., Montreal, Que.
Tkacz, William, Lieut. (E), R.C.N.V.R., B.Sc., (Mech.), (Queen's Univ.), 518 Hargrave St., Fort William, Ont.

Admitted as Students

Bartlett, William Wilton, B.A.Sc., (Elect. Engrg.), (Univ. of Toronto), testman, Canadian General Electric Co., Toronto, Ont.
Baxendale, Lawrence Robert, (St. Francis Xavier), Box 14, Antigonish, N.S.
Blair, David William, (Univ. of New Brunswick), 488 Charlotte St., Fredericton, N.B.
Hall, William Bertram, B.A.Sc., (Elect. Engrg.), switchgear testing, Canadian General Electric, Peterborough, Ont.
MacDonald, Ignatius Lloyd, B.A.Sc., (Univ. of Toronto), development engr., Dominion Rubber Co., Montreal, Que.
Marksfield, Harry, B.Eng., (McGill Univ.), test course, Canadian General Electric Co., Ltd., Peterborough, Ont.
McLaggan, William Alexander, (Univ. of Alberta), 2413 - 14th St., S.W., Calgary, Alta.
Miller, Charles Henry, (Nova Scotia Tech. Coll.), 277 Gottingen St., Halifax, N.S.
Muggah, James Edmond, Jr., (Nova Scotia Tech. Coll.), 35 Harvey St., Halifax, N.S.
Scott, Tom Foster, (Univ. of British Columbia), 4646 W. 8th Ave., Vancouver, B.C.

Students at McGill University

Abel, John Knight, 3506 University St., Montreal 2, Que.
Blackmore, Roland H., 3673 Park Avenue, Montreal, Que.
Brockhurst, Donald Norman, Douglas Hall, Montreal, Que.
Burroughs, John C., 3609 University St., Montreal, Que.
Dumka, Joseph, 593 Notre Dame Ave., St. Lambert, Que.
Jeffrey, Douglass Bruce, 785 Wilder Ave., Outremont, Montreal 8, Que.
Laberge, Jerome Guy, 525 Prince Arthur St. W., Montreal, Que.
Lupu, Melvin, 859 Rockland Ave., Outremont 8, Que.
Rossi, Ernest J., 6657 Monkland Ave., Montreal 28, Que.
Sidler, Joseph, 927 Pratt Ave., Outremont, Que.
Spino, Mario, 7793 Henri Julien St., Montreal, Que.
Villeneuve, Louis Philippe, St. Andre de Roberval, Que.
Wood, William Renfrew Muir, 784 Wilder Ave., Montreal 8, Que.

Students from University of Toronto

Booth, William Lawrence, 365 Dovercourt Road, Toronto, Ont.
Brown, Howard McCrae, 71 Queen's Park, Toronto, Ont.
Carr, William Hamilton, 175 Gamble Ave., Toronto, Ont.
Dalrymple, Alfred Eric, 42 King George's Road, Toronto 9, Ont.
Durand, Edwin Joseph, 45 Taylor St., Toronto, Ont.
Freeberg; James Arnold, 3 Devonshire Place, Toronto, Ont.
Freeman, Willard Arthur, 1 Maple Ave., Hamilton, Ont.
Harding, John Murray, 451 Blythwood Road, Toronto, Ont.
Jones, Harry Edwin, 69 Durban Road, Toronto, Sub. 82, Ont.
Richards, Vincent Llewellyn, 370 Huron St., Toronto, Ont.
Robinson, Alfred, 621A College St., Toronto, Ont.
Scott. William A., 68 Edith Drive, Toronto 12, Ont.
Short, Kenneth W., 2082 Gerrard St., E., Toronto, Ont.
Symes. Donald Cyril, Knox College, 59 St. George St., Toronto, Ont.

Students from Queen's University

Bennett, Lorne Maxwell, 33 Aberdeen St., Kingston, Ont.
Carter, Ronald Arnold, 250 Alfred St., Kingston, Ont.
Dean, Luther Allyn Shourds, 84 Clergy St., W., Kingston, Ont.
Douglas, Donald Hugh Charles, 85 Division St., Kingston, Ont.
Freeman, Reginald Garnet, Yarker, Ont.
Hovey, Frederick Lucas, Box 161, Clinton, Ont.
Mowbray, John Frederick, 619 Johnson St., Kingston, Ont.
Provan, James Thompson, 115 Collingwood St., Kingston, Ont.
Rothschild, Kurt, Queen's University, Kingston, Ont.
Soden, John Wilson, 134 Collingwood St., Kingston, Ont.

Students at Laval University

Belanger, A. Fernand, 315 Royal Ave., Beauport, Que.
Bernier, Charles, 8 Bougainville Ave., Quebec, Que.
Boisvert, Maurice, 46 Aberdeen St., Apt. No. 1, Quebec, Que.
Cahill, Lionel, 4 St. Leon St., Bienville, Levis County, Que.
Carrier, Marcel, 43½ Cartier Ave., Quebec, Que.
deLery, Alexandre C., 5 De Brebeuf, Quebec, Que.
Matte, Gerard, 36 - 10th St., Quebec, Que.
Langevin, Jean-Marie, 103 Ste. Anne St., Quebec, Que.
Lepine, Jerome, 97 Begin Avenue, Quebec, Que.
Milette, Jean-Paul, 3686 Ste. Marguerite St., Three Rivers, Que.
Morin, Adrien, 49 St. Joachim St., Quebec, Que.
Paradis, Maurice, 121 Garnier St., Quebec, Que.
Tousignant, Denys, 12 St. Denis Ave., Quebec, Que.
Trudel, Yves, 942 Ste. Genevieve St., Three Rivers, Que.

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

Saskatchewan

Students, Univ. of Saskatchewan

Hill, Alexander Minett, 612 Albert Ave., Saskatoon, Sask.
Lotts, Gordon Richard, 713 Victoria Ave., Saskatoon, Sask.
McLean, William James Lloyd, Qu'Appelle Hall, Univ. of Saskatchewan, Saskatoon, Sask.
Pickering, John Ernest, 129 - 7th St., Saskatoon, Sask.
Putnam, James Morrison, 616 Lansdowne Ave., Saskatoon, Sask.
Shore, Robert Ellis, 617 Eastlake Ave., Saskatoon, Sask.
Thierman, Vernon Douglas, 1012 Melrose Ave., Saskatoon, Sask.
Tucker, Edwin Charles, 616 Lansdowne Ave., Saskatoon, Sask.
Ward, Lancelot William, 617 Eastlake Ave., Saskatoon, Sask.
Wilson, Andrew Grant, 408, 20th St., E., Saskatoon, Sask.

Student to Junior

Hamilton, Geoffrey Craig, B.Sc., (Civil), (Univ. of Saskatchewan), 839 University Drive, Saskatoon, Sask.

Quebec

Members

Borden, Douglas C., B.Sc., (McGill Univ.), Wiring Materials Mgr., Northern Electric Co., Ltd., Montreal, Que.
Brosseau, Georges, B.A.Sc., C.E., (Ecole Poly.), prod. engr., Regent Knitting Mills, Ltd., St. Jerome, Que.
Clossey, Emile Guillaume, B.Sc., (McGill Univ.), checking structl. plans, Buildings Dept., City of Montreal, Que.
Deschesnes, Fernand Miville, B.Eng., (McGill Univ.), Engineering Draughting Service (directs own business), Montreal, Que.
Jones, George H., B.Eng., (McGill Univ.), electronics engrg. dept., Northern Electric Co., Ltd., Montreal, Que.
McKeagan, Edwin A., B.Sc., (Eng.), (Nova Scotia Tech. Coll.), sales engr., Canadian General Electric Co., Montreal, Que.
Millenbach, John Peter, B.Sc., & E.M., (Michigan Coll. of Mining & Tech.), manager, Canadian Malartic Gold Mines Ltd., Malartic, Que.

Junior to Member

Manseau, Gilbert, B.A.Sc., C.E., (Ecole Poly.), private practice, machine design & industrial organization, Westmount, Que.

Student to Member

Cadieux, Jean, B.A.Sc., C.E., (Ecole Poly.), industrial engr., Dominion Rubber Co., Ltd., Montreal, Que.
Henry, George Robert Stirling, B.Eng. (Mech.), (McGill Univ.), engrg. staff, British American Oil Refinery, Montreal, Que.

Student to Junior

Rousseau, Jean Melville, B.A.Sc., C.E., (Ecole Poly.), jr. engr., development dept., Canadian Marconi Co., Montreal, Que.
Thibault, Bernard, B.A.Sc., C.E., (Ecole Poly.), asst. resident engr., Matane County, Dept. of Roads, Quebec, Montreal, Que.

New Brunswick

Member

Edgett, Conrad Seaton, instrumentman, Canadian National Railways, Moncton, N.B.

DISCUSSIONS

All written discussions on the following papers which were presented at the annual meeting should be received at Headquarters not later than April 20th, 1946:
"Performance, Installation Characteristics and Design of the Rolls-Royce 'Nene' and 'Derwent' Gas Turbines" by J. D. Pearson, M.E.I.C.
"The Future of Radio Communications in Canada" by A. B. Hunt, M.E.I.C.
"The Winter Temperature Cycle of the St. Lawrence Waters" by J. G. G. Kerry, M.E.I.C.
"Evaluation of Light Metal Alloys" by J. A. Van den Broek, M.E.I.C.

Personals

News of the Personal Activities of members of the Institute

Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.

W. G. Heslop, M.E.I.C., has returned to civil life and is now an associate professor of civil engineering at the University of British Columbia, Vancouver, B.C. For the five years prior to his enlistment he was employed by the Hollinger Consolidated Gold Mines Limited at Timmins, Ont., doing general mining and engineering work. He was also in charge of underground ventilation and dust control. He entered the R.C.A.F. as a pilot officer in 1940 and trained as a navigation instructor at Trenton, Ont. He subsequently served as a navigation instructor at McLeod, Alta., Yorkton, and Regina, Sask., and Brandon, Man. He was then employed for two years at Rivers, Man., and Trenton, Ont., on the standardization and redesign of navigation training throughout the Air Training Plan. He rose to the rank of squadron leader and later served as assistant chief instructor at Summerside, P.E.I.

W. W. Fotheringham, M.E.I.C., has joined the staff of Canadian Brown Steel Tank Company Limited at Brandon, Man. He was formerly employed by Plate and Structural Steel Products Company, Toronto, Ont.

R. E. Haskins, M.E.I.C., has accepted the position of plant engineer with the British Columbia Cement Company, Bamberton Works, Tod Inlet, B.C. He was previously assistant superintendent of the light, heat and power department, Defence Industries Limited, at Transcona, Man.

G. H. Kirby, M.E.I.C., is now employed with the Rolland Paper Company at St. Jerome, Que., as plant engineer. He was formerly chief engineer of Canadian Car Munitions Limited at the Cherrier plant, Que.

Léo Roy, M.E.I.C., has accepted the position of assistant superintendent of distribution at the Quebec Hydro-Electric Commission in Montreal, Que. He was formerly associated with the Quebec Power Company in Quebec City as assistant superintendent of the power division. Until his recent appointment Mr. Roy was secretary-treasurer of the Quebec Branch of the Institute.

R. E. L. Johnson, M.E.I.C., has been appointed manager of the Toronto division of Westeel Products Limited. His territory includes that part of Ontario from the Lakehead to Kingston. Born in Westmount, Que., Mr. Johnson graduated from McGill University in electrical engineering in 1932. After several years of production engineering in the automotive industry, he joined R.C.A. Victor in Montreal, following which he spent several years as an industrial engineer with the firm of Stevenson and Kellogg Limited, management engineers.

W. W. Brumby, M.E.I.C., formerly of the British Admiralty Technical Mission at Ottawa, is now associated with the English Electric Company of Canada Limited at St. Catharines, Ont.

W. J. S. Dormer, M.E.I.C., formerly district plant engineer, Laurentian district, Bell Telephone Company of Canada, has been promoted to special studies engineer of the Eastern Division, with headquarters in Montreal.

E. I. W. Jardine, M.E.I.C., formerly with the Inspection Board of the United Kingdom and Canada at Hamilton, Ont., is now associated with the Public Utilities Commission of British Columbia at Victoria, B.C.

Alan Brown, M.E.I.C.

Alan Brown, M.E.I.C., has been appointed general manager of distribution of Gatineau Power Company, Ottawa, Ont. After serving overseas with the Canadian Field Artillery in World War I, he graduated from Queen's University in 1923. Mr. Brown has been with the Gatineau Power Company since 1926. Prior to his recent appointment he was manager of the eastern distribution district of the company.

R. L. Dunsmore, M.E.I.C., has assumed the position of manager of refineries, International Petroleum Company Limited, at Toronto, Ont. Since joining Imperial Oil Limited in 1919 at Sarnia, Ont., he has held the positions of assistant superintendent of the refinery at Calgary, superintendent of the refinery at Halifax, and manager of the Montreal refinery. He worked for some years as general superintendent for the International Petroleum Company at Talara, Peru, S.A. From 1942 until 1944 he served in the R.C.N.V.R. with the rank of commander as director of fuel at Naval Service Headquarters, Department of National Defence, Ottawa.

Charles W. Carry, M.E.I.C., has entered private practice at Edmonton, Alta. He was previously associated with the Standard Iron Works at Edmonton as engineer on design and sales.

Ross E. Clarke, M.E.I.C., is now assistant engineer with the Department of Highways of Ontario at Kington, Ont. He was formerly employed as resident engineer by the Department of Transport, Air Service Airport Construction, at Kingston, Ont.

A. P. Boutilier, M.E.I.C., is now employed by Canadian Refractories Limited at Montreal, Que. He was recently discharged from the Royal Canadian Engineers with the rank of major after serving as chief works officer with the Department of National Defence, engineer services, at Sydney, N.S., and overseas.

Major W. B. Akerley, M.E.I.C., Saint John, N.B., has relinquished the post of district engineer at M.D. 7 to accept the position of field supervisor, Alaska Highway, which has recently been taken over by the Canadian Army. Prior to the outbreak of war he was employed by the New Brunswick Department of Public Works, Highway Division.

D. B. Sutherland, M.E.I.C., is at present employed as assistant to the superintendent, department of buildings, Montreal Protestant Central School Board, at Montreal, Que. He previously served in the R.C.N.V.R. prior to which he was employed with Guysboro Mines at Goldenville, N.S.

J. W. Brooks, M.E.I.C., has recently accepted a position with the Spruce Falls Power and Paper Company at Kapuskasing, Ont. He was formerly employed as engineer with Hyatt Bros. Construction Company, London, Ont.

R. B. Jones, M.E.I.C., engineer of track for the Canadian Pacific Railway at Montreal since 1939, has been appointed assistant chief engineer of the system. He has served with the C.P.R. for 32 years, except for four years during World War I when he saw service with the Royal Canadian Artillery, rising from the ranks to a commission. He served his rail engineering apprenticeship with the North British Railway 40 years ago and came to Canada in 1910. With the Grand Trunk Pacific Railway he had a part in construction of the Fort William terminals and location survey work in Saskatchewan and in 1913 went with the C.P.R. as a transitman in Montreal. On his return from overseas in 1919 he was made assistant engineer at Montreal, a position which he held until his appointment to engineer of track in 1939.

W. G. Dyer, M.E.I.C., division engineer with the Canadian Pacific Railway at Penticton, B.C., for the past three years, has been appointed engineer of track at Montreal to succeed R. B. Jones, M.E.I.C. A native of Saskatchewan, Mr. Dyer joined the C.P.R. as a rodman at Regina, while an engineering student at the University of Saskatchewan. Upon graduation in 1928, he was appointed building inspector at Saskatoon and has since served at Pennant, Prince Albert, Lanigan and Moose Jaw, all in Saskatchewan, before going to Penticton. At Moose Jaw he was at first resident engineer on construction and later division engineer from 1941 until 1943, when he was transferred to Penticton.

L. H. Laffoley, M.E.I.C., has been appointed to the position of engineer of buildings for the Canadian Pacific Railway. He has been in the engineering department of the company since 1919, when he entered their employ as a draughtsman. He had served overseas two years with the Royal Canadian Engineers and later with the Royal Flying Corps in World War I. On his return to Canada he served as a demonstrator in mechanical engineering at McGill University. After seven years as a draughtsman with the C.P.R. he spent twelve years as assistant engineer and for the past eight years has been assistant engineer of buildings.

G. R. Fanset, M.E.I.C., chief engineer of Ducks Unlimited (Canada) at Winnipeg, Man., has been elected chairman of the Winnipeg Branch of the Institute. Born at Morris, Man., he graduated from the University of Manitoba in civil engineering in 1931. He worked first as resident engineer of the Department of Northern Development, Province of Ontario, and in 1938 he joined the firm with which he is now associated.

Mr. Fanset joined the Institute as a Member in 1940.

Frederick Palmer, M.E.I.C., is opening a Canadian trade commissioner office in Stockholm, Sweden. Since the beginning of the year he has been on a tour of Canada interviewing business firms on the subject of trade with Sweden. Mr. Palmer, who has served in Europe, Britain and Australia as trade commissioner since 1921, has recently returned from a special mission to Chungking, China.

Charles Scrymgeour, M.E.I.C., of Imperial Oil Limited, has been transferred from Dartmouth, N.S., to Montreal, Que., where he occupies the position of superintendent.

E. G. Ryley, M.E.I.C., has accepted a position with Dinsmore-McIntire Company, general contractors of western Ontario, with headquarters at Windsor, Ont. He was formerly with A. W. Robertson Co., Long Branch, Ont.

D. O. D. Ramsdale, M.E.I.C., has been appointed manager of the Kirkland Lake district office of the English Electric Company of Canada Limited. His territory covers the mining area from the Timmins district to the Val d'Or district. After graduating from McGill University in 1933 Mr. Ramsdale went directly into the electrical industry and in 1940 joined the English Electric staff. He served with the R.C.N.V.R. from 1942 until 1945 when he resumed his employment with the company.

G. W. Griffin, M.E.I.C., assistant engineer of the Canadian Pacific Railway at Saint John, N.B., has been transferred to Toronto to become assistant division engineer, Bruce Division.

Lucien Allaire, M.E.I.C., is now employed as assistant engineer, West Division, Waterworks and Sewerage Department, City of Montreal. He was formerly division engineer with the Department of Highways of Quebec at Cap de la Madeleine, Que., and joined the engineering department of the City of Montreal in 1944.

Armand E. Lafleur, M.E.I.C., has established a private practice in civil engineering at Drummondville, Que. He was formerly associated with the Department of Roads, Province of Quebec, as resident engineer at Drummondville.

R. B. Jones, M.E.I.C.

W. G. Dyer, M.E.I.C.

L. H. Laffoley, M.E.I.C.

O. C. Steinmayer, M.E.I.C, retired on pension on February 1st from the services of the Canada Creosoting Company Limited, Montreal. At the time of his retirement he held the position of superintendent of timber preservation.

W. O. Sorby, M.E.I.C., has returned to the Canadian Westinghouse Company Limited and is now employed in the apparatus division at Montreal. Before serving in the Canadian Army he was sales engineer with the company at the Winnipeg office.

Colonel H. R. Lynn, M.E.I.C., who commanded the 1st Battalion of the Royal Canadian Engineers overseas, has retired from the Army and resumed his pre-war position as president of Lynn MacLeod Metallurgy Limited, Lynn MacLeod Engineering Limited and other associated firms at Thetford Mines, Que. Col Lynn was active in the development of flame warfare for the Canadian Army and was also technical and military adviser to the British Petroleum Warfare Department.

Jules A. Beauchemin, M.E.I.C., chief engineer of the Provincial Electricity Board, Montreal, has been elected chairman of the Montreal Branch of the Institute. Born in Montreal, Que., he graduated from Ecole Polytechnique with a B.A.Sc. degree in 1911. Upon graduation he became associated with the Federal Hydrometric Service at Ottawa where he remained until 1919 when he joined the staff of the Riordon Pulp Corporation, at Temiskaming, Que., as the engineer in charge of the study of hydro-electric developments. In 1921 he severed his connection with the Riordon Corporation to become chief engineer of Donnacona Paper Company where he remained until 1927 when he was appointed town manager for the new town of Dolbeau in the county of Lake St. John., Que. Mr. Beauchemin 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. Beachemin, M.E.I.C.

Mr. Beauchemin joined the Institute as an Associate Member in 1919, becoming a Member in 1940. He is chairman of the Ecole Polytechnique Graduates Society for 1946.

Gerald Molleur, M.E.I.C., was appointed joint director of personnel of the Quebec Hydro-Electric Commission at Montreal, Que., last November. He was formerly engineer in charge of the rural electrification division of the Commission.

J. E. Pepall, M.E.I.C., has left Canada to join the Indian Aluminium Company at Chota Muri, Bihar Province, India. He had been connected with the Aluminum Company of Canada Limited at Arvida and Montreal, Que.

A. M. Bain, M.E.I.C., has returned to the Dominion Bridge Co. Limited at Lachine, Que., from which company he was on loan to the Department of Munitions and Supply. He had transferred to the Department as technical assistant to the director-general, Army Engineering Design Branch, in 1941. He became assistant director of tank design in 1943 and from March 1945 until the present time he has been acting director.

George T. L. Andrews, M.E.I.C., has recently joined the engineering staff of Canadian Industries Limited at the nylon plant in Kingston, Ont. He was previously employed in agriculture and engineering practice at Blackdale, Man.

J. K. Angerman, M.E.I.C., was recently appointed electrical counsellor for the industrial division, Bureau of Supply, of UNRRA at Washington headquarters. He was formerly connected with the Montreal Armature Works Limited at Montreal, Que., as designer for A.C. meters and generators.

S. R. Weston, M.E.I.C., is the newly elected chairman of the Victoria Branch of the Institute. After graduation from the University of New Brunswick in 1914, he spent six years in general engineering and construction work. When the New Brunswick Electric Power Commission was established in 1920. Mr. Weston was appointed assistant chief engineer. Three years later he was promoted to chief engineer for the Commission, a position he held until 1939 when he resigned to become chief engineer and technical adviser to the B.C. Public Utilities Commission. Since that time he has supervised an appraisal of the fourteen companies in the B.C. Electric group and represented the Commission in the subsequent rate hearings of the company before the Public Utilities Commission. He was borrowed by the government to assist in the preparation of the Electric Power Act when it passed the legislature. In 1945 he was appointed chairman of the British Columbia Power Commission.

S. R. Weston, M.E.I.C.

Mr. Weston joined the Institute as an Associate Member in 1922, transferring to Member in 1925.

Donald S. Smith, M.E.I.C., who was formerly associated with the National Research Council, division of physics and electrical engineering, at Ottawa, Ont., is now employed as power apparatus sales engineer with Northern Electric Co. Limited at Vancouver, B.C.

G. W. E. Nicholson, M.E.I.C., has been appointed vice-president in charge of manufacturing of the Union Bag and Paper Corporation, New York, N.Y. Since 1941 he was employed as resident manager with the Corporation at Savannah, Ga.

Frank C. Dempsey, M.E.I.C., has been appointed by Flintkote Company of Canada Limited sales engineer for western Canada with headquarters at Calgary, Alta. A graduate of the University of Manitoba in civil engineering, he was first employed as resident engineer with the Manitoba Department of Public Works. He joined the British American Oil Company as asphalt engineer in charge of asphalt activities in western Canada, and later became manager of the British American Oil Asphalt Department at Toronto. He founded and operated Asphalt

Services Limited, from which company he goes to his new appointment.

J. W. Thomas, M.E.I.C., has accepted a position with McColl-Frontenac Oil Company in Montreal. Mr. Thomas, who has recently been retired from active service with the rank of major, served for over five years with the Royal Canadian Engineers. After four years overseas, he returned to Canada and for the past year he has been with the Directorate of Engineer Development at National Defence Headquarters in Ottawa.

Arthur Piché, M.E.I.C., who was formerly with the Department of Public Works of Canada, has recently joined the staff of the engineering department of the City of Quebec.

C. E. Olive, M.E.I.C., is now on the teaching staff of the University of Toronto at its Ajax Division. He served formerly as a commander in the R.C.N.V.R.

Denis Stairs, M.E.I.C., who has been serving as director of construction, Department of Munitions and Supply, Ottawa, Ont., has returned to the Montreal Engineering Company Limited, of which he is a director and with which he has been associated since 1922.

Harold C. Oatway, Jr.E.I.C., has now returned to Canadair Limited, Cartierville, Que., as stress analyst. For the past year he has been on loan from the company to Douglas Aircraft Corporation at Santa Monica, California.

James A. MacGibbon, Jr.E.I.C., is at present employed in the alkali division of Canadian Industries Limited at Windsor, Ont. He was formerly draughtsman in the engineering department of the company at Montreal.

O. L. Smith, Jr.E.I.C., is now associated with Price Brothers and Company Limited as an electrical engineer at Riverbend, Que. He was previously employed by Metropolitan Electric Company at Quebec City, Que.

Hugh J. Gordon, Jr.E.I.C., who was discharged from the Canadian Army in January with the rank of lieutenant, has returned to the Canadian Pacific Railway as transitman in Vancouver division.

P. O. Bourgeois, Jr.E.I.C., of International Water Supply Limited, has been transferred from London, Ont., to Montreal, Que.

Captain J. B. Glenn, Jr.E.I.C., has been recently promoted to his present rank and is now attached to Headquarters, R.C.E.M.E., 3 Canadian Infantry Division (C.A.O.F.), Canadian Army Overseas.

J. A. Caverley, Jr.E.I.C., former geologist with the Britannia Mining and Smelting Company, Britannia Beach, B.C., is now associated with the Howe Sound Exploration Co. Limited, Snow Lake Division, Snow Lake, Man.

Sydney M. S. Dunn, Jr.E.I.C., has severed his connection with Defence Industries Limited at Bouchard shell filling works, Jean Brillant, Que., and is now employed by General Steel Wares Limited, Toronto, Ont., as production engineer.

Warren Ball, S.E.I.C., was discharged from the Canadian Army last November with the rank of lieutenant (R.C.E.M.E.). He graduated from Nova Scotia Technical College in 1944 and is at present taking a post-graduate course leading to the degree of M.A.Sc. at the University of Toronto.

C. A. N. Baker, S.E.I.C., has joined the staff of the Norton Company at Chippawa, Ont., as a junior chemical engineer in the research and development section. He received his M.Sc. degree in chemical engineering at Queen's University in 1945.

Fernand Lareau, S.E.I.C., has accepted a position with T. Pringle & Son Limited, Montreal, as a structural designer. He was previously assistant engineer of the City of Verdun, Que.

J. D. Palmer, S.E.I.C., who was previously connected with the Northern Electric Limited at Montreal, is at present employed by the Commonwealth Electric Corporation in Welland, Ont., as a sales engineer.

Marcel Lefebvre, S.E.I.C., is now working for the Provincial Electricity Board at Montreal, Que. He graduated from Ecole Polytechnique in 1944.

Philip T. Nash, S.E.I.C., is at present employed in the maintenance and construction division of Brunner, Mond Canada Limited at Amherstburg,, Ont. He is a graduate of Queen's University in mechanical engineering in the class of 1945.

D. D. Hunter, S.E.I.C., has been discharged from the Canadian Army with the rank of captain and is now employed with Dominion Bridge Company Limited at Lachine, Que. He served overseas with the R.C.E.M.E. in the 1st Division in England, Sicily, Italy, France, Belgium and Holland from December 1942, until October 1945.

Gérard Lefebvre, S.E.I.C., is now associated with Dufresne, McLagan and Associates Regd., industrial consultants, in Montreal. He was formerly superintendent of the Montreal extension of St. Jerome branch of the Dominion Rubber Company Limited.

Ernest W. Wirtanen, S.E.I.C., of Canadian General Electric Co. Limited, has been transferred from the engineering service department at Toronto, Ont., to the apparatus division at Winnipeg, Man.

Obituaries

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

Charles Conyers Kirby, M.E.I.C.

On January 24, 1946, death, as it must to all, came to Charles Kirby at his home in Saint John, N.B. Amongst his many friends and associates it was no great surprise for Mr. Kirby's health had been poor for several years and had forced him into early retirement; yet the suddenness came as a complete shock. The sense of loss in engineering circles is felt to an increasing extent for, until the time of his death, Mr. Kirby was frequently called upon for advice and information, which was available from no other source.

Born at Newport, Monmouthshire, England, on March 8, 1880, son of Conyers Kirby, A.M.I.C.E., Town Engineer, Newport, Charles Kirby was educated at private school 1889 to 1896 and Welsh Intermediate School, Newport 1896 to 1898. In keeping with engineering education in the Old Country during that time, he was articled to the firm Conyers Kirby and Sons, Newport. From 1901 to 1907 he was assistant engineer in private practice on many works of water supply, sanitation, harbour development and structural engineering in various parts of England and Wales. He came to

Canada in 1907 and was at first employed as instrument man with the Grand Trunk Railway on location surveys. Later he was a construction engineer and superintendent of reinforced concrete work at Ottawa. He entered the service of the C.P.R. in Ottawa as instrument man in 1908. From 1910 to 1912 he was Resident Engineer of the C.P.R. at Montreal and from thence to 1915 was Assistant Engineer, Maintenance of Way, on the C.P.R. Staff at Montreal. From 1915 until the time of his retirement he was District Engineer, C.P.R., Saint John, N.B., in charge of New Brunswick and State of Maine lines.

C. C. Kirby M.E.I.C.

He was married in 1907 to Marion Rogers of Newport, who died in 1930. Of the two daughters of this marriage, one died in early childhood. He is survived by his wife, the former Kathleen Sturdee, daughter of Mr. and Mrs. E. T. Sturdee of Saint John, to whom he was married in 1934, his daughter, Mrs. J. M. Brady of Toronto and two grandchildren.

A big man, handsome and distinguished in appearance, courteous and polished in demeanour, of keen intellect and an infinite capacity for taking pains, honest and uncompromising in matters of honour and integrity, an eloquent and inspiring speaker, the stout and loyal champion of engineers' rights, Charles Kirby was well cast in the role he was called upon to play in the affairs of engineers in Canada during the past 35 years.

He joined The Engineering Institute of Canada, at that time the Canadian Society of Civil Engineers, in 1908, having previously been an Associate of the Institute of Sanitary Engineers, London, England, and maintained an active interest in Institute affairs until his death. He was a charter member of the Saint John Branch and was a delegate from this branch in 1919 to the Committee of Thirteen (one from each branch) which met in Montreal on April 7, 1919 and produced the "Model Act", which was the basis of all subsequent provincial legislation. He served as first president of the Association of Professional Engineers of New Brunswick. He was later called in for consultation when the Act and By-Laws were revised in 1938, 1939 and 1940. He advocated the co-operative agreement between the Institute and the Association, which was signed in 1941. He was a member of the "Committee of Four" of the Associations from New Brunswick and Nova Scotia which met in Montreal in 1931 and later the "Committee of Eight" which met in 1933 and proposed the formation of a Dominion Council of Professional Engineers, and in 1936 he was elected its first president, which office he held until 1940. He continued as Dominion Councillor from New Brunswick until forced by ill-health to resign.

Mr. Kirby was also a Warden of Camp IX and took an active interest in the ceremonies of the Ritual of the Calling of an Engineer.

After retirement he still maintained close contact with engineering activities. Even when finally, upon his doctor's orders, he was forced to resign as registrar of the N.B. Association he accepted the Saint John Branch chairmanship of the Committees on Student Guidance and Rehabilitation which he carried on till his death.

His hobby was chess and he was instrumental in founding the St. John Chess Club of which he was president when he died. During recent years he had made a study of the games of the great masters of chess and of chess openings and made a regular practice of visiting the Soldiers' Hospital and teaching the game to all who felt so inclined. He was also a member of Union Club, Riverside Golf and Country Club, Canadian Club and St. George's Society.

A man of deep religious convictions, he was for nearly 12 years on the Vestry of St. Pauls Anglican Church, during which he acted as Warden for two terms and was several times appointed as a delegate to the Anglican Synod. At the time of his death he was a member of the Council of the Church of England Institute.

In every field of endeavour where the well-being of his profession was concerned, Charles Kirby was to be found. Few, if any, have laboured longer and with more success, in laying the foundations and building up the status of the profession in Canada. His "History of Dominion Council", reports of Committees and meetings and other documents prove that the engineering profession may number Charles Kirby as one of its greatest. He might truly be called one of the "fathers of the engineering profession in Canada."

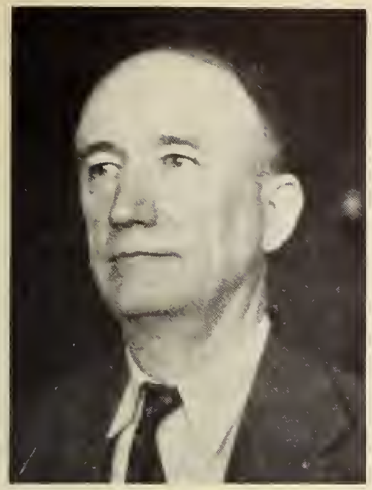
NEWLY ELECTED OFFICERS OF THE INSTITUTE

C. M. Anson, M.E.I.C., has been elected vice-president of the Institute for the Maritime provinces. A native of England, he moved to Australia at an early age and received his preliminary education there. The third generation of his family to be interested in the steel industry, he started to work in it at the age of 14 years and has been connected with it since that time. After obtaining experience in laboratories and rolling mills he worked through all jobs in the open hearth and became superintendent of an electrical steel making plant at the age of 18 years.

Mr. Anson left Australia in 1920 for Canada to enter McGill University and five years later graduated with a B.Sc. in metallurgy. In the year of his graduation he joined the Dominion Steel and Coal Corporation as a laborer at blast furnaces and in two years was made assistant superintendent. In 1928 he became assistant superintendent of rolling mills and later that same year assistant general superintendent. In 1931 he was made assistant general manager and in 1940 general manager of the Eastern Steel Division, which position he holds at the present time.

Mr. Anson joined the Institute as an Associate Member in 1931, becoming a Member in 1940.

G. F. Layne, M.E.I.C., is the newly elected vice-president of the Institute for the province of Quebec. Born in Barbados, B.W.I., he attended Harrison College, Barbados, and later McGill University, graduating from the latter with a B.Sc. in mechanical engineering in 1914. On graduation he enlisted, serving one year with the Canadian Field Artillery and four years with the Royal Field and Royal Garrison Artillery in France and Palestine. On being demobilized he was employed as draughtsman, first with Canadian Ingersoll-Rand and later with the Laurentide Company. In 1921 Mr. Layne joined Price Brothers & Company Limited as technical engineer located at Kenogami, Que., and subsequently held the following positions with the company: assistant mechanical superintendent, Kenogami mill; mechanical superintendent, River-


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


W. R. Manock, M.E.I.C.


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

bend mill; chief engineer, paper division. At present he is chief engineer of the company with headquarters in Quebec City.

Mr. Layne joined the Institute as a Student in 1914, transferring to Junior in 1919 and to Associate Member in 1920. He became a Member in 1940. He served as councillor representing Saguenay Branch in 1927 and again in 1933-4.

W. R. Manock, M.E.I.C., president of Horton Steel Works Limited, Fort Erie, has been elected vice-president of the Institute for the province of Ontario. Born at Farmer City, Illinois, he graduated from the University of Illinois in civil engineering in 1910. After graduation he was employed as resident engineer with the Illinois State Highway for one season, going from there to the county engineer's office in Sandusky, Ohio, where he was employed in the same capacity. In 1912 Mr. Manock became associated with the Chicago Bridge & Iron Company in Chicago, working in the draughting room and engineering department until 1917 when he was made chief draughtsman. He held this position until 1924 when he moved to Fort Erie, Ont., as manager of operations for the Horton Steel Works Limited, which is the Canadian subsidiary of the Chicago Bridge and Iron Company. Two years later he was made secretary-treasurer of the company and in 1936 became vice-president and managing director. In 1944 he was appointed president of the Horton Steel Works Limited.

Mr. Manock joined the Institute as an Associate Member in 1927, becoming a Member in 1940. He served as councillor for the Niagara Peninsula Branch from 1938 until 1942.

J. A. Lalonde, M.E.I.C., has been appointed secretary-treasurer of the Institute. Born at AuSable, Mich., he graduated from Ecole Polytechnique, Montreal, in 1912. After spending a few months on railway work with the North Railway Company at Hudson Bay, he joined the staff of the City of Outremont as assistant engineer in 1913. Seven years later he went with the City of Montreal as assistant superintendent of streets, a position which he left in 1924 to join the staff of Quinlan, Robertson and Janin, Montreal, as manager of the paving department. In addition to these duties he was chief engineer of A. Janin and Company from 1930 until 1939. At that time he became manager and chief engineer of the Quebec Paving Company and associated companies. In 1942 he accepted the position of production manager with Marine Industries Limited at Sorel, Que., which he left at the end of 1944. Since that time he has been acting as a consulting engineer in Montreal. He was professor in municipal engineering at Ecole Polytechnique from 1926 until 1942.

Mr. Lalonde joined the Institute as a Student in 1910, transferring to Junior in 1915, and to Associate Member in 1920. He became a Member in 1940. He served as chairman of the Montreal Branch in 1942, and as councillor of the Institute in 1943-44-45.

S. C. Mifflen, M.E.I.C., has been elected councillor of the Institute representing the Cape Breton Branch. Born at Catalina, Nfld., he graduated from McGill University with a B.Sc. in 1914. For a time he was employed on railway construction and maintenance, piers and general construction. In 1918 he became resident structural engineer of Dominion Iron and Steel Company's iron ore mines at Wabana, Nfld. Three years later he joined the Dominion Coal Company Limited, Glace Bay and Sydney, N.S., and since that time has been chief draughtsman, chief mine surveyor, and office engineer, mining engineering department. In 1944 he was appointed technical assistant to the general manager.

Mr. Mifflen joined the Institute as a Junior in 1918, transferring to Associate Member in 1920 and to Member in 1930. He has been active in the Cape Breton Branch for several years, serving as chairman in 1927-28 and as secretary-treasurer from 1929 until 1944. He was a councillor of the Institute representing the Branch in 1929-30 and served as vice-president in 1932-33.

G. J. Currie, M.E.I.C., is the newly-elected councillor of the Institute representing the Halifax Branch. Born at Halifax, N.S., he was educated at Dalhousie University and Nova Scotia Technical College where he graduated in 1931. Upon graduation he joined the Nova Scotia Light and Power Company at Halifax and has remained with the company since that time. For the present term he is also lecturer in hydraulic engineering at the Nova Scotia Technical College.

Mr. Currie joined the Institute as a Student in 1931, transferring to Associate Member in 1936 and becoming a Member in 1940. He served as chairman of the Halifax Branch in 1944.

S. W. Gray, M.E.I.C., has been appointed to the Council of the Institute representing the Association of Professional Engineers of Nova Scotia. Born at Westville, N.S., he graduated from the Nova Scotia Technical College with the degree of B.Sc. in civil engineering in 1914. For two years after graduation he was engaged in railway work and from 1916 until 1919 was on active service in Canada, England and France. After some time spent as industrial surveyor with the Department of Soldiers Re-establishment at Halifax, he joined the Nova Scotia Power Commission in 1924 and has been with the organization since that time. He holds the position of assistant hydraulic engineer. From 1942 until a few months ago 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 1940. He served as councillor for the Halifax Branch in 1941-42 and as secretary-treasurer of the Branch for several years. He is a past-president of the Association of Professional Engineers of Nova Scotia and has acted as joint secretary of the Association and the Halifax Branch.

H. W. Hole, M.E.I.C., director of New Brunswick Gas & Oilfields Limited, has been elected councillor of the Institute representing the Moncton Branch. Born at Rochester, Kent, England, he graduated from Leeds University with the degree of M.Sc. and from Cambridge University with an M.A. He has been engaged in various administrative capacities with Anglo-Iranian Oil Company Limited and from 1914 until 1939 served that company in Iran, Iraq, Palestine, Albania and England. He served in the Hants Regiment in World War I from 1917 until 1919, and in the Royal Sussex Regiment in 1939-40.

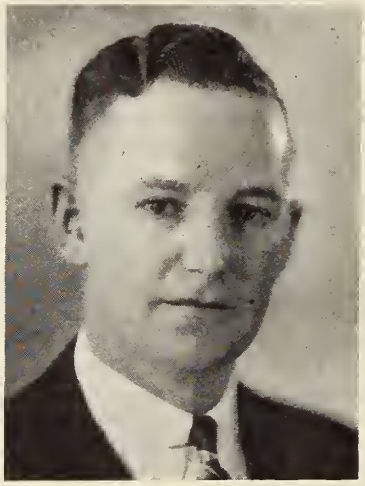
Mr. Hole joined the Institute as a Member in 1942. He was made chairman of the Moncton Branch in 1945.

Mr. Vincent joined the Institute as a Student in 1934, transferring to Junior in 1935 and to Associate Member in 1938. He became a Member in 1940. He served as secretary-treasurer of the Quebec Branch from 1940 until 1943.

C. A. Peachey, M.E.I.C., has been re-elected as one of the councillors of the Institute representing the Montreal Branch. Born in London, England, he graduated from the University of Toronto in 1927. Upon graduation he joined the Northern Electric Company Limited in Montreal and has remained with the company since that time. He spent a few years on manufacturing problems in the vacuum tube shop and the early " talking movie " equipment. He subsequently expanded his engineering interests and became technical superintendent of the telephone division in 1933. Early in World War II he was made shop superintendent of the telephone division and in 1942 became works manager of the rapidly growing electronics division. When victory was achieved the telephone division required a step-up in production and Mr. Peachey was moved into that division as works manager.

Mr. Peachey joined theInstitute as an Associate Member in 1937, becoming a Member in 1940.

H. W. Hole, M.E.I.C.



G. J. Currie, M.E.I.C.

Paul Vincent M.E.I.C.

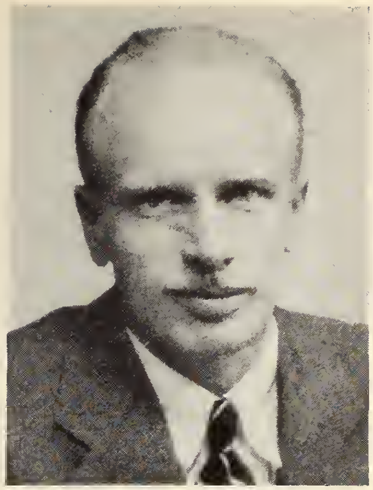
Paul Vincent, M.E.I.C., has been elected councillor of the Institute representing the Quebec Branch. Born in Montreal Que., he attended the University of Montreal from which he graduated with a B.A. degree in 1927. He then studied engineering at McGill University and, after working for two years in the building industry, attended Ecole Polytechnique from which he graduated with honours in 1934. After taking a post-graduate course in radio engineering he acted as laboratory demonstrator in electrical engineering at the Ecole until 1935. He worked for three months on the construction of an extension plant of the Aluminum Company at Arvida, Que., after which he joined the Water Levels Board, Department of Transport, Ottawa, conducting hydrographic surveys, stream gauging and weir studies along the St. Lawrence river channel. In 1937 Mr. Vincent was called to direct two surveying parties for the Quebec Provincial Department of Highways. A few months later he took charge of bridges, roads, and drainage projects for the Department of Colonization of Quebec as district engineer. Following three years' experience in this field he was made assistant chief engineer and in 1941 was called upon to act as superintendent of all civil engineering work in the Department of Colonization. In 1945 he was made director and chief engineer of all colonization works in the province of Quebec, which position he holds at the present time.

J. B. Stirling, M.E.I.C., is one of the newly elected councillors of the Institute for the Montreal Branch. Born at Dundas, Ont., he graduated from Queen's University with a B.A. in 1909 and a B.Sc. in 1911. After graduating he worked on municipal construction projects in Ontario, Manitoba and Saskatchewan. During World War I he served with the Canadian Expeditionary Forces overseas in the Royal Canadian Engineers. In 1915 Mr. Stirling joined E. G. M. Cape and Company, engineers and contractors, and has remained with the firm since that time. He worked first as a field engineer and later as a supervising engineer on many construction projects throughout Canada. In 1928 he became a partner in the firm and in 1940 was made vice-president. He has been connected with such construction projects as the Banting Institute in Toronto, docks and grain elevators at Saint John, N.B., and on Georgian Bay, and the Canadian Vickers plant in Montreal.

Mr. Stirling joined the Institute as an Associate Member in 1913, transferring to member in 1934. He has served on the executive committee of the Montreal Branch since 1939, being chairman in 1945. He has been chairman of the Institute Committee on Professional Interests since 1944.

C. A. Peachey, M.E.I.C.

J. B. Stirling, M.E.I.C.



A. R. Jones, M.E.I.C.

A. R. Jones, M.E.I.C., is the newly elected councillor of the Institute representing the Peterborough Branch. Born at Wessington, Alta., he graduated from the University of Alberta with a B.Sc. (elect.) in 1928. After working for some time in the Alberta mines he joined the Canadian General Electric Company. In 1930 he transferred to the engineering department of the company in Peterborough, Ont., and has remained there until the present time, working first on synchronous machines and later on induction motors.

Mr. Jones joined the Institute as a Junior in 1930, transferring to Member in 1943. He served as secretary-treasurer of the Peterborough Branch in 1942-3 and as chairman for the following year.

Norman Marr, M.E.I.C., has been elected councillor of the Institute representing the Ottawa Branch. Born at Walkerton, Ont., he graduated from the University of Toronto with the degree of B.A.Sc. in 1912. In 1922 he was the recipient of the degree of C.E. from the same institution. Early engineering work included Dominion land surveys in Manitoba, municipal waterworks investigations in Ontario, railway location surveys in the Eastern Townships of Quebec, railway construction in northern Ontario, and hydro-electric construction in Saskatchewan. Following this, Mr. Marr was made resident engineer on construction of the Trent Canal for the Department of Railways and Canals from 1913 until 1918. For the next eight years he was with the Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa, as senior hydraulic engineer. He later became chief hydraulic engineer of the Dominion Water and Power Bureau in the Department of Mines and Resources at Ottawa. In 1941 he was appointed assistant controller.

Mr. Marr joined the Institute as a Student in 1909, transferring to Junior two years later. In 1916 he became an Associate Member and in 1928 transferred to Member. He served as chairman of the Ottawa Branch in 1945.

S. R. Frost, M.E.I.C., is the newly elected councillor of the Institute representing the Toronto Branch. Born at Owen Sound, Ont., he was for several years connected with the Portland Cement Company. In 1918 he was employed as chief draughtsman of American Cyanamide Company and in the following year was made chief mechanical engineer of the company at Niagara Falls, Ont. Since 1941 he has been on loan to the Department of Munitions and Supply in the chemical controller's department and is also in charge of the raw materials section of the fertilizer administration. He has acted as regional representative of the Wartime Bureau of Technical Personnel at Toronto.

Mr. Frost joined the Institute as an Associate Member in 1919, becoming a Member in 1940. He was chairman of the Toronto Branch for 1944.

J. R. Dunbar, M.E.I.C., has been elected councillor of the Institute for the Hamilton Branch. Born at Toronto, Ont., he received his education at the Ottawa Collegiate Institute and at McGill University. He graduated from the latter in 1920 with the degree of B.Sc. in electrical engineering with high honours, being awarded the British Association Medal. He subsequently spent a year on post-graduate study at the Massachusetts Institute of Tech-

Norman Marr, M.E.I.C.

J. R. Dunbar, M.E.I.C.

S. R. Frost, M.E.I.C.

P. E. Buss, M.E.I.C.

G. L. Macpherson, M.E.I.C.

C. Stenbol, M.E.I.C.

nology. During the summers he was engaged on the primary triangulation of the Geodetic Survey of Canada in the Maritime provinces and qualified as a Dominion Land Surveyor. Shortly after graduation he joined the engineering department of the Canadian Westinghouse Limited and has remained with the firm since that time.

Mr. Dunbar joined the Institute as a Student in 1917, transferring to Junior in 1922 and to Associate Member in 1927, becoming a Member in 1940. Besides being a member of the executive committee of the Branch for several years he served as secretary-treasurer for a term and as chairman in 1939-40.

P. E. Buss, M.E.I.C., is the newly elected councillor of the Institute representing the Niagara Peninsula Branch. Born in Three Rivers, Mich., he received his engineering education at the University of Michigan. During World War I he served with the United States Army Engineers in France. Mr. Buss was employed on the engineering staff of Provincial Paper Limited on construction of the first sulphite plant at the head of the lakes at Port Arthur, Ont. He later worked on the engineering staff of Dominion Engineering Works, and for a number of years was plant engineer at the Thorold division of Provincial Paper Limited. During 1932-33 he and his brothers carried on experiments in developing the new process for producing rock wool by the spinning method. He is now president of Spun Rock Wools Limited at Thorold.

Mr. Buss joined the Institute as an Associate Member in 1927, becoming a Member in 1940. He served as secretary-treasurer in 1931 and as chairman in 1935 of the Niagara Peninsula Branch.

G. L. Macpherson, M.E.I.C., has been elected councillor of the Institute for the Sarnia Branch. Born in Markdale, Ont., he studied mechanical engineering at the University of Toronto. After two years at the University he left in 1916 to join the Royal Navy Air Service and qualified as a flight-lieutenant attached to a night bombing squadron in France. In 1919 he returned to his studies and in the following year graduated in mechanical engineering from the University of Toronto. After some engineering experience he was employed by Imperial Oil Limited in 1923 as a junior engineer in the draughting room. Mr. Macpherson was especially interested in process design and his work soon involved most of the duties of head designing engineer. In 1930 he was given leave of absence to attend the Massachusetts Institute of Technology to study the more advanced details of oil refinery design. On his return he devoted himself to the development of the company's refinery equipment and in 1935 was appointed assistant chief engineer in charge of the engineering development department. In 1943 he was appointed chief engineer.

Mr. Macpherson joined the Institute as a Member in 1939. He was elected chairman of the newly formed Sarnia Branch in 1945.

Carl Stenbol, M.E.I.C., chief engineer of the Algoma Steel Corporation Limited, has been re-elected councillor for the Sault Ste. Marie Branch. Born in Norway he began his engineering career in Canada with the Dominion Steel & Coal Company, Sydney, N.S. He was subsequently employed as chief draughtsman with the Algoma Steel Corporation; as smelter engineer and chief draughtsman with Canadian Copper Company; as designer with Anaconda Copper Company, Montana; and as mechanical engineer with Dome Mines Company. During World War I he was with the Canada Cement Company, Montreal, as superintendent of their steel and forge plant. In 1917 he returned to the Algoma Steel Corporation at Sault Ste. Marie and became assistant to the managing director. In the same year he became mechanical superintendent and was later appointed chief engineer.

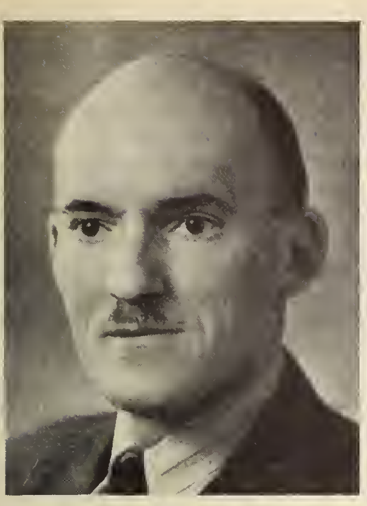
Mr. Stenbol joined the Institute as a Member in 1921.

D. M. Stephens, M.E.I.C., is the newly elected councillor of the Institute representing the Winnipeg Branch. Born near Reston, Man., he graduated from the University of Manitoba with the degree of B.Sc. in civil engineering. During 1929-30 he was engaged on topographic, reconnaissance and control surveys in the Churchill river area for the Topographic Surveys Branch, Dominion Department of the Interior. For the next two years he did similar work with the newly organized Department of Mines and Natural Resources, Province of Manitoba. In 1933 he joined the permanent staff of that Department as a technical draughtsman and was subsequently promoted to the position of office engineer in charge of design. After five years with the Department he was granted leave of absence to do other special work but in 1938 was recalled by the Department and appointed Deputy Minister of Mines and Resources, Province of Manitoba.

Mr. Stephens joined the Institute as a Junior in 1934, transferring to Associate Member in 1935. He became a Member in 1940. He was chairman of the Winnipeg Branch in 1942.

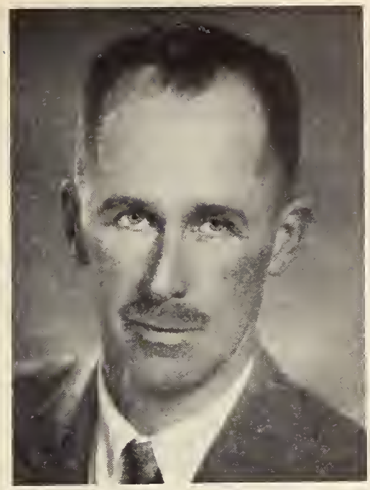
C. S. Donaldson, M.E.I.C., has been elected councillor of the Institute representing the Lethbridge Branch. Born in Scotland, he attended Lauder Technical College at Dunfermline, Fifeshire, Scotland, and worked for a few years at the Rosebank Colliery, Fifeshire. Since coming to Canada he has been employed as manager successively of Grace Coal Mines, Lethbridge, of Federal Coal Co. Limited, Lethbridge, and of Union Collieries, Diamond City, Alta. He is at present mine manager of the Lethbridge Collieries Limited at Lethbridge, Alta.

Mr. Donaldson joined the Institute as an Associate Member in 1925, becoming a Member in 1940.



D. M. Stephens, M.E.I.C.

J. G. MacGregor, M.E.I.C.



K. Reid, M.E.I.C.

J. G. MacGregor, M.E.I.C., has been elected councillor of the Institute for the Calgary Branch. Born in Scotland, he graduated from the University of Alberta with a B.A. in 1926 and a B.Sc. in electrical engineering in 1929. Upon graduation he joined Canadian Utilities Limited at Calgary where he remained until 1931 when he was transferred to Vegreville in charge of the company's diesel plants and transmission and distribution systems in that area. In 1939 he was transferred back to Calgary as assistant manager, which position he holds at the present time.

Mr. MacGregor joined the Institute as a Student in 1929, transferring to Associate Member in 1935, and becoming a Member in 1940. He served as chairman of the Calgary Branch in 1943.

Kenneth Reid, M.E.I.C., is the newly elected councillor for the Victoria Branch. Born at Victoria, B.C., he graduated from McGill University with a B.Sc. degree in electrical engineering in 1926. On graduation he joined the staff of Canadian General Electric Company at Peterborough, Ont., and worked as industrial control engineer for a few years. During this time he did some research work for the company at different points in the United States. In 1928 he was employed by the B.C. Electric Railway Company at Vancouver as engineer on street railway electrolysis and power factor correction and industrial power surveys. Two years later he became assistant chief electrician of Consolidated Mining and Smelting Company at Trail, B.C. In 1930 Mr. Reid was employed by the City of Victoria as assistant city electrician, supervising the city electrical services. From 1942 until 1945 he was on loan to the Department of National Defence as instructor in electrical engineering, army personnel. On his return to work for the City of Victoria in 1945 he was appointed city electrical engineer and superintendent of street lighting for the corporation. In addition to his other duties he has been instructor in electrical engineering at Victoria City Night Schools from 1938 until the present time.

Mr. Reid joined the Institute as Student in 1924, transferring to Junior in 1929, and becoming a Member in 1940.

INSTITUTE PRIZE WINNERS

John M. R. Fairbairn, D.Sc., M.E.I.C., past-president of the Institute and retired chief engineer of the Canadian Pacific Railway Company, has been awarded the Sir John Kennedy Medal of the Institute for 1945. The citation which accompanies the award reads as follows:

" The Chief Engineer of a great railway system should have outstanding personal and professional qualifications combined with technical knowledge and administrative ability. These conditions are fulfilled in the case of John Morrice Roger Fairbairn, who recently retired from the position of Chief Engineer of the Canadian Pacific Railway, and to whom the Council of the Institute is today awarding the Sir John Kennedy Medal.

"A native son of Ontario—he comes from Peterborough—he is a distinguished graduate of the University of Toronto (1893). He entered the service of the Canadian Pacific only five years after the first through train had made the journey from Montreal to the shores of the Pacific. At the beginning of this century Canada was entering upon a period of great activity in railway construction. The young engineer on the staff of the engineering department of a road which was in full development was able to take advantage of this situation. Rapidly gaining experience, he came to the Chief Engineer's office as principal assistant in 1908. Ten years later he was appointed Chief Engineer in the system, a position which he held for just over twenty years until his retirement to pension.

" His work during this period not only gained him a wide reputation as an engineer, but included much public-spirited activity in connection with professional and international matters. In 1929 he represented his company at the World Engineering Congress in Tokyo, Japan, where he also headed the Canadian delegation to the World Power Conference. Active in a number of professional societies, he served as President of The Engineering Institute of Canada in 1921, and was President of the American Railway Engineering Association in 1925. He is a past Member of Council of the Institution of Civil Engineers and has been chairman of its Canadian Advisory Committee. The American Society of Civil Engineers has awarded him Honorary Membership. He is chairman of that society's Canadian Membership Committee. In 1921 the University of Toronto conferred upon him the degree of Doctor of Science.

" With such a record of accomplishment, it is very fitting that he should receive the Sir John Kennedy Medal, the highest honour in the gift of the Institute."

Alexander Joseph Grant, M.E.I.C., past-president of the Institute and formerly engineer in charge, Department of Railways and Canals, Welland Ship Canal Office, St. Catharines, Ont., is one of the recipients for 1945 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:

"A Scotsman who left his native Banffshire at the age of nine, Alexander Joseph Grant has a long record of distinguished service as an engineer in the employ of the Dominion of Canada. His professional career began in 1880 on a survey for the Canadian Pacific Railway, but six years later he entered government service and joined the staff of the Department of Railways and Canals, working on the construction of the Cape Breton Railway. At that time there was great activity in connection with canal and waterways improvement in the St. Lawrence basin, so that in 1891 Mr. Grant was transferred to the engineering staff of the Soulanges Canal, remaining as an assistant engineer until the completion of the canal in 1903. His next appointments were engineer in charge of the improvements at Port Colborne and then superintending engineer of the Trent Canal. In the latter position he was responsible for the construction of the Ontario-Rice Lake Division and the improvement of the navigation of the Severn river, work which had to be suspended in 1916 owing to war conditions.

"From January 1st, 1919, until his retirement in 1934, Mr. Grant was engineer in charge of the construction of the Welland Ship Canal. This great work, with its terminal harbours, bridges and flights of locks, is outstanding as an engineering achievement; its sound design and substantial construction bear witness to Mr. Grant's professional knowledge and ability.

"Mr. Grant joined the Institute fifty-five years ago. He took a leading part in the formation of the Niagara Peninsula Branch in 1919. He served on Council as Vice-President in 1928-29 and was elected President in the following year.

"It is not generally realized that our Dominion Civil Service includes many engineers representing various branches of the profession. Their technical skill and ability receive too little recognition, although our public works and communication systems are largely their responsibility. Mr. Grant is a leading example of this class. For this reason, and also in appreciation of his own services to the Dominion and to the engineering profession, the Council of The Engineering Institute of Canada is awarding to him a Julian C. Smith Medal."

George Alexander Walkem, M.E.I.C., of Vancouver, B.C., past-president of the Institute is one of the recipients of the Julian C. Smith Medal of the Institute for 1945. The citation which accompanies the award reads as follows:

"The prosperity of the city of Vancouver, and indeed that of the province of British Columbia, has been largely due to the enterprise and ability of men who have come to the Pacific coast and become industrial leaders or pioneers in productive undertakings. One of them, responsible for many activities connected with shipbuilding and marine engineering, is George Alexander Walkem, a prominent member of the profession in British Columbia, a member of the Institute of forty years standing—and a past-president—whose services to the community and to his fellow engineers have been outstanding.

"Born in Kingston, Ont., he took his degree in engineering at McGill University in 1896. Two years later he migrated to British Columbia, where he soon was made manager of the Vancouver Engineering Works Limited, then the largest plant in the province. His experience with that firm prompted him to enter the commercial field combined with engineering; accordingly, he incorporated the Vancouver Machinery Depot Limited in 1906.

"In 1915, after applying for a commission in the Canadian forces, he went to England and was commissioned in the Royal Engineers, being posted to the Egyptian Expeditionary Force. Later he was seconded to the Railway Operating Division of the R.E. in Palestine. For his services there he received a Mention in Despatches.

"On his return to Vancouver in 1919 he became interested in municipal and provincial political activities, sitting as a member in the Provincial House of Assembly for nine years. Mr. Walkem was able to assist in 1920 in securing 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. He is a member of the Institution of Mechanical Engineers (Great Britain) and of the American Society of Mechanical Engineers.

"During the last twenty years the activities of Mr. Walkem's original company have led to notable developments. He is now president and managing director of three other companies, namely, the Gulf of Georgia Towing Co., the West Coast Salvage and Contracting Company, Vancouver Ironworks Limited, and finally the recently formed West Coast Shipbuilders Limited, whose war effort has been the building of 52 ships of the 10,000 ton class. The war work of these companies resulted in the development of many new methods and improvements, particularly in boiler making, and has established conditions which would seem favourable for the development of a permanent shipbuilding industry on the Pacific coast.

J. T. Dyment, M.E.I.C.

E. C. Roper, C.I.M.M.

S. T. Fisher, M.E.I.C.

" For fifteen years Mr. Walkem has been on the Board of the Vancouver General Hospital, two years as Chairman. He has also taken active interest in the Children's Aid Society of Vancouver, the Queen Alexandra Solarium for Crippled Children, and the Sea Scouts.

" In recognition of all these services and achievements a Julian C. Smith Medal has been awarded to George Alexander Walkem."

John T. Dyment, M.E.I.C., engineering superintendent, Trans-Canada Airlines, Winnipeg, Man., has been awarded the Gzowski Medal of the Institute for 1945 for his paper " The Engineering Selection of an Airline Aeroplane " which appeared in the June, 1945, issue of *The Engineering Journal.*

Born at Barrie, Ont., he received his engineering educationtion at the University of Toronto where he graduated in 1929. After a few months spent in the aeroplane division of the Ford Engineering Laboratories at Dearborn, Mich., he joined the staff of the Aero Division of the Department of National Defence, Ottawa, in 1930. In 1937 he transferred to the aeronautical division of the Department of Transport as aeronautical engineer and in 1938 he accepted a position in the same capacity with Trans-Canada Airlines in Winnipeg. He later became chief engineer and is now engineering superintendent of the Airlines.

E. Cecil Roper, C.I.M.M., Britannia Beach, B.C., is the recipient of the Leonard Medal for 1945 for his paper " The Raising of No. 7 Shaft at Britannia " which was published in the February 1945 issue of *The Canadian Mining and Metallurgical Bulletin.*

Born in Salvador, Sask., he graduated from the University of Alberta with a B.Sc. in mining engineering in 1936. Immediately after graduation he entered the employ of the Britannia Mining and Smelting Company Limited as a mucker. In 1937 he was attached to the engineering staff and worked first as sampler, surveyor's helper, surveyor, and head surveyor, and then underground as timberman, miner and shaft miner. In 1938 he was advanced to field engineer, exploration department. In that capacity he had charge of the company's exploration work in the Zeballos and Bridge river areas and examined properties in other parts of British Columbia. In 1940 he returned to the mine camp as chief engineer in charge of all the engineering departments. Early in 1945 he was promoted to the position of assistant mine superintendent and in July of the same year to that of mine superintendent, the position he now holds.

Sidney T. Fisher, M.E.I.C., Toronto, Ont., has been awarded the Ross Medal of the Institute for his paper " Radio for Over-Land, Long-Distance Telephone Service " which appeared in the May 1945 issue of *The Engineering Journal.*

Born in Edmonton, Alta., he spent four years at the University of Alberta and one year at the University of Toronto, graduating in 1930 with the degree of B.A.Sc. in electrical engineering. From the time of his graduation until 1943 Mr. Fisher was with the special products division of Northern Electric Company Limited at Montreal, becoming sales engineer and development engineer in 1941. During this period he was responsible for the engineering of the radio installations for Canadian-built Lancaster and Mosquito bombers. Mr. Fisher resigned from the Northern Electric Company in 1943 to organize F. T. Fisher's Sons Limited, consulting engineers specializing in communications and other electronic subjects. He has subsequently carried out engineering projects for Defence Communications Limited, Royal Canadian Air Force, and other service and government groups. In 1943 he became vice-president of Rogers Electronic Tubes Limited, Toronto, and since shortly after V-E day was in charge of the engineering and production of special purpose receiving and transmitting tubes. In 1945 he returned to give full time to his consulting practice.

Since 1941 Mr. Fisher has held a commission as flying officer in the Special Reserve of Officers (technical) of the R.C.A.F. and in this capacity has worked on air force signals problems.

H. L. Lexier, JR.E.I.C., of Regina, Sask., is the recipient of the Duggan Medal and Prize of the Institute for 1945 for his paper " Metallurgy and Machine Design " which was published in the May 1945 issue of *The Engineering Journal.*

Born in Winnipeg, Man., he received his preliminary education in Regina. In 1938 he graduated from the University of Minnesota with the degree of Bachelor of Mechanical Engineering. In 1942 Mr. Lexier joined the Physical Metallurgy Research Laboratories, Ottawa, as research engineer. He conducted extensive research on armour piercing projectiles, fatigue, stress analysis, etc. In 1945 he resigned his position and returned to Regina where he is now manager and plant superintendent of the Queen City Cleaners and Launderers.

Robert Peterson, JR.E.I.C., Saskatoon, Sask., has been awarded the H. N. Ruttan Prize of the Institute for 1945 for his paper " Soil Mechanics as Applied to P.F.R.A. Problems, with Specific Reference to the Proposed St. Mary's Dam " which appeared in the May 1945 issue of *The Engineering Journal.*

Born at Eston, Sask., he attended the University of

H. L. Lexier, Jr.E.I.C.

R. Peterson, Jr.E.I.C.

F. J. McMulkin, Jr.E.I.C.

J. T. Madill, Jr.E.I.C.

J. B. Nobert, S.E.I.C.

F. W. Davidson, S.E.I.C.

Saskatchewan, graduating with great distinction in civil engineering in 1939. For the following year he was employed by the Prairie Farm Rehabilitation Administration on investigation of irrigation projects. In September 1940 he entered the Graduate School of Engineering at Harvard University to take a course in soil mechanics, and received the degree of Master of Science in 1941. Since that time he has been with the P.F.R.A. in Saskatoon, in charge of foundation and soil mechanics projects.

F. J. McMulkin, jr.e.i.c., is the recipient of the John Galbraith Prize of the Institute for 1945 for his paper "The Welding and Fabrication of Canadian Light Armour" which was published in the March 1945 issue of *The Engineering Journal.*

Born in Sault Ste. Marie, Ont., he graduated from the Michigan College of Mining and Technology in 1937 with the degree of B.Sc. in physical metallurgy. From graduation until 1942 he was employed as a metallurgist in the metallurgical department of Algoma Steel Corporation Limited, Sault Ste. Marie, Ont. In that year he joined the department of engineering and metallurgy of the Ontario Research Foundation in the capacity of research metallurgist. His work with the Foundation until recent date has been primarily devoted to the work of the Hamilton Bridge Company which, during the war years, sustained a research fellowship with the Foundation for research and development in connection with the welding and fabrication of light armoured vehicles. During the three years he was connected with this fellowship he acted as welding engineer and metallurgist for the Hamilton Bridge Company, while at the same time carrying on work for other manufacturers who submitted work to the Foundation. In 1945 he was awarded the professional degree of Metallurgical Engineer by the Michigan College of Mining and Technology in recognition of his work on the development of welding of armour plate. At the present time he occupies the position of senior research metallurgist in the Department of Engineering and Metallurgy at the Ontario Research Foundation, Toronto.

J. T. Madill, jr.e.i.c., has been awarded the Phelps Johnson Prize of the Institute for 1945 for his paper "Field Decay Characteristics of Large Hydro-Electric Generators" published in the December 1945 issue of *The Engineering Journal.*

Born in Edmonton, Alta., he graduated in applied science from the University of Alberta in 1939 and received a M.Sc. degree in electrical engineering from the Massachusetts Institute of Technology in 1940. Until April 1941 he was a member of the system study group of Ebasco Services Inc. in New York City. He then came to Arvida to work for the Saguenay Power Company and has been associated with the operation of the Saguenay System since that time. In 1942 he was made system protection engineer, responsible for relaying, metering and test work, and since 1944 he has held the position of electrical engineer for the Shipshaw development of the Aluminum Company of Canada Limited.

J. B. Nobert, s.e.i.c., has received the Ernest Marceau Prize of the Institute for 1945 for his paper "Etude d'installation d'usine de défibrage du bois par le procédé mécanique à la vapeur, à Pont Rouge".

Born in Montreal, Que., he graduated in 1945 from Ecole Polytechnique with an option in industrial chemistry together with the degree of B.A.Sc. Upon graduation he joined the staff of Building Products Limited at Ville LaSalle, Que., where he is now doing research work.

Fred W. Davidson, s.e.i.c., is the recipient of the Martin Murphy Prize of the Institute for 1945 for his paper "Design of an Antenna for VE9AS".

Born at Petitcodiac, N.B., he received his preliminary education there. In 1941 he was the Provincial Matriculation Leader of New Brunswick and in the same year was awarded a Lord Beaverbrook Scholarship tenable at the University of New Brunswick. While at the University he was awarded the Alumni Society Prize for first year English, the Purvis Loggie Scholarship for mathematics and surveying, and the student prize of the Engineering Institute. He graduated in 1945 receiving his B.Sc. degree in electrical engineering. He is at present employed in the Montreal Division of the Bell Telephone Company of Canada, and is also studying for his M.A. degree in engineering at McGill University.

News of the Branches

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

BORDER CITIES BRANCH

J. G. Hoba, Jr.E.I.C. - *Secretary-Treasurer*

On Friday, November 16th, 1945, the regular meeting of the Branch was held at the Prince Edward Hotel with Mr. E. R. Complin, manager of the industrial relations department of Canadian Industries Limited, as the main speaker. His subject, **Some Employee Relations Aspects of Management Engineering** was well received, and a record attendance was established. Mr. Complin's present position on the National War Relations Board gave him an excellent background for the interesting question period that followed at the conclusion of his talk.

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The principle of driving with fluid (oil) through the use of a hydraulic coupling aroused considerable interest at the annual meeting of the Border Cities Branch on December 7th, 1945. Mr. Glen V. Edmondson, staff engineer of the American Blower Corporation, Detroit, presented a highly appreciated paper. He supplemented his talk with slides which further explained the future uses of this comparatively new torque converter.

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

The ever-growing use of electricity to increase the fighting and operating efficiency of ships in the Royal Canadian Navy, was discussed by Electrical Commander J. Deane, speaking on **Electricity in the Navy** before the Edmonton Branch in the Macdonald Hotel on January 17th. Commander Deane, engaged on electrical personnel for the permanent navy, traced the uses of electricity in the navy from early times to the present. He illustrated his address with lantern slides showing the most modern cruiser in the Canadian Navy, the 11,300 ton *Ontario*. In conclusion he outlined briefly the training received by an electrical officer.

Electricity, the speaker stated, was first used on ships in 1874 to fire guns, then in search lights, then for lighting the ship and later to run motors. The modern applications found on the *Ontario*, he said, include a master gyro-compass with several repeat compasses, a sensitive log and an A.R.L. automatic plotting table which receives electrical impulses from the two previous instruments and records a continuous plot of the ship's course. The ship also uses a precise depth sounding instrument which distinguishes between rock and mud, and other electronic equipment. The speaker explained that the power plants on the ship are well distributed so that if one plant is hit, power can be supplied by the others.

The most important development in the use of electricity on ships, he continued, was radar. By it, the ship's crew had ample warning of approaching enemy surface craft and air craft. Radar, he said, was also used to control gun fire with extreme accuracy and to determine the fall of shot and the positions of all craft in the battle area.

Commander Deane explained the importance of land transmission stations, for guiding ships in a fog, or through a mine field, or for locating enemy craft or for determining the ship's own geographic position.

In outlining the training of an electrical officer, the speaker mentioned that many courses are taken in industry, at sea, and at Naval School. After three years the student qualifies as a Lieutenant.

Chairman of the meeting was F. R. Burfield. The speaker was introduced by R. E. Phillips and received a hearty vote of thanks proposed by C. W. Carry. Dinner attendance was 35.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - *Secretary-Treasurer*
I. M. Macdonald Jr.E.I.C. - *Branch News Editor*

The annual meeting and dinner of the Hamilton Branch was held on Tuesday, January 15th, at the Scottish Rite Club, with approximately 80 members and guests in attendance. H. A. Cooch presided in the absence of Chairman Norman Eager.

After the dinner was concluded and the head table introduced, W. E. Brown, secretary-treasurer, reported on the activities of the branch during the past year. The report of the nominating committee was read, and the executive for 1946 announced.

Business conducted included the ratification of a motion previously accepted by ballot concerning associate fees, the consensus of opinion being that these fees be $5.00 per year. T. S. Glover presented a scroll and cheque to T. S. Boyle, winner of the branch papers competition in 1945 with his presentation of "The Design of a Tubular Conveyor." J. R. Dunbar presented the nominating committee for this year, which was unanimously accepted.

The speaker of the evening, popular and well-known Dr. Sidney E. Smith, president of the University of Toronto, was introduced by W. J. W. Reid.

The years spent in educational work in Nova Scotia, Ontario, and as president of the University of Manitoba qualified Dr. Smith to speak on **Canada,** his subject of the evening.

Expressing himself as optimistic regarding the development of a strong spirit of unity in Canada, the president declared that all Canadians should learn the lesson afforded by members of the armed forces who enlisted and fought as Canadians, not as residents of the various provinces. Dr. Smith spoke of the great criss-crossing of reactions and inter-reactions by the young people in the services as they moved about the Dominion in training, and voiced the hope that this would lead to a reconciling of conflicting sectional interests with national aims and objectives.

Canada draws on many racial and cultural backgrounds for its stock and is better for it. If any doubted this, Dr. Smith referred them to Canada's achievements in war and peace.

While Canada is the 35th nation in the world in population, it holds first place in the production of foodstuffs for the United Nations, and in the production of nickel, asbestos and newsprint. The Dominion ranks third in trade and in sea-power, Dr. Smith said in listing Canada's important place.

We can have a stronger Canada, the speaker went on, provided we afford all the provinces an opportunity to work out their own destinies. In his opinion there is much reason for encouragement, in the attitude of both Federal and Provincial authorities at the recent Dominion-Provincial talks.

Dr. Smith defined democracy as "the free competition of ideas as put forth by individuals, provided that everyone recognizes comparable rights", and declared himself as opposed to a standard mould or pattern of Canadians.

The loss of gallant Canadians in the war was irreparable, Dr. Smith said. Out of the war had come a sense of loss and bitterness, but out of the war had come a realization that there was no satisfactory settlement of disputes between members of the human race other than through arbitration and law.

At the conclusion of Dr. Smith's talk, a vote of thanks was tendered by J. T. Thwaites.

The gavel of office was handed to the new chairman, A. R. Hannaford, who after a few remarks adjourned the meeting.

An Erratum

The *Journal* regrets that in the report from the Hamilton Branch contained in the January issue, the author of the paper, was reported incorrectly. The author was Mr. W. B. Nicol, M.E.I.C., chief engineer of the Hamilton Bridge Company.

KINGSTON BRANCH

J. Douglas Lee, Jr.E.I.C. - *Secretary-Treasurer*

The first 1946 meeting of the Kingston Branch was held on Wednesday, January 16th, at Queen's University. The speaker was Lieutenant-Commander H. G. Burchell, R.C.N,. an electrical officer, who described the part played by electricity in the navy during the war. Many of the developments have been given little publicity by the traditionally " silent service ", so that this address, which was illustrated, was of particular interest to engineers. Lieutenant-Commander Burchell informed his audience that in both the Royal Navy and in the Royal Canadian Navy the formation of a new electrical branch had been approved, as the increase in quantity and complexity of electrical equipment affecting the fighting and operating efficiency of ships had reached a point where such matters could no longer be handled with maximum efficiency by the torpedo branch. The latter, in future, will confine their activities to underwater warfare.

The following is a list of future meetings during the balance of the season: Feb. 7—Lt.-Col. A. Dove, M.E.I.C., " Some Engineering Aspects of the European Campaign." Feb. 21—Mr. Wm. Storrie, Gore and Storrie Consulting Engineers, Toronto, " Water Works and Sewerage with Particular Reference to Kingston." Mar. 21—Mr. R. N. Boyd and Mrs. W. R. Burks, Canadian Industries Ltd., Nylon Division, Kingston, "Air Conditioning."

LETHBRIDGE BRANCH

T. O. Neumann, M.E.I.C. - *Secretary-Treasurer*
H. T. Miard, M.E.I.C. - *Branch News Editor*

Friday evening, January 25th, thirty-five members of the Lethbridge Branch and their guests attended a banquet in the small dining room of the Marquis Hotel, following a cocktail hour. Enjoyable dinner music by the trio, Mr. and Mrs. George Brown and Mr. Henderson, humorous songs by Wm. Riley, community singing led by Bob Lawrence, and a short speech by Dave Elton featured the dinner. P. E. Kirkpatrick, chairman of the Branch, presided. Minutes of the previous meeting were read by the secretary, T. O. Neumann.

A. L. H. Somerville introduced the guest speaker, Dr. T. How, district meteorologist of the Department of Transport at Edmonton. Dr. How graduated from the University of British Columbia in 1933, and obtained his M.A. there in 1935. He lectured in physics at Perdue, and his Ph.D. degree was conferred in 1938. He joined the Department of Transport and was appointed district meteorologist at Edmonton in charge of weather observing and forecasting for the entire North West Territories and Arctic area.

Dr. How, a fluent and excellent speaker presented an interesting and enjoyable address on **Arctic Meteorology.**

To emphasise the importance of weather, particularly fog, to aviation, Dr. How showed a coloured motion picture prepared by Walt Disney for the U.S. Navy, illustrating the relation of land and air temperatures and the dew point, and the formation of fog; ground and advection fogs; land and coastal fogs, and the motion of fogs caused by wind.

In the introduction to his paper, Dr. How pointed out that Canada has been fighting an uphill battle against the universal miconception that it is a " land of ice and snow." Canadians know better, and have endeavoured to publicize our pleasant climate. We have, however, ignored the fact that the greater portion of our nation is practically uninhabited because of the extremes of climate. It will be necessary to conquer the Arctic to obtain the gold from Yellowknife, oil from Norman and uranium from Great Bear.

The Meteorological Service of Canada has been a pioneer in the Canadian Arctic, but information is still limited. It is necessary to obtain information and understanding of the Arctic weather to assist in designing technical devices to operate in the lowest temperatures and forecast accurately the Arctic storms. Only then can Canadian engineers and scientists conquer its coldness.

Dr. How stated that the northern summer was not exceptional, except for the long daylight. His talk was confined to winter conditions.

He exhibited a diagram showing the distribution of mean monthly temperatures for January over northern and western Canada. This showed the spacing of 5 deg. isotherms. The coldest area, —25 deg., was over Baffin Land, Pond's Inlet and Churchill. Over the Arctic regions the isotherms were spaced widely, indicating little variation in mean temperature, while in central and southern Alberta, the isotherms were closer, indicating a more rapid rise in temperature as one travelled southwest. Dr. How pointed out that the —25 deg. temperature in Churchill might prevail for a month and might be accompanied for several days by a 30-mile wind.

The wind in the Arctic is an important element, as a high wind in cold weather makes outdoor activity almost impossible. The Barrens and the Churchill area are more subject to wind than the McKenzie Valley.

A third element in the Arctic is snowdrift. This is fine snow, kept suspended in the air, and blown along by high winds. Arctic drift storms may rage for six or seven days at 30 m.p.h. with temperatures of 30 or 40 below, and, compared to them, prairie blizzards are mere flurries.

There is a lack of scientific records of Arctic meteorology. Official records have been taken by nurses, R.C.M.P., radio operators and traders, but these reports lacked scientific comment. In 1942, George Chapman moved into Aklavik with balloons, hydrogen generator, and radios and transmitters to establish a meteorological station north of the Circle. In 1943 another station was set up at Arctic Bay, another is operating at Coral Harbor, and a fourth is being constructed at Coppermine. Most of the Arctic is without stations.

Data are still required on freeze-ups and break-ups, soil temperatures, and permanent frost, to assist in planning building and industry in the Arctic.

The small amount of moisture held in cold air is an important factor in forecasting fog, clouds and snow. It is also important in the design of clothing. Study of humidity data is still required.

Dr. How exhibited three other maps showing isobars for three successive days, with 'high' and 'low' areas marked. Isobars are important because they represent accurately the direction of wind in levels near the earth. Air moves counterclockwise about a 'low' and clockwise about a 'high'. Crowded isobars indicate strong winds;

isobars spaced widely indicate light wind. 'Fronts' on the maps marked boundaries between two different types of air.

Before discussing the charts, the speaker mentioned that the atmosphere receives its heat from the earth by conduction, convection and radiation, and not from the sun.

The cold weather then prevailing was due to a polar front having passed over Lethbridge. When the polar front was north east of town, warmer weather prevailed. On the charts, fronts of cold air invading warm air are shown in blue; fronts of warm air in red. Polar fronts usually exist when the isotherms are close together, and the front is usually in Alberta. The weather system of the Pacific affects the polar fronts, and forecasters are on the lookout for these impulses.

The U.S. Weather Bureau has done research on long range forecasting. Five-day means for the entire northern hemisphere are plotted, and a prognostic chart issued to forecast the general weather trends for the next five days. These are of great assistance in local forecasting. "High index" indicates rapidly moving air travelling from west to east; "low index" indicates a north and south movement of air masses but little west to east movement.

The upper air is also observed at various Canadian stations and isotherms and isobars plotted for 1,000 ft., 5,000 ft. and 20,000 ft. levels. The circulation at these levels is different from that at ground level. Charts are simpler because of the absence of effects of terrain and moisture.

The upper air data obtained by radiosonde instruments. These consist of instruments measuring temperature, pressure and humidity. They are carried aloft by a balloon and transmit the information by a minute radio to an automatic graphing recorder. Such stations in the Arctic are difficult of access and hard to maintain.

High pressure areas are due to heavier cold air, and in the far Arctic are difficult to trace due to the scarcity of recording stations.

Forecasters watch all features of the weather map, particularly lows and the effects at mountain ranges.

The Muskox expedition is being accompanied by an experienced meteorologist to make observations. The Department of Transport stations at Churchill and Yellowknife are furnishing information for the party, and the Edmonton office will forward the basic forecasts. Weather maps will be dropped to the party daily, and other information will be radioed. The meteorologist with the party will radio information including data on snow conditions and wind.

A meteorologist has been sent to Baker Lake to take weather observations and data on magnetic declination.

Dr. How exhibited a radiosonde instrument at the conclusion of his address.

In answering questions, the speaker stated meteorologists have not been able to account for seasonal trends, but it could be due to radiation factors or ocean currents.

Russia has a great number of meteorological stations in the Arctic, placed not in convenient places, but where required. The information obtained has not been made available.

R. C. Bell thanked Dr. How for his interesting paper.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr. e.i.c. - *Secretary-Treasurer*
J. L. McDougall, m.e.i.c. - *Branch News Editor*

The Niagara Peninsula Branch held its annual joint meeting on January 17th, 1946, with the Association of Professional Engineers of Ontario. Some 50 members of both organizations were welcomed by the local branch chairman, J. H. Ings, to the dinner held at the General Brock Hotel, Niagara Falls, Ont.

The guest speaker was Dr. G. R. Lord, president of the Association. A. W. F. McQueen introduced the speaker and Col. T. Medland who was also present. Dr. Lord outlined the activities and endeavours of the Association, tracing its growth. He stated that registration four years ago showed 2,600 engineers while to-day registration stands at 4,300 members, plus 3,000 student engineers in training.

The Professional Engineers' act was put through in 1922 and amended in 1937. The work in the main consists of registering of engineers, acting in an advisory capacity on legal matters, and helping in the standardization of salaries of engineers. In this connection the Association has published guidance booklets on job evaluation and standard practice. The Association provides an open membership to all who qualify and applications are reviewed carefully.

The function of the Federation of Engineers was also explained as a body composed of engineers and employers, handling such matters as collective bargaining.

Some matters before the Association include dignified advertising schemes, commensurate salary scales for engineers, co-operation with Dominion Council, endeavours to provide engineers for jobs, work in conjunction with Technical Service Council, responsibilities in public works, and town planning.

Dr. Lord in concluding stressed the importance of the Association having ample funds available on hand to contend with possible emergencies in getting necessary legislation. An appeal was made for the co-operation of all engineers and for volunteers wishing to serve on many committees now set up.

Col. Medland was called upon to say a few words. The meeting was thrown open to discussion and the numerous questions asked the speakers added much to what had already been said.

C. C. Moon, as a member of both the Association and the Institute, expressed a desire to see the two organizations more closely identified in Ontario. To many of the younger members of the Institute it was news when he stated that the Institute was really instrumental in launching the provincial associations.

An interesting highlight to the discussion was given by S. V. Jenkins, a guest from Niagara Falls, N.Y. He very ably outlined how professional engineers are granted state permission to practise. In New York State authority is given by meeting the necessary qualifications and being granted a State license, for which an annual fee is charged. Mr. Jenkins extended an invitation to those present to join the New York State Society of Engineers holding dinner meetings at Niagara Falls, N.Y.

At the close of the meeting J. L. McDougall thanked the speakers on behalf of those present.

OTTAWA BRANCH

C. G. Biesenthal, jr. e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - *Branch News Editor*

The annual meeting of the Ottawa branch was held at the auditorium of the National Research Laboratories on the evening of January 10th. Norman Marr, chairman for 1945, presided. Committee reports were presented and the election of officers for the ensuing year took place.

The elections resulted as follows: chairman, J. H. Irvine; secretary-treasurer, C. G. Biesenthal, re-elected; members of managing committee to serve two years, L. M. Christmas, S. G. S. Murphy, and J. L. Shearer.

Following the business portion of the meeting an address was given by Allan C. Ross who had recently returned from the 27th session of the International Labour Conference held at Paris, France. He spoke on **Experiences**

of the European Trip. At the conclusion of the entire meeting refreshments were served.

Outlining his trip, he spoke of conditions as he experienced them in England, France, Switzerland, and the Low Countries. Many of the railways that lay in the path of war, he said, were not in good condition with temporary bridges doing duty until more permanent bridges could be erected. There was a serious shortage of fuel and it was a common sight to see the interior of large banks and other public buildings piled high with cordwood. If you wished to visit the Folies Bergeres you might have to sit in your overcoat with a blanket around you while the chorus turned blue with cold. Some days they would have to close up altogether.

Paris, he said, had "Lost its sparkle". It was, however, very little destroyed. Some damage was inflicted by machine gun fire in the city itself. In the suburbs, particularly to the north, there was more damage and there were more temporary structures in evidence.

One of the most affecting sights of all, according to Mr. Ross, was the farm houses throughout the country districts that had been war-damaged and were still being lived in. On account of the coal shortage and the necessity of using coal in its manufacture, very little glass was available to replace broken windowpanes. They would be stuffed with rags or patched with cardboard or other makeshift material. The farmers, just as everyone else, had difficult times ahead before they could get on their feet.

Prices in Paris were high. A pair of unlined leather gloves cost 1000 francs or \$20. Eating was expensive when you went "off the beaten track". A meal for three which he told about brought a bill for \$74.

The most enjoyable portion of his visit was a side trip to Switzerland. The Swiss people, however, are currency poor and though prices are fairly reasonable there is great difficulty in getting Swiss money in exchange for other currency. Food was strictly rationed, food coupons had to be surrendered before obtaining a meal and there were three meatless days a week. Automobiles generated gas from wood or charcoal or carried gas under compression. Mr. Ross commented upon the truly magnificent buildings that formerly housed the League of Nations assemblies at Geneva.

It was easy to get into Switzerland as far as the customs were concerned, but not as easy to get out. Baggage was examined closely and if it included purchases made in Switzerland then explanations were in order as to where the Swiss money came from to make such purchases.

Mr. Ross, at the conclusion of his address, expressed the belief that it would take another two or three years before facilities for civilian transportation to the European countries could be carried out in such a manner as to make travelling a real pleasure.

At a joint evening meeting with the Ottawa Section of the American Institute of Electrical Engineers, held at the National Research Auditorium on January 29th, the Ottawa Branch listened to an address on **Looking Ahead with Telephone Scientists.** G. L. Long, historian of the Bell Telephone Company, was the speaker and the address included demonstrations of various types of military telephones designed during the war.

The speaker outlined the prospects for extending telephone service to motor vehicles by radio, the use of radio telephony for serving outlying communities, and systems for relaying network programs as well as large numbers of telephone messages from station to station across country. He pointed out that while there is no prospect of radio replacing wires for the vast bulk of telephone messages, it is finding increasing use as a supplement to the regular wire network.

Some Impressions of German Wartime Metallurgy was the subject of an address before the Ottawa Branch at a noon luncheon at the Chateau Laurier on February 13th. The speaker was Dr. G. S. Farnum, chief metallurgist of the Department of Mines, who had recently returned from a three months' trip to Germany and the continent along with a number of other scientists who had investigated German processes and techniques for the Department of Reconstruction. Dr. Farnum's interest was in metallurgical processes and his travels took him through the greater part of western Germany.

Regarding the German industrial plants visited, many of them were located on the outskirts of the towns and accordingly were not damaged to the extent of the towns themselves. They did not fare as badly as some people might think. Though the exterior of factory buildings might be damaged as much as 50 per cent, quite often the equipment on the inside would only suffer to the extent of, say, 10 per cent. However, on the other hand, this 10 per cent might be key equipment in which case, of course, the factory would definitely be put out of commission at least until it was replaced. An exception was a Dornier factory that was totally destroyed while the surrounding buildings were unharmed.

German scientists, according to the speaker, naturally appeared to be "down in the mouth" at the time of his visit to the continent since many of them had been banned from working on account of their Nazi leanings. The Nazi set-up, contrary to the opinion of many, did not appear to him to produce a decadence of technological development.

"Germany produced very good results from her attempts to solve problems in production which arose from the shortage of raw materials," he said. "Any country which progressed so well in rocket, jet propulsion and atomic theory certainly could not be said to be scientifically decadent." Many of the efforts of German scientists had to be expended upon the production of substitutes and the solutions of problems with which they would not be faced under normal circumstances. Their contributions in this regard "cannot be sneered at" he said.

PETERBOROUGH BRANCH

E. Whiteley, M.E.I.C. - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - *Branch News Editor*

On Thursday evening January 10th, Mr. Paul Clark of the publicity department of the Aluminum Company of Canada presented a paper to the Peterborough Branch on **The Canadian Aluminum Industry.**

Mr. Clark briefly outlined the development of the aluminum industry until the beginning of World War II. Until this time little has been published about the accomplishments of the aluminum industry during the war. However, Mr. Clark stated that he was now at liberty to report briefly on those activities.

Although Canada's prewar position in the aluminum industry was relatively large, the position has been greatly altered by war circumstances. The so-called Battle of Britain early revealed the air weakness of the United Nations and impressed upon the general staff of the military forces the compelling necessity of strengthening our air arms. Almost overnight aluminum became the critical material in the prosecution of the war. Unheard of quantities of aluminum had to be made available with the greatest urgency. The ability of the various United Nations to produce additional aluminum was rapidly scanned, and Canada was found to be advantageously situated to cope with the problem. In Canada were considerable electrical resources, and available labour remote from the battlefields. Canada was assigned the job of producing the required crude aluminum and immediately the multitudes of industrial operations required for this end were initiated.

To far-off British Guiana, additional geologists, mining engineers and technicians were flown to open new bauxite mines to supply the four tons of ore needed for each ton of the pure metal. Railroad tracks were laid through the jungle to bring out the ore. To handle the increased flow of bauxite, a new powerhouse, a crushing and washing plant, three new dryers and a machine shop were required at Mackenzie, British Guiana,—a port far up the Demarara River. These buildings were designed, the materials and equipment ordered, shipment made and they were in service in "jig" time. Approximately 2,700 dark natives living in that torrid climate were marshalled and quickly taught new duties far remote from their primitive living.

At Trinidad, in the British West Indies, a completely new port was dredged, and the most modern of heavy equipment was hauled to Trinidad and erected. This building of a deep-water port for handling large volumes of ore shipments would ordinarily have been a major project, but in the overall scheme it decreased in stature and became only one relatively small phase of a tremendous program.

In damp, foggy Newfoundland, geologists located new fluorspar deposits to replace the shut-off sources in Europe. Shafts were sunk, miners engaged and facilities provided so that boat load after boat load of fluorspar channelled into the process followed at Arvida.

At Arvida, where at one time only two pot rooms had existed, 23 additional smelters were erected, making a total of 25. The prewar ore plant (where chemical processes made bauxite into alumina), which was regarded as a sizeable installation and, in fact, was one of the largest in existence, had to be greatly expanded in order to process the bauxite that was pouring into Arvida at the rate of five train loads a day. Houses, hospitals, schools, water facilities, food dispensaries, electricity and all the multitudinous details to sustain the greatly increased population were installed. At the peak, 25,000 persons were employed at Arvida.

Four new pot lines were installed at Shawinigan Falls, two at La Tuque, two at Beauharnois and one at Isle Maligne. One of these "little" plants turned out more aluminum than the entire Canadian output before the war.

Probably the hardest part of the expansion program was electric power, and to see the picture clearly a bit of background must be explained. Aluminum is a glutton for power,—that is what brought it to Canada in the first place some 45 years ago. All other basic materials of aluminum have to be imported into Canada.

At about the time when the Isle Maligne project was completed, plans for the power development, known as "Shipshaw", were drafted. By the late 1920's the prospects for increased consumption of aluminum were sufficiently promising to justify opening up of the first stage of the Shipshaw power site. However, by the time the first stage of the Shipshaw station was completed in 1931, we were well into the industrial depression and for quite a number of years its 240,000 h.p. capacity left a substantial power cushion in the Saguenay Valley. Then came the demands of the war, and the plans for the complete Shipshaw project—yellowed with age—were drawn from the drawer and the final construction commenced.

These aged plans of Shipshaw called for summer work only—no year-round work, winter camps nor special sub-zero equipment. The original design called for a devious canal route going through soft earth that could be shovelled instead of blasted. No concrete side dams were in the plans, but instead somewhat more risky but adequate earth dams were intended. The exigencies of the war scrapped all these intentions. The station had to be completed quickly, and that meant a year-round job with all the difficulties inherent in a site in the latitude of Labrador. The canal was re-routed through solid rock because in the Saguenay winters rock is easier to blast than is frozen earth and, in addition, the route was shorter. The canal sides were not earth dams but concrete—which were faster to build but much more costly. The original plans utilized the Little Shipshaw River as a tailrace, but as the Shipshaw River could not be dredged in winter these plans had to be discarded and a tailrace cut through a high ridge of solid stone. Thus, Shipshaw never touches the little stream which gives it its name. Economy was completely sacrificed for speed and there is no doubt that speed was made. Excavation started on August 15th, 1941 and in less than 15 months, on November 7th, 1942, the first generator was on the line. Five big dams were built, a wide, deep canal one and a half miles long was cut through solid rock and the six pen-stocks are rock tunnels, each 468 feet in length at a depth of 141 feet. The power house is a massive structure, and to build it over 3,000,000 cubic yards of earth and almost 3,000,000 cubic yards of rock had to be excavated. Over 3,250,000 pounds of dynamite were placed in 840 miles of blasting drills. To reach these totals over 55,000 individuals were engaged on the operation.

In order to make certain that sufficient water would be available at all times, upstream storage dams were required. Survey gangs found two locations,—one at Lake Manouan and the other at Passe Dangereuse, both of them in the upper reaches of the Peribonka River watershed. The most interesting of these two water-storages is that timber dam at Lake Manouan nearly 200 miles north-east at Arvida on the old canoe and portage route from Jacques Cartier's kingdom of the Saguenay to Hudson Bay. Every single piece of equipment, except timber, had to be flown to the site, and that added up to over four million pounds of air-borne traffic. The landing field was the lake, using pontoons in the summer and skiis in the winter. The other storage dam at Passe Dangereuse was 177 miles from Arvida, where the topography required a reinforced concrete dam. The location was inaccessible in that no roads led to the site, hence a highway had to be carved through virgin stands of timber. Working summer and winter, tough habitants cut their way through the forest making a road fit to bring in the material and the men. Over the woodland road moved the steel, concrete and machinery to construct a modern dam approximately 1,200 feet long by 160 feet high, containing 151,000 cubic yards of concrete.

As said before, the first stage of the Shipshaw power station had a capacity of 240,000 h.p. and the completion of the second stage added another 2,200,000 h.p. The combined capacity of Isle Maligne and Shipshaw power stations is 2,000,000 h.p. Since the installed turbine capacity of the whole of Canada is approximately 10,250,000 h.p., just about 25 per cent of the total is in the Saguenay district.

Submarines made carriage of the imported constituents through the Gulf of St. Lawrence and the Saguenay River to Port Alfred, too dangerous and uncertain. Scarcity of ships cut down even the cautious routing of lake steamers down the St. Lawrence from lake or canal points. The expanded supply of raw materials had to be brought into Arvida by rail from American ports. The rail connection in Canada was via the Canadian National Railways.

Mr. Clark stated that in the space of but a few paragraphs it is difficult to make clear what occurred during almost six years of frantic war effort. At times it seemed almost impossible to correlate the activities in far-off South America, foggy Newfoundland and in the vastness of Canada so that everthing fell into place at its proper time. Materials were difficult to get, it took time to design buildings and tabulate specification lists. Manufacturers of equipment were terribly overloaded with other urgent duties. Looking back at the accomplishments, it seems as though there was a "crisis" every day. So much had to be done at so many places. It was not done by the Aluminum Company of Canada, Ltd. alone. It was the outcome of the teamwork of the many industries of this continent who somehow or other fabricated their equipment and made deliveries. Not to be overlooked was the cooperation of the Provincial and Federal governments of this country whose staffs worked long hours day in and day out.

Following his paper, Mr. Clark presented an historical film on the Aluminum Industry entitled "Unfinished Rainbows".

At the close of the meeting there was a question period, and a vote of thanks was moved by J. F. Osborn.

QUEBEC BRANCH

Roger Desjardins, m.e.i.c. - *Secretary-Treasurer*

On January 16th, 1946, a meeting was held at the Faculty of Sciences of Laval University, during which a paper was given by Lt. Commander J. G. Ferraris, R.C.N.V.R., on **Electricity in the Navy.**

Lt. Commander Ferraris began his talk by giving the history of electricity in the Navy, dating back to 1874 for the firing of guns. Then came the discharging of torpedoes, 1879, searchlights in 1876, electric lighting in 1881, both arc and incandescent, at first, from Brush dynamos at 800 volts, changed later to 80 volts. A first class ship in those days had three dynamos 180-200 amperes at 80 volts.

The cables finally adopted as standard were rubber insulated with lead covering.

In most of the ships of the R.C.N. to-day, we have a D.C. voltage of 220 volts.

On a warship the electrical designer has to contend with many severe conditions, such as vibration, rolling, pitching and yawing of the ship, shock from gunfire, battle damage, extremes of temperature, restricted space, demand for reduced weight, effect of salt laden atmosphere, technical problems of design, etc.

With the aid of slides, Lt. Commander Ferraris, gave examples of the immense electrical installation in a man-of-war, by speaking of the installation on the cruiser H.M.C.S. "*Ontario*".

The lighting and fans cannot stop for more than 10 minutes. If that should happen the personnel in the engine and boiler rooms would have to be withdrawn and the ship would become a sitting target for the enemy.

Degaussing is used against magnetic mines by coils around the ship carrying just sufficient current to neutralize the magnetism induced in the hull of the ship by the earth's magnetic field.

The direction in which a ship is heading is given by the gyro-compass, consisting of a flywheel rotating at 6,000 r.p.m. about a horizontal axis, and so suspended about a vertical axis that it will respond to the feeble force tending to bring its axis of rotation parallel with that of the earth.

Distance and speed through the water are measured by a "Chernikaeff Log". This consists of a small propeller under the ship geared as to make and break a set of contacts 400 times every nautical mile (6080 feet).

A typical example among the many electronic systems which have been developed for long range navigation is "Loran", a pulsed system of hyperbolic navigation.

A number of ground stations are located to cover the area to be served and a single receiver is used aboard the ship or aircraft connected to an ordinary radio antenna. Pulses of radio energy are transmitted. These trigger off a station about 300 miles away which in turn transmits a second pulse on the same frequency after a fixed delay. The receiver on board an aircraft or ship simply measures the time between the arrival of the two pulses and thus a location on a certain line of position is obtained.

By taking another pair of stations a second line of position is obtained. Where the two lines intersect is the position of the ship.

The communication equipment of a ship like the cruiser "*Ontario*" is manifold. She has:—

a) Radio equipment to communicate with her own bases from nearly anywhere in the world;
b) Radio equipment for communication with
   1) Fighter Aircraft,
   2) Patrol Aircraft,
   3) Other ships in company,
   4) Bombardment liaison officers ashore,
   5) Spotting aircraft over enemy ships.

Infra-red devices are also used in communication and a great deal of work is being done in this field.

A radar set transmits a pulse of radio energy, of ultra high frequency, which is reflected by any object in its path and within a reasonable range. The time taken for the pulse to make the return trip to the object is measured extremely accurately and translated into range.

Slides were projected showing the radar aerials on the H.M.C.S. "*Ontario*" of:—

a) High powered air warning set capable of detecting A/C up to 120 miles away.
b) High powered height finding set with fully stabilized aerial which will determine the height of an A/C 40 miles away with an accuracy of 500 ft.
c) Main armament gunnery set capable of giving the range of another cruiser 15 miles away with an accuracy of—25 yds., and which is capable also of spotting shell splashes at great range. This aids in applying necessary corrections to the guns to obtain a hitting range and bearing.
d) High angle gunnery sets to give accurate range and hearing of A/C up to 10 miles range.
e) Close range gunnery sets to give an extremely accurate range of close-in targets. These sets will automatically follow a target once it has been set "On".
f) Gunnery bombardment sets for accurately ranging on shore bambardment targets, and also capable of following the large calibre shells to the target.
g) Target indication set which displays the whole surface and low flying A/C picture on a large scope, and which has attachments which enable it to indicate by bearing and range targets to be engaged by different sections of the armament.
h) Numerous sets designed to identify surface and air contacts as friendly or hostile.
i) Sets to identify the ship as friendly to our own forces.
j) Radar sets in shells cause latter to explode when a certain distance from target.

The control of naval guns has reached the point where a ship's first salvo usually straddles an enemy ship at a range of many miles. All the data necessary is transmitted electrically to a "Fire Control Table" which transmits in turn its "dictates" electrically to the guns.

Generation is divided among a larger number of units and with more capacity in reserve than in common shore practice. Instead of being arranged all in a row as in a power house, the generators are placed in as many separate compartments as possible, some are steam, (fed from different boilers) and some are diesel driven. A Ring-Main round the armoured section of the ship ties all the generators together and feeds the various loads. Under adverse conditions the ring can be split up into a number of sections each fed by a generator and independent of, but available to supply damaged adjacent sections.

The location of a navigable object by means of plotting the direction of arrival of a received signal at two or more stations is by no means new, but operational requirements during the war years have brought out many new refinements and opened up a large field of investigation and application.

Pre-eminent in this field is the cathode ray direction finder: a device which gives a visual indication of the direction of arrival of an incoming radio sgnal by means of a line on the face of a cathode ray tube. The direction and sense of the bearing can be read off instanteously from a compass scale marked on the face of the tube.

Radio communications, radio navigation, direction finding, radar and associated electronic methods have made necessary precise knowledge on the behaviour of wave propagation, which necessitates the study "Ionispheric Investigation ".

Canada, with the auroral zone traversing its northland and the north magnetic pole within its territory, is probably the world's greatest laboratory in the investigation of wave propagation.

International scientists and naval engineers in association with other services are working on the problems of ionispheric technique.

Lt. Commander J. G. Ferraris, R.C.N.V.R., finished his talk by giving details on the courses of the R.C.N. Electrical School which is being equipped in Halifax, which will be staffed by electrical officers and will train ratings and officers in all applications of electricity to the Navy including power, radar, radio, fire control, anti-submarine, etc.

SAGUENAY BRANCH

H. R. Fee, M.E.I.C. - *Secretary-Treasurer*

Industrial Electronics—Today and Tomorrow was the subject of a paper presented to the Saguenay Branch on January 31st, 1946, by Mr. J. D. Willis, assistant manager, Industrial Division of the Apparatus Department of Canadian General Electric Company, Toronto, Ont., who was introduced by Chairman B. E. Bauman.

The speaker reviewed the elements of electronics, explaining how some of the electrons could be freed from the atoms in certain substances, and forced to travel from atom to atom producing the electric current. He then described the elements of the electron tube, explaining how electrons could be emitted by a cathode heated directly or indirectly, or from a cold cathode by high voltage, by impact, or by light. By the application of external potential, these emitted electrons could be made to flow to an anode thus producing an electric current without the use of an internal connecting wire between the anode and cathode.

Mr. Willis then went on to describe a number of applications. As examples of application in measurement and inspection he gave the electron microscope and X-ray machine. He described in some detail the control system of a machine for applying force at a constantly increasing rate to test samples of textile.

As an application of the photo-electric cells he described an apparatus designed to inspect glass food containers for radial cracks.

Mr. Willis explained how electro-static precipitators were used to remove flue dust, and how this principle is used in the manufacture of sandpaper to produce maximum abrasive quality, in the manufacture of certain textiles and rugs, and for certain paint applications. In the field of lighting and light control the photo-electric cell is used extensively for on and off control, and the electronic principle is involved in florescent, germicidal, sodium paper, and mercury vapour lamps. Electronics also finds a wide application in the use of carrier current communication and power conversion.

The possible trend of electronic applications in the future was indicated by the use of various types of the electronic apparatus for the position control of paper in printing presses, for timing and counting, for welding control, heat control, high frequency heating, and automatic speed control. An application of the latter use was described in the control used for rewinding wire, in the manufacture of metallic cable.

M. L. Carey moved a vote of appreciation to Mr. Willis for his interesting and instructive paper.

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Mr. A. H. Tait, manager of the Mistassini Exploration Company, Arvida, Que., addressed the Saguenay Branch February 19th, choosing as his topic **The Romance of Gold Mining.**

The speaker defined an ore deposit as a concentration of minerals occurring in nature, which could be processed at a profit. Before any new development can be started the ore deposit has to be discovered, which makes prospecting one of the most important factors in the mining industry. The speaker told how some of the largest deposits in Canada, such as those at Sudbury, Cobalt, and Porcupine, were discovered more or less by accident. Out of every one hundred prospects only one to two prove to be ore deposit in the economic sense.

Mr. Tait explained in considerable detail the procedure usually followed in developing a prospect. Diamond drilling is first carried out to intersect the deposit at 100 to 150 feet below the surface close to the ore deposit, then a shaft is dug, a crosscut driven from the shaft to the ore deposit, and a drift driven along the ore body. Finally a raise is driven from the drift up through the vein. The material removed from the drift and raise is ore, and can be stored or processed.

The various methods of stoping, such as the open stope, shrinkage stope, and cut and filled stope were well illustrated by means of lantern slides.

Gordon Antenbring moved a vote of thanks to the speaker.

The programme also included a sound colour film entitled " River of Paper," which was loaned by the Powell River Company. This film depicted the various processes involved in making paper, and included a number of shots of the magnificent B.C. mountain scenery.

SARNIA BRANCH

F. F. Dyer, M.E.I.C. - *Secretary-Treasurer*
C. E. Leon, M.E.I.C. - *Branch News Editor*

On January 24 a joint meeting of the Sarnia Branch of the E.I.C. and the Sarnia Branch of the C.I.C. was held. The speaker of the evening was Mr. Earl Smith, a member of the research staff of the Dow Corning Company, Midland, Michigan. Mr. Smith graduated from Nebraska Wesleyan University and following his graduation did post-graduate work at the University of Nebraska. He was then an instructor in chemistry at Michigan State College until the early days of the war when he joined the chemical warfare branch of the Dow Corning Company.

Mr. Smith opened his remarks by defining the term " silicone "—a popular name for Organic Silicon Oxide Polymers. In chemistry they present a new field that combines both organic and inorganic study. In comparison to other elements, silicones are second in abundance to oxygen and comprise 27.7 per cent by weight of the earth's crust. They are the least electro-negative of all non-metals and the two basic linkages in silicone chemistry are to oxygen and carbon. Silicon polymers have electrical properties similar to glass. Mr. Smith reviewed a proposed nomenclature for organosilicone compounds that has been suggested by a sub-committee of the American Chemical Society.

In 1823 Berselius first synthesized $SiCl_4$ and Si. In 1899 a study of Organosilicone derivatives was started by Kipping, and from 1900 to 1930 most of the research developments in this field were dominated by Kipping and Stock. In 1904 Kipping first used the Grignard reagent which so far has been used by Dow Corning to produce their products. Early in 1930 flexible silicon polymers were discovered by Dr. Frank Hyde of Corning Glass Works. Previous to this any polymers produced resulted in hard, brittle substances but Dr. Hyde found that by hydrolizing a di-cloro-silicone with an alkyl phenyl and then heating, a viscous resin is produced. This resin cures at 250 deg. C. to a flexible film, and it is characteristic that this type of polymer and subsequent polymers so far discovered are all thermosetting.

In the field of silicone fluids, research has been carried on at the Mellon Institute under the direction of Dr. R. R. MacGregor. At the present time Dow Corning produces various silicone fluids which are characterized by their high viscosity index and water repellent properties. Water droplets on a silicone treated glass surface form a contact angle of 103 deg.; thus these fluids are useful in preventing the formation of water films on electrical insulators. Other uses of silicone fluids are as rubber lubricants and also foam inhibitors. Only a few part-per-million of fluid in oils will prevent foaming. In the field of lubrication, fluids have been produced that prove to be satisfactory lubricants under certain conditions. Work on these fluids is in an early stage of development. Silicone fluids also have a flat dielectric constant curve and a flat per cent power factor curve when plotted against frequencies up to 108 cycles.

Silicone rubbers retain their elasticity indefinitely under the elevated temperatures of 150 deg. to 250 deg. C. They do not have the tensile strength or abrasive resistance of natural rubber, but do have a strong resistance to chemicals and can be moulded, extruded, or coated on electrical condensers, resisters and other equipment.

Silicone resins as produced at the present time require curing from one to five hours at approximately 250 deg. C. and are later diluted with a volatile hydrocarbon to provide easy application and are ideal as a heat-resisting impregnating material. Prolonged heating carbonizes organic resins, but fifty hours exposure to 250 deg. C. does not affect silicone resin. As an example of their use in the electric motor industry, Mr. Smith told of a test on a 10 h.p. induction motor in which the insulation had been impregnated with one of the silicone resins. At the accelerated conditions of the test, this motor has run for 2,106 hours at 300 deg. C. which, converted to the usual operating temperature of 160 deg. F. means that this motor has been running for 782 years! By using heat-resistant pigments and silicone resins, paints have been made that stand up to over 1,000 hours exposure to a temperature of 250 deg. C. without blistering, cracking or running.

In conclusion, we should all be aware of the immense new field in chemistry that silicones present. This is a day of amazing scientific discovery and foremost in recent developments are silicones and their applications. Mr. Smith emphasized that designers should be aware of these applications depending upon thermal stability, electrical properties, high moisture resistance, and to realize that, at the present time, certain design problems can be solved only by the use of silicones.

TORONTO BRANCH

E. G. Tallman, m.e.i.c. - *Secretary-Treasurer*

One of the outstanding meetings in the history of the Toronto Branch was held in the Debates Room of Hart House on Thursday, January 24th. The meeting was the Annual "Student Night". Over 200 members and students were present.

The meeting was conducted by the Branch chairman, Prof. C. F. Morrison, who opened proceedings with a brief talk on the Engineering Institute. Four fourth year engineering students from the University of Toronto then presented papers. These four students were the finalists selected from a group of ten who competed in the preliminary contest.

The four students were: Mr. Rosenthal whose paper was on **High Speed Flight;** Mr. Findlay who spoke on **Earth Dams;** Mr. Buchanan who discussed **Variable Speed A.C. Motors** and Mr. Moore whose paper was entitled **Cemented Carbide Cutting Tools.** All the papers were excellent and the judges selected the winners with difficulty. Mr. Buchanan was awarded first prize of $40.; Mr. Findlay second prize of $30. and Messrs. Rosenthal and Moore were declared tied for third prize and received $10. each. Student Memberships in the Institute were given to all ten students.

While the judges were arriving at their decision the motion picture "The Failure of the Tacoma Narrows Bridge" was shown and was viewed with great interest by all.

Copies of the Annual Salary Survey Report, conducted and compiled by the Junior Section, were distributed to all the Students present.

The meeting was adjourned and re-convened in the Great Hall for coffee and doughnuts.

VANCOUVER BRANCH

A. M. Eyre, s.e.i.c. - - *Secretary-Treasurer*
P. B. Stroyan, m.e.i.c. - *Branch News Editor*

On January 21st about sixty members of the Branch gathered to hear Electrical Commander Deane, R.C.N., give an address on **Electricity in the Navy.** J. P. Fraser introduced the speaker, who had graduated from the University of British Columbia in 1934 in electrical engineering, followed his profession in electrical installation connected with the mining industry and, at the outbreak of war, joined the Royal Navy as an electrical engineer, later transferring to the Royal Canadian Navy. Commander Deane is now on the permanent force and explained that the Canadian Navy has laid down a policy of employing a definite number of electrical graduates each year to build up a competent staff of experts, giving them an intensive three year course of practical and theoretical training, with sufficient remuneration to attract and retain suitable candidates.

The speaker noted the tremendous strides taken in the development of electrical and electronic equipment during the war, and the incessant and continuous battle to keep ahead of the enemy by bringing out new devices for purposes of attack and counter-measures for combatting enemy inventiveness. The principles of navigation had been revolutionized by the invention of the electrically operated gyro-compass which had superseded the magnetic compass; an electrically operated device measured speed, and the combination of the two in an automatic plotter laid out the course and speed of the ship immediately. An electrically actuated echo-sounder plotted the depth of water and the condition of the sea-bottom so that the captain had all the navigational information required without any delay or guess-work. Latitude and longitude could be determined in any condition of weather by means of triangulation on fixed points by radio sending and receiving devices.

The miracle of radar had made possible the detection of aircraft at great distances, and later developments indicated the difference between friendly and hostile aircraft. Radar-directed long range guns spelled doom for enemy surface craft and anti-aircraft guns similarly equipped raked the skies. The final invention of the proximity fuse for large and small diameter shells, which picked their own targets by means of radar equipment in the head of the shell, had proven particularly deadly. By means of radar, details of coastlines and harbours within a range of several miles could be picked out on a receiving screen which indicated, almost as well as in an aerial view, the outlines of salient features as well as the disposition of any ships in the harbour.

The speaker showed slides picturing the maze of equipment and control panels necessitated by the tremendous use of electrical devices in the modern warship, including electrical installations for lighting, ventilating and steering the ship.

Commander Deane answered a number of questions and was warmly thanked for his instructive and informative address.

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About fifty members and student members of the Branch met in Salon B at the Hotel Vancouver on February 13th, on the occasion of the Annual Students' Night. R. C. Pybus, branch chairman, introduced Gordon Heal, chairman of the Student Chapter at the University of British Columbia, who presented the speakers.

The first address was given by D. R. Bakewell, who spoke on **Detailed Topographical Maps for Logging.** The speaker dwelt on the importance and long range economy of preparing detailed maps of an area which is to be logged, explaining that, by gathering definite and accurate information in the first instance, much wasted effort could be avoided. The method recommended was by dividing the area into sections of one square mile each, running a transit line on the perimeter, with an allowable error in closing of one foot horizontally and one foot in elevation. Fifteen strip lines in each direction, parallel to the sides of the square were then run by compass and chain, and the elevations taken by clinometer, with an allowable error on each strip of 60 ft. in alignment, 30 ft. in chainage and 8 ft. in elevation. Errors can thus be proportioned back up each strip line, and information on drainage and general topography noted, which when plotted on a map, would give adequate information on the area covered. When the original transit line is being run round the perimeter of the section tally points are referenced at 330 ft. centres to correspond to the strip lines. These are later used by the cruisers to tie in their work.

The completed map, with 20 ft. contours, with timber types shown in various colours, and with details of ground formations, is invaluable in laying out roads, railroads, stream-crossings, logging settings. It forms a permanent record which can be used as a basis for assessment of fire claims and future re-forestation plans.

The cost of procuring and recording the information would average, in ordinary country, about two dollars per acre, which for a fairly good stand of forty thousand board feet per acre, would not add appreciably to the cost of logging.

The second address, entitled **Ripple Rock**, was given by G. M. Ellis. This rock, situated about 110 miles north of Vancouver, at the southern end of Seymour Narrows, between Maude Island and Vancouver Island, has been a thorn in the flesh of coast navigators and has been the cause of a great many ship-wrecks. Through the years many representations have been made to the Federal government, but it was not until the United States government, anxious to use the inside passage to Alaska for supply ships, applied sufficient pressure to induce the Canadian government to seek bids for the removal of the rock.

Seymour Narrows is a long, narrow channel, about 2,600 ft. wide at this point, and subject to tides of fourteen knots in either direction, with only half hour periods at high and low water slack when the water is still. Ripple Rock is in the centre of the channel, and is 220 ft. long by 150 ft. wide, with an average depth at low water of only 15 ft. These conditions, combined with strong cross currents at certain stages of the tide, thus prove a very definite hazard to shipping.

When, in 1942, the Federal government called for tenders for the removal of the rock to a depth of 33.8 ft. below low water, no bids were received. Tenders were then called on a basis of cost plus a fixed fee, the individual contractors to suggest methods of doing the job. Several proposals were submitted, including the construction of a caisson and the use of open mining methods, tunnelling underwater from the shore and working from underneath, and the method which was finally settled upon, namely, anchoring a barge over the rock, drilling and blasting the material. A barge was constructed and held in position by cables fastened to underwater anchors, but the vibration caused by the current on the cables made this method unworkable. The barge was then held by overhead cables, and work proceeded on this basis. Due to the shortness of time during which drilling could be done at slack water periods and the impossibility of locating partly drilled holes on the next tide, progress was so slow as to be entirely uneconomical. The work had therefore been stopped pending further appropriation.

The speakers were thanked for their most interesting discourses and each received first prize for his efforts.

Tom Scott reported on his recent trip to the annual meeting of the Institute in Montreal, which he attended on behalf of the University of British Columbia, giving an outline of the subject under discussion at the student sessions. Mr. Scott was thanked for his report and congratulated by Dean J. N. Finlayson.

WINNIPEG BRANCH

A. T. McCormick, M.E.I.C. - *Secretary-Treasurer*
A. V. Dick, M.E.I.C. - - - *Branch News Editor*

The showing of the Mulberry Port Exhibition in Winnipeg, under the joint auspices of the Hudson's Bay Company and The Engineering Institute of Canada, was officially opened on Friday January 11th at 3:00 p.m., by the Lieutenant-Governor of Manitoba, and opened to the general public on Saturday, January 12th. The attendance of 20,500 on the opening day broke all records for attendance set so far in the showing of Mulberry in Canada. The total attendance for the first five days being over 60,000.

The members of the Winnipeg Branch and the Manitoba Association of Professional Engineers with their ladies were guests of the Hudson's Bay Company at a private showing of Mulberry on Friday night, January 18th, with a record attendance of over 500, at which those present were guests of the Hudson's Bay Company at a complimentary dinner, starting at 6:00 p.m. Mr. Geo. F. Klein, store manager of the Hudson's Bay Company, welcomed the guests to the dinner and private showing of Mulberry. C. P. Haltalin, chairman of the Winnipeg Branch, on behalf of those present thanked the Hudson's Bay Company and staff for their hospitality, and the management and staff of Mulberry for their assistance in putting on the private showing of the exhibit for the engineers of Winnipeg.

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The annual meeting of the Winnipeg Branch was held in theatre E, University Building, on Thursday, February 7th, with C. P. Haltalin in the chair. As retiring chairman, Mr. Haltalin gave a brief report on the activities of the Branch during 1945, outlining details of a very successful year, culminating in the successful showing of Mulberry, which created a record both for the greatest attendance for one day and in total attendance, which exceeded that of any city so far and amounted to approximately 70 per cent of the population of the City of Winnipeg.

The auditors' report was submitted and approved, showing a substantial surplus for the year, with a total surplus of $1,396.62.

The secretary-treasurer then submitted a report for the year covering the activities of the Branch and the Executive during 1945, in which the outstanding features were the proposed revisions to the Branch by-laws and the successful formation of two Branch Sections—the Electrical Section and the Student Section. A considerable increase in membership was reported, with a total of 63 new members in 1945, of which 60 were student members, making the total Branch membership 338.

During the evening nominations were received for the Electrical Section, the following being nominated:

Chairman ....H. L. Briggs
Vice-Chairmen ....S. G. Harknett, D. A. McCuaig
Executive Members....J. D. Peart, A. M. Thompson

It was announced that the Student Section was being organized under the following temporary officers:

Chairman ....E. M. Scott
Vice-Chairman ....Paul Bergman
Secretary ....George Flavelle
Chairman Papers Committee....Wm. Porter

The inaugural meeting of the Student Section was announced as being held on Friday, February 15th, at which H. L. Briggs would present a paper on **Carrier Current Control Applications.**

Following the business portion of the meeting, the latest moving picture of wild life and conservation construction was shown through the courtesy of Ducks Unlimited, and the beautiful coloured photography of Canada's "Duck Factory" was much appreciated by the large number of members in attendance.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

Arch Design Simplified:
A text-book on rapid and economical design of arch bridges, including 33 tables and illustrative designs. W. A. Fairhurst. London, Concrete Publications Ltd., 1945. 9½ x 6½ ins., 61 pp., illus., cloth, 12s.

Canadian Almanac and Legal Court Directory, 1946:
Edited by Horace C. Corner. Toronto, Copp Clark, 1946. 9 x 6¼ in., 750 pp., cloth, $7.00.

Materials Handling Manual (II):
Edited by M. M. Williamson and G. W. Williamson. London, Paul Elek (Publishers), c1945. 9 x 5¾ in., 488 pp., illus., cloth, 30s.

Optical Instruments in Engineering:
Sydney H. Hemsley. London, Paul Elek (Publishers), 1945. 8½ x 5½ in., 80 pp., illus., cloth, 7s 6d.

PROCEEDINGS, TRANSACTIONS

New Zealand Institution of Engineers:
Proceedings. Vol. 31, 1945.

REPORTS, YEARBOOKS, ETC.

Association of Secretaries of Technical Societies in Glasgow:
Technical Meetings in Glasgow and Edinburgh, January-June, 1946.

Canada. Dept. of External Affairs:
Conference Series, 1945: No. 2—*Report on the United Nations Conference on International Organization held at San Francisco, 25th April-26th June, 1945. Ottawa, King's Printer, 1945. No. 3—Proposals for Expansion of World Trade and Employment; Communicated by the United States Government together with the Text of the Financial Agreement between the United Kingdom and the United States signed at Washington on December 6, 1945; and related Documents. Ottawa, King's Printer, 1945.*

Canada. Dept. of Mines and Resources. Bureau of Mines:
Metallurgical Works in Canada, Pt. 2—Non-Ferrous and Precious Metals, December, 1945.

Canada. Dept. of Public Works:
Annual Report, April, 1944-March, 1945. Ottawa, King's Printer 1946.

Canadian Standards Association:
Significance of its Services to Canadian Industry and Consumer Interests. Ottawa, C.S.A., 1945.

Dresser Industries Inc.
Annual Report, 1945.

Institution of Electrical Engineers:
History and Objects of the Institution. London, 1944.
. . . Regulations for the Associate Membership Examination. London, October, 1945.
. . . Royal Charter; By-Laws. London, 1945.

Manitoba (Prov.). Dept. of Mines and Natural Resources. Mines Branch:
Sixteenth Annual Report on Mines and Minerals for the year ending April 30th, 1944.

North East Coast Institution of Engineers & Shipbuilders:
List of Members, Sept., 1945.

Smithsonian Institution:
Annual Report for the Year Ending June 30th. 1944. Washington, Government Printing Office, 1945.

United Nations Relief and Rehabilitation Administration:
Report of the Director General to the Council for the Period 1 April to 30 June, 1945. Washington, 1945.

TECHNICAL BULLETINS

Bituminous Coal Research, Inc.:
Information Bulletin No. 7, December, 1945: Freezeproofing Coal Shipments, by J. F. Foster and R. A. Sherman. (Reprinted from Mechanization 9 n 12 Dec 1945.)

Canada. Dept. of Mines and Resources. Geodetic Service of Canada:
Publication No. 17—Precise Levelling in Quebec, South of St. Lawrence River, by R. H. Montgomery. Ottawa, King's Printer, 1946.

Edison Electric Institute:
Cable Operation, 1943: a Joint Report of Committee on Power Distribution, Association of Edison Illuminating Companies and Transmission and Distribution Committee, Edison Electric Institute. (Publication No. M16.)
. . . Turbines, Condensers and Feedwater Heaters, 1943-1944: a Report by the Turbines and Condensers Sub-committee of the Prime Movers Committee, Edison Electric Institute. (Publication No. L3.)

Electrochemical Society—Preprints:
88-29—Production of Nickel and Chrome Steels from Laterite Ores, T. F. Baily; 88-30—Zirconium Metal, Its Manufacture, Fabrication and Properties, D. B. Alnutt and C. L. Scheer: 89-1—Deposition of Nickel-Cobalt Alloys from Chloride Solutions, C. B. F. Young and Clifford Struyk; New Carbon Resistor Furnace, W. J. Kroll, A. W. Schlechten and L. A. Yerkes.

Institution of Mechanical Engineers—Preprints:
. . . Development of the La Mont Boiler in Great Britain. G. A. Plummer; Operating Experience with La Mont Boilers with special reference to Feed Water Problems, G. A. J. Begg, W. M. Hebblethwaite and G. Cooke. January, 1946.
. . . Early History of the Whittle Jet Propulsion Gas Turbine, Frank Whittle. (First James Clayton Lecture.) October, 1945.
. . . Elementary Principles of Plant Organization and Maintenance for Civil Engineering Contractors, H. O. Parrack. November. 1945.
. . . Generation and Utilization of Steam in the Heavy Industries, G. E. Hider. April, 1946.

. . . *Mechanism of Tool Vibration in the Cutting of Steel; Cutting Tool Research: Report of the Sub-committee on Carbide Tools, prepared by R. N. Arnold. October, 1945.*
. . . *New Temperature—Total Heat—Entropy Chart for Gases with Variable Specific Heats, J. R. Finniecome. April, 1946.*
. . . *Papers on Piston Ring Problems: Analysis of the Lubrication between the Piston Rings and Cylinder Wall of a Running Engine, J. S. Courtney-Pratt and G. K. Tudor; Improved Method of Measuring Piston Ring Wall Thrust, B. Pugh; Some Notes on the Mechanical Factors Affecting Ring Gumming in Petrol Engines with Particular Reference to the Rating of Lubricating Oils, B. Pugh. November, 1945.*
. . . *Some Notes on the "Merchant Navy" Class Locomotives of the Southern Railway, O. V. S. Bulleid. December, 1945.*

Research Council of Alberta—Contributions:

No. 7—Bituminous Sands of Alberta, K. A. Clark. August, 1945. (Reprinted from Oil Weekly.) No. 8—Asphaltic Road Oils from Alberta Bituminous Sand, K. A. Clark. September, 1945. (Reprinted from Canadian Chemistry and Process Industries.)

U.S. National Bureau of Standards. Building Materials and Structures:

Report BMS104—Structural Properties of Prefabricated Plywood Lightweight Constructions for Walls, Partitions, Floors, and Roofs. Sponsored by the Douglas Fir Plywood Association, by Arnold Wexler, Sanford B. Newman and Vincent B. Phelan. Washington, 1945.

PAMPHLETS, ETC.

Application of 8-Hydroxyquinoline to the Analysis of Aluminium Alloys:

Determination of Magnesium in the Presence of Manganese and Nickel, Paul E. Gagnon and Henri Shehyn. (Reprinted from Canadian Journal of Research, B, 23: 183-193, September, 1945.)

Britain Against Germany, 1939-1945; A Record in Pictures:

Ottawa, United Kingdom Information Office, 1945.

Community Planning:

Toronto, Meadows, Critoph & Co., 1946.

Contributions a L'Etude de la 3, 3-Diphenyl-1-Indanone et de ses Dérivés:

Paul E. Gagnon, L. Gravel and G. L. Huot. (Reprinted from Canadian Journal of Research, B, 23: 194-198, September, 1945.)

Developments in Marine Water-Tube Boiler Design:

R. E. Zoller, January, 1946.

Engineering Interpretation of the Economic and Financial Aspects of American Industry:

Vol. 7—Plastics and the Plastics Industry. N.Y., Montreal, George S. Armstrong, 1946.

Etude des Huiles Essentielles Tirées des Feuilles de Quelques Conifères du Québec:

J. Risi and M. Brulé. (Reprinted from Canadian Journal of Research, B, 23: 199-207, September, 1945.)

Financial Agreement between the Governments of the United States and the United Kingdom:

Dated 6th December, 1945. Includes a Joint Statement regarding Settlement for Lend-Lease, Reciprocal Aid, Surplus War Property and Claims. London, H.M.S.O., 1945. Cmd 6708.

Fur Production in the Northwest Territories:

M. J. and J. L. Robinson. (Reprinted from Canadian Geographical Journal, January, 1946.)

German "Fasteners" Industry; Bolts, Screws, Nuts and Rivets:

Roy Harmon Smith and Charles F. Newpher, July 6th to July 20th, 1945. Cleveland, American Institute of Bolt, Nut and Rivet Manufactures, 1945.

Handbook on Stainless Steel:

Brackenridge, Pa., Allegheny Ludlum Steel Corp., c1946.

Institution of Mechanical Engineers:

Award of the 1945 James Watt International Medal to Dr. G. W. Lanchester, January 26, 1945.

International Engineering Relations:

Policy of the American Society of Mechanical Engineers, N.Y., A.S.M.E., 1945.

Physics Gives Us Nuclear Engineering:

E. U. Condon. (Reprinted from Westinghouse Engineer, November, 1945.)

Rolls-Royce "Griffon" Aero Engine:

(Reprinted from Flight, September 20th, 1945; also reprinted from Aeroplane, September 21, 1945.)

Science and Craftsmanship in the Engineering and Shipbuilding Industries:

J. W. Stephenson. January, 1946.

Scientist and the War:

J. H. Hildebrand. (Reprinted from Chemical and Engineering News, V 23, P 2317, December 25, 1945.)

Ships and Storms on the Great Lakes:

C. G. Andrus. (Paper read before a joint meeting of the Royal Meteirikigucak Society, Canadian Branch, and the Dominion Marine Association, at Toronto, October 18, 1943.)

Some Aspects of Gas Turbine Development:

S. G. Hooker. February, 1946.

Statistical Material Presented during the Washington Negotiations:

London, H.M.S.O., 1945. Cmd. 6707.

United Nations Educational, Scientific, and Cultural Organization:

Final Act of the London Conference; Constitution; Instrument Establishing a Preparatory Commission. Ottawa, Canadian Council of Education for Citizenship, 1945.

Water Transportation in the Canadian Northwest:

J. L. Robinson. (Reprinted from Canadian Geographical Journal, November, 1945.)

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

HISTORY OF THE KODAK

By Mina Fisher Hammer. N.Y., House of Little Books, c1940, 95 pp., illus., cloth, $2.00.

This is a history of the Kodak and its continuations, the fist folding and panoramic cameras, the magic lantern, kodak and movie camera. Biographical data about the inventor, David Henderson Houston, is also included. The history is fully documented with the U.S. Patent Office records, Federal Reports of the U.S. Supreme Court, together with patent drawings by the inventor. Assignments of patents, Houston to Eastman, include not only the original 1881 Kodak, but also the 1892 First Folding Pocket cameras and later Panoramics. The book is well illustrated with plates and drawings.

INTRODUCTION TO MAGNESIUM AND ITS ALLOYS

By John Alico. Chicago, New York, Ziff-Davis, 1945. 183 pp., illus., cloth, $5.00.

The need for an extensive American survey of available information on this subject has long existed. Serious metallurgical students and those concerned with the practical aspects of the fabrication and use of metals will find this need answered in the present work. With years of practical experience in the metal industries, including magnesium production and fabrication, the author is well qualified to evaluate technical information. The clarity and simplicity of his presentation will earn the appreciation of all readers. The book covers the fundamentals of production and fabrication for those manufacturers and design engineers who may be considering magnesium alloy applications for their particular products, and for research engineers, metallurgists, and students who desire such aid in their work. Bibliographical references are included at the end of each chapter.

SWEDISH CEMENT AND CONCRETE RESEARCH INSTITUTE —Proceedings

Svenska Forskningsinstitutet for Cement Och Betong Vid Kungl Tekniska Hogskolan I Stockholm. Handlingar N:R 1, 1945. Report of the Director on the Work of the Institute during the Period from July 1st, 1942, to June 30th, 1944. (In Swedish.)

A brief account is given of the organization, building, and resources of the Institute at the Royal Technical University, Stockholm, and of the work of the Institute from its inception on July, 1942, to July, 1944. The Chemical Department carried out investigations on the hardening of Portland cement, the extraction of alkalis from cement clinkers, and the rapid colorimetric analysis of silica materials. The Physics Department, which is the largest department of the Institute, studied some of the problems concerning the mechanics of concrete deformation. The primary purpose of this study was the evolving of methods and instruments of measurements suited to macroscopic observation. In this connection, research was carried out on the theoretical groundwork required for a detailed investigation into the structure of concrete and cement paste. The Technical Department made tests on the resistance to wear of concrete floors, and the development of cracks in reinforced concrete structures. In addition, this Department conducted courses in concrete engineering for concrete inspectors and supervisory staff.

. . . *Handlingar N:R 2; Beskrivning av Cement och Betonginstitutets Byggnad, Maj 1945. Description of the building of the Swedish Cement and Concrete Research Institute, May, 1945. (In Swedish.)*

A description of the new building of the Institute is detailed with many illustrations. *(Continued on page 212)*

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

September 30th, 1943.

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 be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thrity-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, 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 attainment 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

BANNATYNE—NINIAN, of 3876 Kent Ave., Montreal, Que. Born at New Romney, Kent, Eng., December 5th, 1889. Educ.: Birkenhead Tech. Coll., Birkenhead, Eng., 1908-13; 1914-23, R.C.N., as Eng. Sub. Lt., examined and promoted to Eng. Lieut.; 1923-30, Affiliated Engrg. Cos., Montreal; 1930-34, supt. engr., Canadian National Steamships; 1934-38, general work on steamships, survey, repairs, new constrn., assisting Lloyd's Register of Shipping, British Corp. Register of Shipping, Lambert & German, Naval Architects, etc.; 1939, boiler dept., Dominion Bridge Co.; 1939-45, recalled to R.C.N., promoted to Cmdr. (E), March 1941, and discharged, "services completed"; 1945 to date, temporarily employed on general boiler & steam engrg., Fraser Companies Limited, Montreal. (Assoc. Member, E.I.C., 1922-29).

References: F. S. B. Heward, F. A. Combe, G. H. Archibald, F. O. White, G. L. Stephens.

BJARNASON—JOHANNES, of Reykjavik, Iceland. Born at Knarrarnes, Myrasysla, Iceland, July 18th, 1920. Educ.: B.Eng. (Mech.), McGill Univ., 1943; 1944 to date, technical director, doing all kinds of engrg. work such as factory and machinery layouts, mounting of machinery and machinery instruction, Orka Limited, Machinery & Engineering, Reykjavik, Iceland.

References: E. Brown, C. M. McKergow, F. M. Wood, A. R. Roberts, G. A. Wallace.

BROADHURST—ERIC BERTRAM, of Trail, B. C. Born at Salford, England, January 1st, 1913. Educ.: Univ. of British Columbia, 1929-30; R.P.E. British Columbia, (by Exam.); with Consolidated Mining & Smelting Co. of Canada, Trail, as follows: 1934-38, apprentice dftsman., designing dftsman, 1938-45, genl. dtfing, and mechanical designing, including design of water-cooled screw conveyors, magnesium melting furnace and electrolytic layout, design of zinc roasters, layouts of ammonium nitrate plants, 1945 (4 mos.), on loan to Defence Industries Ltd., and at present mtce. engr. for lead smelting dept.

References: J. V. Rogers, S. C. Montgomery, G. H. Bancroft, T. W. Lazenby, A. C. Ridgers, C. R. Bown.

CHISTENSEN—HENRY FREDERIK OTTO, of Dolbeau, Que. Born at Horsens, Denmark, Nov. 13th, 1901. Educ.: Horsens Tech. School (evenings), 1917-21, Aarhns Electrotechnikon (evenings and day coure), 1921-24; 1921-25, licensed electrician and foreman on various A.C. and D.C. and H.T. installns. throughout Denmark; 1925-29, in business for self as elect. engr. and contractor; 1929 to date with Lake St. John Power & Paper Co., Dolbeau, Que. becoming asst. electrical supt. in 1942 and elect. supt. in 1944.

References: H. R. Fee, J. R. B. Milne, A. G. Jacques, N. F. McCaghey, A. Cunningham.

COMTOIS—PAUL-EMILE, of 34 Lamontagne Ave., Quebec City. Born at Quebec, Que., Feb. 5th, 1917. Educ.: B.Sc., (Mining), Laval Univ., 1941; 1941-42, asst. surveyor, Noranda Mines Ltd.; 1942 to date, Lieut. in R.C.E., Section Commander, returned from overseas and awaiting discharge.

References: G. J. Cote, A. Pouliot, G. W. Waddington, L. Roy, P. E. Gagnon.

CRAIG—GORDON HARBISON, of Winnipeg, Man. Born at Armagh, Northern Ireland, April 3rd, 1910. Educ.: B.Sc. (Elect.), Univ. of Manitoba, 1933; 1933-37, elect. dept., Swift Canadian, Winnipeg; 1933, (1 mo.), motor winding, Canadian Westinghouse, Winnipeg; 1938-39, costing, C.S.D., Canadian General Electric, Winnipeg; 1939 (part), sales engr., Mumford Medland Ltd., Winnipeg; 1939-45. Regt. Signals Officer in theatre of operations; 1946 to date, sales engr., Mumford Medland Ltd., 576 Wall St., Winnipeg, Man.

References: S. G. Harknett, E. P. Fetherstonhaugh, N. M. Hall, A. Campbell, W. Hurst, T. E. Storey.

DUNLOP—WILLIAM HAMILTON, of 2327 Windermere Road, Windsor, Ont, Born at Motherwell, Scotland, April 24th, 1893. Educ.: Glasgow Tech. (evenings). 1910-15; 1910-15, 5 yrs. apprent'ship as structl. dftsman and designer with Alex. Findlay & Co., Motherwell, Scotland; 1915-19, Lanarkshire Steel Co. and Sir Wm. Arrol, Glasgow; 1919-25, leading dftsman and designer, Redpath Brown & Co., Edinburgh; 1920-23, evening school teacher under the Edinburgh Education Authority; with Canadian Bridge Co., as follows: 1925-37, checker in dfting. office, 1937 to date, squad foreman i/c of structural contracts and assisting in design.

References: G. G. Henderson, P. E. Adams, W. G. Mitchell, E. M. Krebser, J. M. Wyllie.

ELLIOT—THOMAS CAMBPELL, 349-15th Ave., W., Calgary, Alta. Born at Melita, Man., Feb. 20th, 1921. Educ.: B.Sc. (Chem. Engrg.), Univ. of Alberta, 1943; R. P. E., Alberta; with Imperial Oil Limited, Calgary, as follows: 1943-44, asst. instrument engr., refinery, 1944 to date, instrument engr., refinery.

References: W. D. Suitor, J. J. Hanna, F. C. Tempest, T. D. Stanley, W. A. Smith.

GARDNER—FRANK KENNETH, of 5 Wolseley Blvd., St. Catharines, Ont. Born at Kidderminster, Eng., Oct. 10th, 1906. Educ.: Birmingham Univ., 1926-29; indentures apprent'ship, Victoria Engrg. Co., Kidderminster; 1929-32, dftsman., tool design, jigs, fixtures, dies, layout and detail, transferred to standards dept. on tooling development in conjunction with time study operators, Massey Harris Co., Brantford; 1932-39, i/c all standards, tooling development, modernization of mould shops, machine mtce., etc., Dominion Glass Co., Hamilton; 1939-41, on loan from Dominion Glass to R. McDougall Co., Ltd., Galt, as works mgr., i/c all plant operations for expansion and organizing machine tool programme for war needs; 1941-43, genl. supt., i/c all activities of war plant set up to specialize in mfg. of armour-piercing projectiles, commenced with bar stock and shipped finished heat-treated projectile, this included responsibility for tool-jig, fixture, die and drawing office, St. Catharines Steel Products; 1943 to date, mgr. i/c plant and office routine, Imperial Iron Corporation, St. Catharines, Ont.

References: W. L. MacKenzie, J. M. Millman.

GILLEAN—IAN, of 355 Kensington Ave., Westmount, Que. Born at Westmount, Que., Oct. 18th, 1918. Educ.: B.Eng., (Elect.), McGill Univ., 1940; 1941-45, Education & Signals Officer, R.C.A.F.; and at present jr. engr., Canadian Marconi Co., Montreal, Que.

References: J. B. Challies, W. J. Armstrong, E. P. Muntz, R. DeL. French, C. V. Christie, L. A. Wright, L. Trudel.

GRAEB—JOHN WILLIAM, of 290 George St., Sarnia, Ont. Born at Preston, Ont., June 18th, 1915. Educ.: B.A.Sc., Univ. of Toronto, 1939; 1939-40, Canada Sand Papers Ltd., Plattsville; 1940-43, Spruce Falls Power & Paper Co., Kapuskasing, Ont.; with St. Clair Processing Corp., Ltd., Sarnia, Ont., as follows: 1943-44 instrument foreman, 1944-45, asst. instrument engr., 1945 to date, instrument engr.

References: E. K. Lewis, R. W. Dunlop, E. W. Dill, F. F. Dyer, C. P. Warkentin, F. F. Walsh, C. W. Boast.

HURD—EDWIN CECIL, of Toronto, Ont. Born at Marquis, Sask., July 3rd. 1914. Educ.: B.Sc.,(Chem. Engrg.), Univ. of Saskatchewan, 1934; with British American Oil Co. as follows: 1934-38, laboratory and various operating positions, Moose Jaw Refinery, 1939, process foreman, Montreal Refinery, 1940-42, asst. refinery mgr., Toronto Refinery, 1942 to date, refinery mgr., Toronto Refinery.

References: T. J. Pounder, C. J. MacKenzie, F. A. Gaby, F. C. Carley.

KENDALL—EVAN WILDRIDGE JACKSON, of 4870 Cote des Neiges Rd., Montreal. Born at Montreal, March 30th, 1920. Educ.: 1945 graduate of special electrical course at the Nova Scotia Tech. Coll., givent o selected personnel in the Navy qualifying them for commissioned officer. (Course approved by Council as meeting requirements for Junior); with Bell Telephone Co. as follows: 1940-42, central office man, mtce. of equipt. in exchanges, 1942, stn. installer, same duties; 1942-45, R. C. N. V. R. as Anti-Sub. Artificer; and at present with Bell Telephone Co. as central office repairman, tele. machine-switching equipt.

References: F. H. Sexton, G. H. Burchill, A. R. Ketterson, A. McGugan, F. Irvine-

LAMBERT—ARTHUR ALEXANDER, of South Slocan, B.C. Born at Nelson, B. C., Aug. 23rd, 1903. Educ.: B.A.Sc. (Civil), Univ. of British Columbia, 1925; R.P.E., British Columbia; with West Kootenay Power & Light Col, Ltd., South Slocan, B.C., as follows: 1926-27, asst field engr., 1927-32, dftsman, 1932-33, field engr. on constrn., 1933, dftsman.; 1935-36, field engr., A. H. Green Construction Co.; 1936-38, res. engr., highway constrn., Prov. Dept. Public Works; with West Kootenay Power & Light, as follows: 1938-43, cheif dftsman, 1943 to date, asst. to chief engr.

References: E. M. Stiles, S. C. Montgomery, C. G. Mills, A. S. Mansbridge, C. E. Webb.

LeBLANC—ARTHUR JOSEPH, Major, M.B.E., R.C.E., of Montreal, Que. Born at Grand Falls, N.B., Dec. 6th, 1910. Educ.: Matric., McGill Univ., 1931; private study engrg. subjects, School of Military Engrg. (RE) England; military engrg., Chatham-Ripon; Assoc. Member, Institution Royal Engineers, Eng.; 1932-33, sub-contr. and supt., road constrn., survey excavation, culvert and road constrn.; 1933-35, asst. supt., harbour reconstrn., Montreal, Angus Robertson Ltd., Montreal; 1935, asst. supt., steel pile driving and genl. constrn., T. C. Gorman Co., Ltd.; 1935 (part), genl. constrn., river control dams, E. G. M. Cape & Co., Ltd.; 1936-38, asst., harbour reconstrn., steel caissons (air), piles, reinforced concrete, reinf. concribs and piers, supt., townsite and power development, Angus Robertson Ltd., Montreal; with R.C.E., as follows 1941-43, Lieut., Eng. and France, Field Coy. Officer i/c constrn. and defence installns., camps, roads, tunnels, underground hdqts., etc., demolitions, flame defenses, IORE Divn. Engineers, Officer i/c demolition instruction for RCE Officers and NCO's., 1943-45, Capt., England, France and Belgium, Adjutant Formation of Engineers, 1945, (6 mos.), Major, Holland, and Germany Staff Officer RE (Bridges) Staff of Chief Engr., 1st Cdn. Army, 1945 to date, O/C Engr. Services and Works Coy., R.C.E., (Canada), District Engr. Officer M.D. No 4, Montreal.

References: J. B. Stirling, J. P. Carriere, O. J. McCulloch, E. S. Miles, C. N. Mitchell, P. N. Gross, D. Kirk, A. S. Rutherford, G. Walsh.

LOCKEBERG—ROLF SIGURD, F/Lieut., R.C.A.F., 542 Wellington St., Ottawa. Born at Ottawa, Jan. 28th, 1918. Educ.: B.Sc. (Mech.), Queen's Univ., 1940; 1940-41, dftsman., Shawinigan Engrg. Co.; with R.C.A.F. as follows: 1941, Aero. Engr., 1943-44, Engr. Officer, i/c mtce. Catalina Squadron, 1944-45, Eng, Officer i/c Repair and Inspecn. Squadron for Typhoon Wing, 1945-46, Eng. Officer. 2nd TAF, i/c Mtce. of No. 412 Spitfire Squadron; and at present on disembarkation leave pending discharge.

References: D. S. Ellis, L. T. Rutledge, H. G. Conn, C. W. Crossland, J. K. Kielland, J. A. McCrory, R. E. Heartz.

MASSE—GASTON W., of Sherbrooke, Que. Born at Sherbrooke, Dec. 28th, 1904. Educ.: B.Sc. (Elect. Engrg.), McGill Univ., 1931. 1931-33, instru'man and concrete inspector on highway constrn., Provincial Road Dept.; with City of Sherbrooke, Gas and Electricity Dept., as follows: 1933-36, genl. experience in elect. generation, transmission and distribution, 1936-39, transmission and distribution supt., in complete charge of generating and distributing system and also of the municipal gas works and distribution system.

References: A. C. Crepeau, J. Morse, R. Latreille, M. L'Heureux, G. Hulme, R. M. Doull.

McKAY—JAMES TACKABERRY, of Montreal, Que. Born at Moose Jaw, Sask., Feb. 6th, 1921. Educ.: B.A.Sc. (Chem. Engrg.), Univ. of British Columbia, 1943; 1943-44. jr. engr., Bahrein Petroleum Co., Ltd.,; 1945-46, supvr., Mtl. refinery, McColl-Frontenac Oil Co., Ltd.; and at present heating and ventilating engr., Duwright Agencies Co., Ltd. and National Heating Products Co., Ltd.

References: A. G. Farquharson, B. A. Margo, G. W. Jarvis, J. N. Finlayson, W. W. Timmins, A. Peebles.

McGEACHY—DUNCAN DONALD CAMERON, of 536 Queen's Ave., London, Ont. Born at Hazelton, B.C., Dec. 12th, 1918. Educ.: B.Sc. (Mech.), Queen's Univ., 1940; 1940, (4 mos.), foreman in training, Proctor & Gamble Co., Hamilton; 1940-41, shift supvr., metallic factory, Dominion Amm. Co., Brownsburg, Que., with R.C.N. V.R., as follows: 1941-44, Asst. Inspector of Naval Ordnance, British Admiralty Delegation, New York, engaged in organization and supervision of inspectn. of British aerial and submarine torpedoes, responsible for physical and chemical tests of materials including castings and forgings, brake tests of engines, and working tests of all other sub-assemblies, assignments included, Officer i/c Can. Westinghouse torpedo engines, Officer i/c Precision Mfg. Corp., Fall River. Mass., 1944-45, Engr. Officer, operation of ship's machinery for 8 mos., i/c of repairs and alterations to torpedo tubes (destroyers), 6 mos.; now student at Univ. of Western Ontario, course in intensive business administration.

References: G. J. Dodd, D. S. Ellis, L. T. Rutledge, A. M. Swan, A. L. Furanna, E. R. Jarmain, L. A. Wright.

PAQUETTE—NORMAN ONESIME, of Vancouver, B.C. Born at Windsor, Ont., Aug. 10th, 1909. Educ.: S.B. (Arch.), Mass. Inst. Technology, 1932; R.P.E., Ontario; 1933-35, student engr., Crysler Engineering Institute, Detroit; 1935-41, asst. to chief engr., Crysler Corp., Windsor; 1941-42, tech. advisor, automotive prod. branch, Dept. of Munitions and Supply, Ottawa; with Stevenson & Kellogg, as follows: 1942-45, sr. engr., Toronto, 1945 to date, chief engr., Pacific Coast, Vancouver.

References: T. M. Moran, J. P. Fraser.

ROSE—DONALD CHARLES, of Valcartier, Que. Born at Prescott, Ont., April 17th, 1901. Educ.: B.Sc., M.Sc. (Engrg. Physics), Queen's Univ., 1923 and 1924 respectively; Ph.D., Cambridge Univ., 1927; 1929-30, lecturer in physics, Queen's Univ.; with National Research Council staff, as follows: 1939-42, i/c general physics lab., 1942-43, deputy director of scientific research, Royal Canadian Navy; 1943-45, scientific adviser to Chief of General Staff (Army); and at present, chief supt., Canadian Armament Research & Development Establishment.

References: C. J. Mackenzie, B. G. Ballard, J. H. Parkin, A. G. L. McNaughton, R. W. Boyle.

ROSS—ALEXANDER STIRLING, of 1045 Chilco St. ,Vanvoucer, B.C. Born at Renfrew, Ont., Jan. 1st, 1887. Educ.: private tutors; R.P.E., British Columbia; 1904-24, communication systems, instalns., mtce., cost estimating and designing, Northern Electric and Bell Telephone Co.; with British Columbia Telephone Co., Vancouver, as follows: 1924-44, equipt. engr., 1944 to date, equipt. and bldg. engr.

References: A. C. R. Yuill, A. D. Creer, J. H. McHugh, W. B. Greig, R. C. Pybus, J. S. Cameron, J. W. Fagan, G. Kearney.

ROSS—JOSEPH HOPE, 46 Curzon Ave., Montreal, West Que. Born at Calgary, Alta., April 9th, 1916. Educ.: B.A.Sc., Univ. of Toronto, 1939; Graduate, Royal Military College, 1937; 1939 (4 mos.), elect. engr., International Nickel Co.; with Royal Canadian Navy as Elect. Lieut. Cmdr., as follows: 1940-41, Officer i/c Degaussing Maritime Command, Halifax, 1941-44, Supt. of Degaussing, Ottawa; 1944-45, chief, Electrical Section, Wartime Shipbuilding Co., Ltd.; 1946 to date, design and sales engr., McGruer, Fortier Meyers Ltd., Montreal.

References: G. L. Stephens, A. V. Armstrong, E. G. Cullwick, F. S. B. Heward, C. L. Dewar, J. H. Ross, W. Eastlake.

SHUPE—CHARLES AHRENS, of Montreal, Que. Born at Kitchener, Ont., May 18th, 1917. Educ.: B.A.Sc., Univ. of Toronto, 1940; with Hydro Electric Power Commission of Ontario, as follows; 1940-42, asst. supt., and for 4 mos. during this period, acting supt., carrying the responsibility of a rural power district management; with the R.C.C.S., as follows: 1943-44, instructed Signal Officers in line transmission and telephone theory, 1944-45, went overseas with Signals draft, then to France, responsible for line communications of Signals, 2 Cdn. Corps, disbanded in 1945, 1945 (3 mos.), posted as Lines Officer for 1st L. of C. Signals, Breda, Holland, responsible for L. of C. Telephone ccts. for south Netherlands forces; 1946 to date, sales engr., Electric Tamper & Equipment Co. of Canada, Montreal.

References: S. Shupe, D. J. LaFontaine, M. A. P. Harrigan, W. F. Purves, O. J. McCullogh.

SMITH—GEORGE WASHINGTON, of Thetford Mines, Que. Born at Thetford Mines, Feb. 22nd, 1898. Educ.: home study and I.C.S. study for C.E.; 1920-41, mine supt., Bell Asbestos Mines Ltd.; with R.C.E., as follows; 1941-42, O/C 15 Field Coy., with the rank of Major, 1942-45, O/C 3 Battalion, with rank of Lt. Colonel; and at present supt., Bell Asbestos Mines Ltd., Thetford Mines Que. (applying for admission as Affiliate).

References: G. A. McClintock, H. R. Lynn, G. Dick, W. J. Johnson, H. R. Lynn.

SZWARC—ALEKSANDER, of 495 Prince Arthur St., W., Montreal, Que. Born at Zgierz, Poland, Dec. 1st, 1899. Educ.: Ph.D., (Chemistry), Univ. of Posnan, Poland, 1925, (educational qualifications guaranteed by the Assn. of Polish Engineers in Canada); 1925-27, analytical chemist, Empreza M.Met., Lisbon; 1927-30, analytical chemist, Etab. Kuhlman, Paris; 1930-39, worked as research and consultg. chemist in Poland;1941-43, research chemist, for Allied War Supplies,Montreal, and C.N.R.; 1943 to date, consultg. chemist, Howard Smith Paper Mills Ltd., Montreal.

References: H. Scott, C. H. Gordon, W. H. Wharton, L. Thomson, P. G. Gauthier, D. Goldwag, A. Gantz.

SZYMANSKI—MICHAL BERNARD, of 3210 Maplewood Ave., Montreal, Que. Born Warsaw, Poland, Aug. 28th, 1891. Educ.: Civil Engr., Univ. Of Warsaw, 1925, (education qualifications guaranteed by Assn. of Polish Engineers in Canada); R.P.E., Quebec (licensed; 1915-18, asst. engr. for highway and bridge constrn., Russian Army; with the Polish Ministry of War, Warsaw, as follows: 1918-25, asst. chief engr., 1925-27, chief engr.; 1927-29, prof. engrg. and designing, Military School, Warsaw, 1929-39, City of Warsaw, chief civil engr., (constrn. dept.); 1939, Capt. in Polish Army, (mobilized in Sept.), 1940, instructor in bridge bldg., with Polish Army in France; 1942-45, stress engr., Canadian Car & Foundry, propeller divn.; 1945, (7 mos.), stress engr., Noorduyn Aviation Ltd., Montreal; and at present, stress engr., Fairchild Aviation Ltd., Montreal.

References: D. O. Stapleton, J. Pawlikowski, D. Goldwag, J. K. Angerman, E. Stearns, M. Weinreb.

TINDALE—WILLIAM J., of South Slocan, B.C. Born at Eston, Yorks, Eng., Sept. 20th, 1886. Educ.: private study; R.P.E., British Columbia since 1920; 1913-18, chief dftsman., dfting and structl. design in stn. equipt., responsible for design, detail and specifications of elect. structures throughout Ontario for Ontario H.E.P.C.; 1918-20 ,dftsman., designer and checker, 4 mos., chief dftsman., British-American Nickel Corp.; 1920-26, dftsman., designer and checker, 1924, i/c design and detailing, Consolidated Mining & Smelting Co. of Can.; with West Kootenay Power & Light Co., Ltd., as follows: 1927-42, chief designing & hydraulic engr., i/c engrg. dept., responsible for layout, design and detail drawings of hydro elect. plants on Kootenay River, etc., 1942 to date, chief engr.

References: L. A. Campbell, E. M. Stiles, C. E. Webb, J. Robertson, S. C. Montgomery.

TRELOAR—GEORGE EDWARD, of 14 St. Andrews Gardens, Toronto, Ont. Born at Toronto, July 4th, 1893. Educ.: B.A.Sc., M.A.Sc., Univ. of Toronto, 1914 and 1915, respectively; R.P.E., Ontario; 1920-25, estimating, design, Dominion Bridge Co., Ltd.; 1925-34, consultg., private practice; with Sarniai Bridge Co., Ltd., as follows: 1934-40, branch mgr., 1940 to date, chief engr.; also, from 1922 to date, pres. and mgr., T. Tomlinson Foundry Co., Ltd.

References: C. F. Morrison, C. R. Young, W. S. Wilson, W. H. M. Laughlin, W. E. Ross, F. R. Ewart.

WOLEVER—FRANK DAY, of 536 Prince Albert Ave., Westmount, Que. Born at Montreal, Oct. 2nd, 1920. Educ.: B.Eng. (Mech.), McGill Univ., 1943; 1940-42 (summers), instru'man. on constrn., munitions plant and constrn. of Shipshaw, dftsman., Shawinigan Engrg.; 1943-45, R.C.N.V.R., as Lieut.(E)., and now demobilized.

References: C. M. McKergow, A. R. Roberts, J. A. Coote, W. W. Graham.

YOUNG—MINTO DUNCAN, of 1404 Wellington Crescent, South, Winnipeg, Man. Born at Dunrea, Man., March 28th, 1900. Educ.: B.Sc. (Elect. Engrg.), Univ. of Manitoba, 1925; R.P.E., Manitoba; with City of Winnipeg Hydro-Electric System, as follows: 1926, started with Company, 1930-38, distribution engr , 1938-43. asst. supt. of distribution, i/c design and operation of overhead and underground distribution system under genl. supt., 1943 to date, asst. general supt.

References: E. P. Fetherstonhaugh, J. W. Sanger, H. L. Briggs, T. E. Storey, E V. Caton, L. M. Hovey, D. A. McCuaig.

FOR TRANSFER FROM JUNIOR

ROUE—JOHN EDWARD, A/Lieut. Cdr.(L)., R.C.N., of 244 Spring Garden Road, Halifax, N.S. Born at Halifax, N.S., Aug. 25th, 1916. Educ.: B.Eng.(Elect.), Nova Scotia Tech. Coll., 1939 (7 mos.), asst. fieldman, inventory of elect. power and distribution, Nova Scotia Light & Power Co.; 1939-40, with Imperial Oil Co., Halifax, as follows: engrg. dept. i/c of dfting. office, preparation of reports, misc. engrg. work, process control dept., mtce. indicating, recording and control instruments; 1940 to date, with R.C.N., as Base Radar Mtce. Officer, on Staff, Director of Signals and at present Chief Radio Engr. Officer, H.M.C.S., Scotian. (Jr. 1944)

References: W. H. G. Roger, F. H. Sexton, J. R. Kaye, C. Scrymgeour, S. Ball, P. A. Lovett, D. S. Nicol.

VALIQUETTE—FRANCIS PIERRE, of Bourlamaque, Que. Born at Montreal, Que., July 31st, 1915. Educ.: B.A.Sc.,C.E., Ecole Poly., 1940; R.P.E., Quebec; 1940-44, Shawinigan Chemicals; 1944-45, Shawinigan Water & Power; 1945 to date, town mgr., Bourlamaque, Que. (Jr. 1945)

References: H. K. Wyman, A. C. Abbott, A. Trudel, L. Brossard, L. P. Cousineau, E. A. Delisle.

FOR TRANSFER FROM STUDENT

ARCHAMBAULT—JEAN HENRI, 3243 Van Horne Ave., Montreal, Que. Born at Montreal, Oct. 15th, 1915. Educ.: B.A.Sc.,C.E., Ecole Poly, 1941; R.P.E., Quebec; 1941 to date, service mgr., Lasalle Coke Company. (St. 1940).

References: L. A. Duchastel, J. A. Lalonde, P. P. Vinet, R. E. Matte, L. Trudel.

DANCOSE—LEON PAUL EMILE, of 549 Fourth Ave., Quebec, Que. Born at St. Evariste Station, Que., Dec. 15th, 1914. Educ.: B.A.Sc.,C.E., Ecole Poly., 1942 to date, engr. of mtce. of way, Levis Divn., Canadian National Railways, Quebec. (St. 1942).

References: J. E. Dumontier, H. Gaudefroy, C. A. Auclair, L. Roy, P. Vincent, L. Trudel.

DESAULLES—JEAN, of Three Rivers, Que. Born at Shawinigan Falls, Que., May 12th, 1914. Educ.: B.A.Sc.,C.E., Ecole Poly., 1940; 1940-41, joined staff of Shawinigan Water & Power Co.; 1941-45, Aero. Engr., R.C.A.F.; 1945 to date, industrial power sales and relations engr., Shawinigan Water & Power Co., Three Rivers, Que. (St. 1939).

References: C. R. Lindsay, L. A. Duchastel, L. Trudel, R. H. Mather, H. Beique. L. Roy, R. Dupuis.

DOEHLER—ROLF JOHN, of Montreal, Que. Born at Montreal, Nov. 1st, 1915. Educ.: B.Eng. (Civil), McGill Univ., 1940; 1940-41, dist. engr., Bell Telephone Co of Canada; 1941-45, with R.C.A.F., as Eng. Officer and Chief Tech. Officer; and at present asst. engr., Montreal Welding Company. (St. 1939).

References: R. DeL.French, G. J. Dodd, R. P. Vaughn, C. Frost, B. C. Nowlan.

DUNCAN—GAYLEN RUPERT, of Montreal, Que. Born at Ottawa, Ont., Aug. 6th, 1914. Educ.: B.Eng. (Elect.), McGill Univ., 1935; 1937-38, Lake Sulphite Pulp and John Stadler; 1938-39, Montreal Engineering; 1939-40, commercial supt. and asst. to genl. mgr., Venezuela Power Co.; 1940 sales engr., H. E. McKeen & Co. and

Electric Tamper & Equipt. Co.; 1942-45, Active Service as Lieut. and Capt. in R.C.C.S.; and at present, manager for Ontario, H. E. McKeen & Co., Ltd., and Electric Tamper & Equipt. Co., Ltd. (St. 1939).

References: D. J. Lafontaine, O. J. McCulloch, W. F. Purves, W. Schippel, J. H. McLaren.

EASTWOOD—JOHN RUSSELL, of Upper Alamville, Que. Born at Montreal, Que., Jan. 10th, 1916. Educ.: B.Eng. (Mech.), McGill Univ., 1939; with Consolidated Paper Corp., as follows: 1939-41, dftsman., making equipt. layouts, detailing work for instaln., etc., 1941-42, mtce. foreman; with Canadian Industries Limited as follows: 1943-44, scheduling engr., Nylon, Kingston, 1944-45, project engr., Nylon, Kingston, 1945 to date, works project engr., i/c requests for engrg. assistance and design work for constrn. jobs, Shawinigan Falls, Que. (St. 1939).

References: A. S. Holder, V. Jepsen, H. G. Timmis, E. T. Buchanan, J. R. Carter.

ESTABROOK—HOWARD ALBERT, of Arvida, Que. Born at Wallaceburg, Ont., Sept. 27th, 1918. Educ.: B.Sc. (Met. Engrg.), Queen's Univ., 1941; with Aluminum Co. of Canada, as follows: 1941-42, engr., aluminum reduction plant, 1942-43, supervisor, aluminum reduction plant, 1943 to date, supt., time study and efficiency dept., Arvida Works. (St. 1941).

References: M. L. Carey, F. T. Boutilier, B. E. Bauman, McN. DuBose, H. R. Fee.

MacKENZIE—JOHN JAMES, of 1021 Dominion St., Winnipeg, Man. Born at Toronto, Ont., June 1st, 1915. Educ.: B.Sc. (Elect. Engrg.), Univ. of Manitoba, 1938; with Canadian Westinghouse, Hamilton, as follows: apprentice, testing, motors and transformers, transformer design, correspondence dept.; 1940-45, Aero. and Elect. Engr. Officer, R.C.A.F.; and at present engr. and dftsman, Schumacher MacKenzie Ltd., Winnipeg, Man. (St. 1938).

References: A. E. Macdonald, J. W. Greenlaw, E. P. Fetherstonhaugh, E. Arnason, R. Stewart, R. T. Harland.

McCOLL—BRUCE JOHN, of 1340 Regent Road, Town of Mt. Royal. Born at Forest, Ont., March 29th, 1918. Educ.: B.Sc. (Mech.), Queen's Univ., 1944; with Canadair Limited ,Montreal, as follows: 1945, power plant engr., design office, preliminary design of power plants for Douglas DC-4M aircraft, chief, power plant section, i/c of power plant design section installing Rolls Royce Merlin engine in DC-4M aircraft, and at present, asst. to surpevisor, design office. (St. 1943)

References: A. Jackson, D. S. Ellis, R. E. Heartz, S. D. Lash, J. T. Dyment.

McRAE—ROBERT BRUCE, of 29 Galt St., Sherbrooke, Que. Born at Edmonton, Alta., Nov. 14th, 1915. Educ.: B.Sc. (Elect. Engrg.), Univ. of Alberta, 1936; M.A.Sc., (Elect. Engrg.), Univ. of Toronto, 1937; 1937-42, industrial engr., time and motion studies, work simplification ,etc., i/c all elect. design and work, cost accounting; Julius Kayser & Co., Sherbrooke, Que.; 1942-45, Lieut., R.C.E.; 1945 to date, plant engr. and supvr. of purchasing, Julius Kayser & Co., Ltd., Sherbrooke, Que. (St.1937).

References: R. M. Hardy, H. J. MacLeod, J. W. Porteous.

NEIL—CHARLES HAMILTON, of Three Rivers, Que. Born at Pembroke, Ont., Oct. 10th, 1915. Educ.: B.Sc. (Mech.), Queen's Univ., 1940; 1049-42, asst. to steam supt., Wayagamack Divn., Consolidated Paper Corp., Three Rivers, Que., steam plant operation, piping layouts and automatic steam controls for paper machines, heating and air conditioning; 1942-45, with R.C.O.C., Overseas, repatriated in Oct., 1945, and discharged on Nov. 24, 1945; at present, asst. steam supt., Wayagamack Divn., Consolidated Paper ,Three Rivers, Que. (St. 1940).

References: H. G. Timmis, E. Butler, F. W. Bradshaw, H. G. Conn, P. C. Kirkpatrick.

ONASICK—PETER, of Fort William, Ont. Born at Toronto, Ont., June 11th, 1917. Educ.: B.A.Sc., Univ. of Toronto, 1943; De Cew Falls Extension from power house to Henley, complete charge of engrg. end in constrn. of wiers, etc., Canadian Dredge & Dock Co., Ltd.; 1944-45, genl. dfting., keeping various hydraulic records, charts and graphs, etc., Ontario H.E.P.C.; with Canadian Dredge & Dock Co., Ltd., at Clarkson and Port Burwell i/c engrg. on various projects, and at present, chief field engr., Fort William, Ont. (St. 1943).

References: W. E. Bonn, O. Holden, S. H. deJong, R. F. Legget, S. W. B. Black.

SCHOFIELD—WILLIAM DOUGLAS, of Waterloo, Que. Born at Winnipeg, Man., May 11th, 1914. Educ.: B.Eng. (Mech.), McGill Univ., 1940; R.P.E., Quebec, 1933-40, (summers), apprentice car building, Canadian National Railways; 1941-45, with R.C.E.M.E., as Officer Commanding Light Aid Detachments and Workshop; and at present, mech. supt., Slack Bros., Waterloo, Que. (St. 1939).

References: N. S. B. Watson, D. C. NacCallum, E. Brown, R. DeL. French, H. G. Thompson.

LIBRARY NOTES

(*Continued from page 209*)

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

A.S.M. REVIEW OF METAL LITERATURE, Vol. 1, 1944

Prepared by T. Reinberg. American Society for Metals, Cleveland, Ohio, 1945. 699 pp., 9 x 6 in., cloth, $15.00.

This volume contains the annotated lists of books and articles published during the year 1944 that appeared serially in "The Metals Review". The entries are classified carefully, and author and subject indexes are provided, affording three approaches to the literature. Appended is a bibliography of publications on quality evaluation that appeared between 1925 and 1932. The book is a valuable addition to metallurgical reference books.

AERIAL NAVIGATION

By H. E. Benham. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 344 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $4.00.

Beginning with a description of the characteristics of the earth and the methods of depicting all or parts of it on charts or maps, this book proceeds to describe the underlying principles of the main methods of aerial navigation. The effective techniques for applying these fundamentals to practical navigation are explained in detail with a wealth of helpful illustrations. A brief glossary of terms and abbreviations is appended.

PRACTICE of PRINTING

By R. W. Polk. Manual Arts Press, Peoria, Ill.; Copp Clark, Toronto, 1945. 300 pp., illus., diagrs., charts, tables, 8 x 5 in., cloth, $4.00 in Canada.

This work covers the essentials of a well-rounded apprentice training in the printing industry. Types, type cases and type setting are described in detail; the composition of text, tabular forms, stationery, advertisements, books, etc., is discussed with many illustrations; presses, composing machines, paper and inks are covered; the fundamental principles of display and the use of decoration and color are explained. The first chapter presents a brief history of printing, and the last chapter describes photo-offset-lithography. There is a glossary of trade and technical terms.

STRENGTH of MATERIALS

By A. P. Poorman. 4th edit. McGraw-Hill Book Co., New York and London, 1945. 339 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.00.

This standard textbook is intended for use in undergraduate courses in mechanics, and a knowledge of the principles of physics, the calculus, and statics is assumed. The first two chapters cover the general topics of stresses and strains in tension, compression and shear. The rest of the book deals with shear and moment in beams, stresses and deflections in beams, columns, riveted and welded joints, and resilience in bars and springs. Material on aluminum, duralumin and magnesium columns has been added in the new edition, with new problems throughout.

TABLE of ARC SIN X.

Prepared by the Mathematical Tables Project, conducted under the Sponsorship of the National Bureau of Standards, present volume began under the auspices of the Works Projects Administration for the City of New York. L. J. Briggs and A. N. Lowan, Directors. Published by Columbia University Press, New York, 1945. 121 pp., tables, 10¾ x 7¼ in., cloth, $3.50.

This present table of 12-place values of Arc sin x, in radian measure, may be regarded as a companion volume to the previously published Table of Arc tan x. The function is tabulated at intervals of 0.0001 in the range between 0 and 0.9890, and at intervals of 0.00001 in the range between 0.98900 and unity. A few useful auxiliary tables are included.

TABLES of ASSOCIATED LEGENDRE FUNCTIONS,

Prepared by the Mathematical Tables Project, conducted under the sponsorship of the National Bureau of Standards, L. J. Briggs, Director, and A. N. Lowan, Project Director. Columbia University Press, New York, 1945. pp. xlvl—306, tables, 11 x 7¼ in., cloth, $5.00

Legendre functions are encountered in the general solution of the differential equations of wave motion and the potential theory in spherical coordinates. The present volume of a series of mathematical tables was produced to meet needs for a table of Legendre functions to about six significant figures at intervals of 0.1. Further work is to be done to improve the process of interpolation of these functions.

THEORY of STRUCTURES.

By S. Timoshenko and D. H. Young. McGraw-Hill Book Co., New York and London, 1945. 486 pp., diagrs., charts, tables, 9 x 6 in., cloth, $5.00.

The various practical methods of analysis of trusses and frames are shown as a development of the general principles of mechanics. Separate chapters deal with the analysis of statically determinate trusses in one plane, influence lines, space trusses with hinged joints, principles of mechanics preparatory to the analysis of statically indeterminate structures, deflection calculations for trusses, bending of beams and frames, and the theory of arches.

TRANSMISSION LINES, Design, Construction and Performance.

By F. C. DeWeese. McGraw-Hill Book Co., London and New York, 1945. 297 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.50.

With clear explanation, illustrative examples, and typical problems, this book presents both the fundamental and the more involved aspects of electric power transmission engineering. It provides data and material applicable not only to transmission line problems but also to other problems of a similar nature. Special attention is given to modern methods of field work and to the recent developments in transmission line devices. (*Continued on page 216*)

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET,
MONTREAL 2, QUE.

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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.

NOTICE

SERVICE PERSONNEL: The completed rehabilitation questionnaires have indicated a need for the employment service to be made available to all members of the E.I.C. in the Armed Forces. It is suggested that all those who are interested—

1. Consider these positions as indicative of present conditions.
2. Reply to interesting advertisements to establish contact for the future.
3. Apply for any of these positions when discharge is imminent.

CIVILIAN TECHNICAL PERSONNEL should not reply to any of the advertisements for situations vacant unless—

1. They are registered with the Wartime Bureau of Technical Personnel.
2. Their services are available.
A person's services are considered available only if he—
(a) is unemployed;
(b) is engaged in work other than of an engineering or scientific nature;
(c) has given notice as of a definite date; or
(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.

Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.

Situations Vacant

CHEMICAL

TECHNOLOGIST, preferably a chemical graduate, age 25 to 30, bilingual, with maturity, poise and personality is required by a firm in the Montreal area to be trained in U.S.A. in connection with solution of packaging and processing problems in field, factory and laboratory. Excellent salary is offered to suitable candidate. Apply to Box No. 3315-V.

GRADUATE CHEMICAL ENGINEER with good personality is required to act as assistant or second in command of a department, to be responsible for allocation of work to employees as well as administrative duties. Permanent position. Location northern Ontario. Salary $300.-350. month. Apply to Box No. 3362-V.

CHEMICAL ENGINEER, preferably graduate with natural aptitude for mathematics to head up a new department on statistical quality control for a paper company in Ontario. Good personality essential, with ability to contact employees and superintendents amicably. Salary about $350. a month depending on ability. Apply to Box No. 3362-V.

CHEMICAL ENGINEER with some experience in the use of control instruments (Bailey, Brown, Mason, etc.) is required for work in a paper mill in northern Ontario. Apply to Box No. 3362-V.

JUNIOR CHEMICAL ENGINEER, preferrably ex-sevice man, not necessarily experienced, is required for experimental and research work on the potentialities of newsprint for a company in Ontario. Starting salary of about $200 to 225. a month. Apply to Box No. 3362-V.

CIVIL

CIVIL ENGINEER, graduate, is required by a firm in Montreal to supervise construction, according to specifications, of new buildings all across Canada. Preferably young man with enough experience . Salary will be $300. to $400. a month. Apply to Box No. 3292-V.

TWO CIVIL ENGINEERS, age 25-40 are required as (1) road construction engineer and (2) general building construction engineer, for estimating , organizing and supervising construction work for a firm in Newfoundland. Some designing and draughting. Salary open according to qualifications. Apply to Box No. 3318-V.

CIVIL OR MECHANICAL ENGINEER, not necessarily a graduate, age 24-30, some experience in concrete and steel draughting, some sales ability, required to work with a consulting engineer and contractor in Montreal. Salary open. Apply to Box No. 3339-V.

CIVIL ENGINEER, young graduate with 2 or 3 years experience, is required to be trained for survey work on municipal, sewer, drainage, etc. problems with a consulting engineer in southern Ontario. (Might eventually be partner). Salary $200. to $225. a month. Apply to Box No. 3340-V.

CIVIL ENGINEER, young man with some experience, is required for survey work on a construction job in the Eastern Townships of Quebec. This is a temporary position and would be worth up to $300. a month. Apply to Box No. 3341-V.

CIVIL ENGINEER, age 30 to 40, bilingual with construction and hydraulic experience, is required for the Richelieu River development. Headquarters in Montreal, field work in St. Jean, Que. Salary $3000. to $3600. per year. Apply to Box No. 3348-V.

TWO CIVIL ENGINEERS, graduates with one or more years experience, are required for hydro electric construction and development in South America. Salary $300. to $350, a month. Applu to Box No. 3350-V.

SEVERAL CIVIL ENGINEERS, two with two or three years' experience in road construction and two recent graduates, are required for road building work in northern Quebec. Salary $2400. to $3000 a year. Apply to Box. No. 3351-V.

GRADUATE CIVIL ENGINEER, three or four years out of college, is required for surveying in bush in the Ottawa district, able to take charge of survey and do some plotting, make studies, etc. at office. Salary about $250. a month. Preference to veterans. Apply to Box. No 3357-V.

CIVIL ENGINEER graduate with a good background of experience is required to act as superintendent or project manager for a large company in the Montreal area. Experience in heavy building construction essential. Age 40-50. Salary open. Apply to Box No. 3358-V.

CIVIL ENGINEER, experienced in concrete and steel construction, is required for structural work with a paper company in Ontario. Apply to Box No. 3362-V.

CIVIL ENGINEER is required for work involving maintenance of company houses, roadways, sewage, lighting etc., in a townsite in Ontario for a large paper company Good personality and ability to deal with the public. Salary about $300. up a month. Apply to Box No. 3362-V.

CIVIL ENGINEER, experienced in highway or road construction, is required to act as resident engineer to extend railway spur for a large paper company in Ontario. Position would last six to eight months with good living accommodation on job. Salary $275. a month plus room and board. Apply to Box No. 3362-V.

CIVIL ENGINEER with some experience in highway or railway construction is required by a paper company in Ontario to act as instrumentman. Able to do some layout work on railway lines, take cross sections, calculate earth quantities and be familiar with surveying instruments. Salary about $200-225. a month plus room and board. Apply to Box No. 3362-V.

TWO CIVIL ENGINEERS, preferably but not necessarily graduates, are required to act as structural steel draughtsmen or checkers for a company engaged in this sort of work in Alberta. All applications should indicate education, experience and salary expected. Apply to Box No. 3365-V.

CIVIL OR MECHANICAL ENGINEER with four or five years experience in a pulp and paper company is required by a company engaged in this work in eastern Ontario. Apply to Box No. 3367-V.

ELECTRICAL

ELECTRICAL OR MECHANICAL ENGINEER is required by a firm in Ontario, for work in connection with research and development in electrical farm equipment. Some experience in design and manufacturing methods desirable. Apply to Box No. 3309-V.

ELECTRICAL ENGINEER with experience in steam power engineering is required by a consulting firm in the Montreal area for work in connection with the construction of a new chemical pulp mill. Salary up to $450. a month according to qualifications. Apply to Box No. 3312-V.

SIX ELECTRICAL ENGINEERS, preferably graduates, but not necessarily experienced, are required for specification work by a company in Montreal engaged in the production of telephone systems, automatic dialing equipment, etc. Preference will be given to young veterans, who will be completely trained. Salary $170. to $250. a month. Apply to Box No. 3324-V.

TWO ELECTRICAL ENGINEERS, graduates with at least five to ten years experience, preferably but not necessarily bilingual, are required for office engineering in connection with design and layout of sub-stations and transmission lines by a power company in Quebec. Salary $300. to $400. a month. Apply to Box No. 3329-V.

ELECTRICAL ENGINEER, graduate, young man with at least one year of construction experience since graduation, bilingual, is required for work in connection with the erection of wood pole, steel tower transmission lines and sub-stations in various parts of the province of Quebec. Salary open. Apply to Box No. 3332-V.

ELECTRICAL ENGINEER, graduate with a minimum of two years' experience, including a background in power generation. Preference to veterans. Location: southern Ontario. Salary $225. to $275. a month. Apply to Box No. 3344-V.

ELECTRICAL ENGINEER with some experience with machinery and/or electrical installation work, with ability to get along with people, and interested in investing some capital, is required for executive work with a small company on the west coast for work in connection with the electrical machinery requirements and installation of lighting and power plants in the province. Salary open. Apply to Box No. 3352-V.

SEVERAL ELECTRICAL ENGINEERS, two experienced ,if possible, in transmission and distribution line work; two recent graduates are required for rural electrification work in the province of Quebec. Salary $2400.-3000. yr. Apply to Box No. 3368-V.

ELECTRICAL ENGINEER, not necessarily experienced (recent graduates may apply) is wanted for design work on power distribution systems, by a firm of consulting engineers in Montreal. Salary $175. a month to start. Apply to Box No. 3371-V.

MECHANICAL

MECHANICAL ENGINEER, graduate, with at least four year's experience, some of it supervisory is required by a firm in Montreal, to be responsible for the maintenance of textile machinery and equipment. Age 26-32. Location: Ontario. Salary about $250. to $300. a month. Apply to Box No. 3294-V.

MECHANICAL ENGINEER, recent graduate, preferably ex-service man is required by a company in the Toronto area for work in salt processing, steam heating evaporators, power plant etc. Age 25-27. Salary $200. to $300. a month depending on qualifications. Apply to Box No. 3308-V.

MECHANICAL ENGINEER, age about 35-40 with experience in thermo-dynamics, mechanical and chemical work is required to be chief engineer of a company in the Toronto area. Preference to ex-service man. Salary about $400-$600. a month. Apply to Box No. 3308-V.

FIVE MECHANICAL ENGINEERS, preferably graduates but not necessarily experienced, are required for manufacturing methods engineering by a company in Montreal engaged in the production of telephone systems, automatic dialing equipment, etc. Preference will be given to young veterans who will be completely trained. Salary $170 to 250. a month. Apply to Box No. 3323-V.

MECHANICAL ENGINEER, with 4 or 5 years industrial experience since graduation, with knowledge of and interest in steam as applied to industrial equipment, and by preferably some experience in ventilation work and in pulp and paper mills, is required by a company in southern Ontario. Salary $3600. per year. Apply to Box No. 3333-V.

MECHANICAL OR CIVIL ENGINEER, with at least five years' experience in pulp and paper industry, and capable of assuming responsibility, is required to plan, direct, and technically supervise new development work in the mills of a company with headquarters in southern Ontario. Salary $4800 to $6000 per year. Apply to Box No. 3334-V.

THREE MECHANICAL ENGINEERS, recent graduates, (1946) for draughting and engineering work in the office and field. Location: southern Ontario. Preference to veterans. Salary $200. to $225. a month. Apply to Box No. 3344-V.

MECHANICAL ENGINEER, preferably graduate, with some experience in general lines of contractors' equipment including tractors, shovels, diesel engines, concrete machinery, etc., is required to act as manager of machinery department head office of a large machinery house in the maritimes. Salary excellent. Apply to Box. No. 3353-VI

MECHANICAL DRAUGHTSMAN is wanted for layout and design work in a pulp and paper mill in the province of Quebec. Salary $250. to $275. a month. Apply to Box No. 3354-V.

MECHANICAL ENGINEER, graduate, with some experience in the sale of marine engines, is required to head up the marine department of a large machinery house in the maritimes. Remuneration would depend entirely on the ability and efforts of successful candidate. Apply to Box No. 3355-V.

EIGHT MECHANICAL ENGINEERS or senior draughtsmen are required for design on a large plant extension project near Montreal. Salary $200. a month and good room and board available. Apply to Box No. 3360-V.

MECHANICAL ENGINEER, senior man is required for responsible position in a pulp and paper mill in the province of Quebec. Salary open according to qualifications. Apply to Box No. 3361-V.

MECHANICAL OR ELECTRICAL ENGINEER, preferably but not necessarily with some experience on design of tools and small parts is required by a company in the Montreal area. Salary: open. Apply to Box No. 3374-V.

MECHANICAL ENGINEER with some experience, and ability to handle men is required to act as rock quarry superintendent for a company in southern Ontario Company house available on property. Replies, which will be treated confidentially, should state experience, salary required, availability and should be addressed to Box No. 3378-V.

TWO OR THREE MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

MINING ENGINEER

MINING ENGINEER, with good experience, is required by a company in Brazil, South America, engaged in the mining and smelting of lead. Successful candidate would have complete authority to operate mine, and in addition to salary would have house accommodation provided. Salary open. Apply to Box No. 3321-V.

MISCELLANEOUS

SALES ENGINEER, not necessarily a graduate but with engineering qualifications and aptitude, is required by a firm in Ontario engaged in selling machinery to the construction industry. Veteran preferred. Apply to Box No. 3290-V.

DRAUGHTSMAN, not a graduate, is required by a firm in Montreal engaged in heating and ventilating work. Prefer young man with little or no experience, to be trained. Apply to Box No. 3293-V.

SERVICE REPRESENTATIVE is required by a firm in Toronto to sell automotive, electrical and fuel system parts, and to train automotive mechanics. Position would be in Ontario and salary is open according to qualifications. Apply to Box No. 3295-V.

ARCHITECT, graduate, preferably, but with some reasonable experience, with good background and personality is required by a firm in Montreal. Interested in someone willing to start at the bottom with prospects of eventually becoming a partner in the firm. Apply to Box No. 3298-V.

DRAUGHTSMAN, preferably someone experienced in process piping work in food industries is required by a firm in the Montreal area engaged in consulting work Apply to Box No. 3299-V.

DRAUGHTSMAN, not necessarily a graduate but experienced, to assist in the work of preparing machinery, pipe arrangements and details of cargo ships, is required by a firm on the west coast. Salary about $225. a month. Apply to Box No. 3302-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of high grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose photograph to Box No. 3303-V.

SALES ENGINEER, with some experience and if possible, bilingual, is required by a company in Montreal handling contractors' equipment, road building equipment, electrical devices such as generators and vibrators and snow machinery. Salary open according to qualifications. Apply to Box No. 3304-V.

SALES ENGINEER not necessarily a graduate but with some mechanical ability is required by a firm in Montreal. Candidate must be willing to travel throughout Canada selling to paper mills and will be trained by company. Age 25-30. Starting salary $175.-$250. a month. Apply to Box No. 3311-V.

SEVERAL DRAUGHTSMEN are required by a consulting firm in the Montreal area for layout and design work, piping, electrical layouts, detail, etc. Apply to Box No. 3312-V.

ENGINEER, French, bilingual, with some accounting and business experience is required by a company in the Montreal area to investigate prospects for loans, examine premises, evaluate assets, check expansion programmes and study personnel. Salary about $4000. a year. Apply to Box No. 3317-V.

TECHNICAL SALES ENGINEERS are required by an oil company in the Montreal area. Candidates must be bilingual, and experience may range from recent graduate up. Salary will be $150. to $250. a month depending on qualifications. Apply to Box No. 3320-V.

YOUNG ENGINEER, age 25-30, not necessarily a graduate, interested in photography, publicity, editorial and journalistic work, is required to act as assistant to the Sales Development Manager of a large company in the Montreal area. Salary $200-225 a month. Apply to Box No. 3322-V.

DESIGNING ENGINEER with four or five years experience in designing and detailing is required for work with consulting engineer in Vancouver. Salary is open according to qualifications. Apply to Box No. 3325-V.

TWO INSTRUMENTMEN, one experienced on layout and quantities on heavy construction, the other experienced in transit surveys and levelling, are required for survey work in eastern Ontario. Standard salaries will be paid and work will last for possibly two years or more. Apply to Box No. 3327-V.

TWO DESIGNERS, with a minimum of three years draughting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V.

GRADUATE ENGINEER, age 25-35, preferably married wth five to 10 years experience in the design of complicated machines to be trained in the designing of shoe machinery. Starting wage will range from $60. to $75. a week for five-day week. Apply to Box No. 3330-V.

TWO ARCHITECTURAL DESIGNERS AND DRAUGHTSMEN, or architects with some experience in modern materials and design are required by a young progressive firm of architectural designers and engineers in Alberta. Salary will be commensurate with ability. Apply to Box No. 3331-V.

INDUSTRIAL ENGINEER is required by a city in New Brunswick to accept the appointment of Industrial Commissioner. Salary good. Apply to Box 3337-V.

GRADUATE ENGINEER, veteran, interested and talented in editorial work, age 27-30, is required for work in Montreal. Salary open. Apply to Box No. 3349-V.

TWO ENGINEERS experienced in heating and ventilation work in the newsprint field are required by a pulp and paper mill in eastern Canada. Salary open according to qualifications. Apply to Box No. 3356-V.

SEVERAL ENGINEERS, recent graduates in chemical, civil, electrical or mechanical engineering, are wanted to undertake an eight-month's course in pulp and paper with a company in Ontario. Permanent positions will be available for successful candidates. Apply to Box No. 3363-V.

ONE MECHANICAL AND TWO ELECTRICAL OR CHEMICAL graduates are wanted for a two-year course with a firm manufacturing electric wire and cables, telephone equipment, etc. Training through various departments of several factories, including some sales. Salary about $175. a month. Apply to Box No. 3364-V.

TRAINING SUPERVISOR to act as assistant to personnel manager, not necessarily a graduate but with engineering background and knowledge of shop procedures. Must be completely bilingual. Age 28-35. Location: Eastern Townships of Quebec. Salary about $3000. a year. Apply to Box No. 3370-V.

TWO ARCHITECTURAL DRAUGHTSMEN, not necessarily graduate engineers, are required for positions with a railway company in Montreal. Salary in accordance with qualifications. Apply to Box No. 3372-V.

MECHANICAL, ELECTRICAL OR CIVIL ENGINEER, recent graduate who must have fluent knowledge of Spanish, preferably under 30, is required by a firm in the Montreal area for technical work in connection with production. Some travelling. Salary open according to qualifications. Apply to Box No. 3373-V.

RECENT GRADUATE in chemical, mechanical or electrical engineering is required to be trained in heating and ventilating field with a company in Montreal. Candidates should be completely bilingual. Salary $30. to $50. a week. Apply to Box No. 3375-V.

DRAUGHTSMAN is required for design work, preferably with some experience in the construction field. Work will involve estimates and detailing of precast concrete work. Salary about $250. a month depending on qualifications. Apply to Box No. 3376-V.

ENGINEER, with considerable experience in foundry work and administration, is required for a senior position by a firm of manufacturers with head office in Toronto. Salary range $5000.-$8000. a year. Apply to Box No. 3379-V.

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

CHEMICAL

SEVERAL CHEMICAL ENGINEERS for technical service and plant operations, (not laboratory work) with good personality and background are required by a manufacturer in Montreal. Preference will be given to ex-service men and successful candidates will be completely trained at a starting salary of $170. per month. Apply to Box No. 3260-V.

CHEMICAL ENGINEER, preferably with graduate training in chemical engineering and some industrial experience will shortly be required in the chemical engineering department of a university in Ontario. Apply to Box No. 3280-V.

CIVIL

STEEL BRIDGE INSPECTOR, not necessarily a graduate but with good experience, is wanted by a railway company with headquarters in Montreal, to supervise the erection and repair of steel bridges. Salary about $250. a month. Apply to Box No. 3246-V.

SALES ENGINEER with knowledge of building materials, preferably discharged service man with sales ability and inclinations, is required by a manufacturer in Montreal. Successful candidate will have opportunity to become head of this department. Salary is open according to qualifications. Apply to Box No. 3263-V.

CIVIL ENGINEER, graduate with road construction experience, preferably bilingual, age 30-45 years, is required to act as sales engineer for a manufacturer of building materials in Montreal. Candidates should have good personality and appearance to be able to contact government officials, sit in at council meetings, etc. Apply to Box No. 3264-V.

MISCELLANEOUS

CONSTRUCTION AND MAINTENANCE ENGINEER and a DESIGNING ENGINEER, preferably with pulp and paper mills experience are wanted for a paper mill in Newfoundland. Salaries would be from $250. a month up depending on qualifications. Apply to Box No. 3239-V.

PRODUCTION ENGINEER, either graduate or with good practical experience is required by a manufacturer in eastern Ontario. Candidates should be 30 to 40 years old and should have experience in production methods in the manufacture of small parts and assemblies, and in cost control. Apply to Box No. 3257-V.

SAWMILL SUPERINTENDENT, not necessarily a graduate engineer but with practical experience in the production of lumber and preferably with some engineering training is required for a mill in western Quebec. Successful candidate would be in charge of mill production and would supervise the piling and shipping of lumber and also would supervise the steam plant, machine shop, garage, etc. Salary would be about $300. a month. Apply to Box. No. 3274-V.

GRADUATE ENGINEER in mechanical and electrical is required for a junior position as assistant to the works engineer of a company in southern Ontario engaged in the manufacture of wire, fences, gates, mesh, etc. Apply to Box No. 3278-V.

GRADUATE ENGINEER with a good knowledge of the manufacture of steel containers such as oil drums, etc., and with sales and manufacturing inclinations is required by a manufacturer of this type of product in Toronto. Apply to Box No. 3281-V.

Situations Wanted

SENIOR REINFORCED CONCRETE DESIGNER and civil engineer, R.P.E. (Ont). experienced field and office, various countries, seeks first class opening. Apply to Box No. 107-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., age 39, married, B.Sc., U.N.B., widespread experience in construction with experience in plant maintenance both in civilian and Air Force capacities. Interested in responsible position involving plant maintenance. Apply to Box No. 225-W.

CIVIL ENGINEER, B.Sc.M.E.I.C., R.P.E. (Man.) and Dominion Land Surveyor, now in the army but expects early discharge. Experience comprises seven years air photo surveys, land subdivision, drainage plans, precise levels and topographic mapping and seven years administrative and technical direction in connection with sewers, water mains, roads, building and camp construction. Age 42, married. Apply to Box No. 589-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont.), age 42, married. Experience in general plant engineering work, design, layout and testing of equipment. Also worked as field engineer on various construction projects. Position in Ontario preferred. Apply to Box No. 1249-W.

EXECUTIVE ENGINEER available. Graduate in mining, Jr.E.I.C., age 35, married, two dependents. Five years' experience in mining and milling, mine development, construction and operation. Canadian and foreign experience. Five years' administrative experience, mass production, development and supervision. Was assistant superintendent of operations in large industrial munitions works. Capable of handling personnel and planning, seeks a responsible position in industrial business or mining. Available on short notice, registered with W.B.T.P. Apply to Box No. 1423-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont). interested in mechanical design and production; experienced in hydro-electric station design, transformer and machine layouts and in development and design of radar equipment. Services available immediately. Location preferred: Toronto or Hamilton. Apply to Box No. 1693-W.

GRADUATE ENGINEER, B.Sc. (Civil) M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to Box No. 2440-W.

MECHANICAL ENGINEER, age 34, Lt. (E) R.C.N.V.R. soon to be discharged. Experience, 6 years' heavy maintenance on railroad; 5 years as charge hand on maintenance and renewal of mine and smelter equipment, 2 years foreman of large boiler shop; 2 years production engineer, job estimating and planning, two years with Navy of which 20 months have been at sea. Thorough knowledge of machine and boiler shop, able to plan and handle men, registered with W.B.T.P. Apply to Box. No. 2456-W.

CHEMICAL ENGINEER, young university graduate, previously engaged in war industry, desires permanent position. Available immediately. Apply to Box No. 2464-W.

MECHANICAL ENGINEER, Jr. E.I.C., age 23, single, with degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy. Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

GRADUATE ELECTRICAL ENGINEER, UBC '41, P.E. Ont., Associate A.I.E.E. Age 32, married, one child. Six years school teaching, five months thawing assistant engineer; first class honors degree, C.G.E. Test Course. Major, Technical Staff, R.C.E.M.E., four years active service. Radar trained. Active part in build-up of Canadian Army Telecommunications maintenance and repair organization and production of technical literature. Accustomed to planning, forecasting, general organizing and supervision. Not a specialist. Available in B.C. after discharge February '46. Apply to Box No. 2588-W.

MECHANICAL ENGINEER, Jr.E.I.C., single, age 27, graduate Royal Naval Engineering College (Practical Engineering Prize) wishes work of practical nature, mainly outdoor. Interested in operation or construction of steam, hydro or internal combustion machinery. Eight years in R.C.N., including operational, overseeing and instructing. Medical discharge. Seven months on shipyard staff. Prefer to remain near Pacific Coast but would consider temperate climate like New Zealand, South Africa, southern England. Apply to Box No. 2589-W.

GRADUATE MECHANICAL ENGINEER (Sask. '36). Six years' experience on estimating, design and construction of industrial buildings and heavy equipment installation as well as a fair amount of general shop experience. Four and a half years as Engineer Officer in R.C.A.F. Two years in charge of servicing and maintenance of Anson trainers and two years in charge of Mosquito maintenance with operational squadrons in England and Europe. Interested in executive position on construction maintenance. Apply to Box No. 2591-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in Canada and abroad in tool design, product design, shop and industrial engineering, labour relations. Successful organizer. Available due to closing of war plant. Apply to Box No. 2592-W.

CHEMICAL ENGINEER, single, age 25, B.Sc., Sask. '42. Recently discharged from the army. At present taking post graduate work. No significant industrial experience. Interested in a position in production or plant control. Services available in May 1946. Apply to Box No. 2593-W.

CHEMICAL ENGINEER, B.A.Sc., U.B.C., S.E.I.C., Jr.A.I.Ch.E., age 25, married, no dependents, residing in east, desires employment in production control and/or sales service in Ontario or Quebec. Apply to Box No. 2594-W.

CIVIL ENGINEER, R.P.E. (Ont.) desires executive position as plant engineer; seventeen years' experience, initial and layout surveys and plant installation for production of gold, coal and slate. Drainage design and road construction. Five years construction engineer officer (R.C.A.F.) supervising the construction and maintenance of air stations under the Commonwealth Air Training Plan. Available on one or two months' notice. Apply to Nox. Bo. 2595-W.

ELECTRICAL ENGINEER, R.P.E. (Ont.) age 28, married, C.G.E. Test Course and Sales. Five years' plant experience in direct charge of engineering, maintenance and construction of several large chemical plants. Would consider employment with progressive engineering organization or in sales. Prefer Ontario. Apply to Box No. 2596-W.

MECHANICAL ENGINEER, B.Sc. Queen's, Jr. E.I.C., R.P.E., (Ont.) age 28 single, recently returned from overseas after service with R.C.E.M.E., presently in Ottawa, available shortly. Experience includes one year as demonstrator in thermodynamics, machine design, fuel testing laboratories; one year instructor R.C.A.F. wireless course; four years Telecommunication Officer R.C.E.M.E., maintenance radar, wireless and electrical equipment, experience in handling men. Willing to go anywhere in Canada. Apply to Box. No 2601-W.

PART-TIME SERVICES Engineer with 25 years construction experience, now operating a private practice, would consider part-time sales agency for building materials or equipment. Location: Maritime provinces. Apply to Box No. 2606-W.

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LIBRARY NOTES

(*Continued from page 212*)

TREATISE ON APPLIED HYDRAULICS

By H. Addison. 3 ed. rev. and enl. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 514 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $6.50.

The purpose of this book is to present a compact summary of the fundamental principles of hydraulics and of the manner in which they are supplied by the engineer. Particular attention has been given to the following topics: frictional loss in closed and open conduits; pressure and thrust on immersed solids; water-hammer in pipes; and pressure distribution on pump and turbine blades. There is a bibliography divided by chapters.

URANIUM AND ATOMIC POWER

By J. De Ment and H. C. Dake. Chemical Publishing Co., Brooklyn, N.Y., 1945. 343 pp., illus., diagrs, charts, tables, 9 x 5½ in., cloth, $4.00.

Following a brief discussion of the background and possibilities of atomic power, come chapters on the constitution of uranium minerals and prospecting methods. Chapters 4 and 5 deal respectively with the physics and chemistry of uranium. Chapters 6 and 7 cover in detail the methods used in the detection and determination of uranium. A large bibliography of original sources of information and a number of tables of useful data are appended.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their February 1946 copy to headquarters.

On account of difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

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* * *

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COVER PICTURE

To save precious cargo space, the nourishing value of eggs is reduced to its simplest form, before being shipped to the millions of hungry people in Europe. The cover picture shows the huge cone into which the egg mixture is pumped at high pressure through a tiny nozzle, is immediately dried by an air current and settles to the bottom as egg powder.

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WARTIME PRODUCTION OF PRECISION OPTICS IN CANADA

D. C. R. MILLER, M.E.I.C.

Development engineer, Fiberglas Canada Limited, Oshawa, Ont., formerly production superintendent of optical shops, Research Enterprises Limited, Toronto, Ont.

This is the first of four instalments of a paper describing the establishment, as a result of war exigencies, of a new industry in Canada. Because of the special interest created among engineers by this development, and the dearth of literature on the production of precision optical parts, the Publication Committee has allocated this unusual amount of space to the paper.—Ed.

The Nature of the Problem

When, late in 1940, war developments led to the decision to produce precision optical instruments in Canada, not the least of the difficulties involved was the quantity production of precision optics. This problem was itself a formidable one, quite apart from the problems of producing optical glasses, producing intricate metal parts and assembling the instruments so as to meet rigid specifications, since optics of the type used in military fire-control equipment had never before been produced in Canada except possibly on a laboratory scale.

The purpose of this paper is to outline the nature of this wartime problem and to describe in general terms the methods used and results achieved at the Government-owned plant of Research Enterprises Limited in Toronto[1].

Before proceeding to more detailed considerations, it may be as well to glance at the types of fire-control instruments for which optics had to be supplied. Between the years 1941 and 1945, nineteen different kinds of instruments with optics were built—nine different sighting telescopes, three different periscopes, the dial or panoramic sight, the director, two kinds of binoculars, and three different rangefinders—the one metre base, 12 ft. base, and 9 ft. base height and rangefinder. In addition, optics were supplied in quantity for assembly into similar instruments by other Canadian firms. These various instruments and their several models had in total some 350 different optical elements—lenses, prisms, mirrors, windows, filters or graticules—embracing virtually every type of precision optical part. In an article of this scope, it would obviously be impossible to describe in full detail the manufacturing techniques employed in all this wide variety of parts: all that is possible is a general description of methods on representative types.

Some idea of the number and variety of optical parts required may be gained from a study of the four assembly drawings in Figs. 1 to 4, showing the optical trains in some representative instruments, all of which were required and produced in very large numbers. Figure 1 shows the optical assembly in a typical sighting telescope. The entrant light passes first through a ¼ in. thick replaceable protecting window, then through the objective system comprising two achromatic doublets[2], next through an erector doublet which forms an erect image of the target on the surface of the graticule situated in the focal plane of the erector lens. The sighting lines and figures engraved on the graticule are thus superimposed on the target and the whole viewed through the two eyepiece doublets under magnification. This telescope, used in large quantities for aiming tank and anti-tank guns, and for close-range work on field artillery, has no less than ten precision optical elements.

Figure 2 shows the optical system in a typical panoramic sight. Light enters the rotatable sighting head by a parallel window and is directed by a front-surface mirror, through the objective lens doublet and top prism with two silvered surfaces to be imaged on the engraved surface of the plano-convex graticule. The image so formed is viewed through a system comprising two eyepiece doublets, two erector doublets, a 45°-45°-90° prism, and a rotating Dove prism. This instrument, used for azimuth sighting on the 25-pounder field gun, has 16 optical components.

Figure 3 shows the optical system of the prismatic binocular. Light enters through the objective doublets, passes through the two pairs of prisms which in the Porro system combine to compress the light path and give an erect image on the engraved graticule at the focal plane (on the right side only). These images are viewed through adjustable focus Kellner type eyepieces, each comprising an achromatic doublet and plano-convex field lens. Binoculars of this type have therefore a total of 15 optical elements.

Figure 4 shows the optical assembly arrangement in the 1-metre baselength coincidence-type rangefinder. Light enters the left window, passes through the left pentagonal prism and astigmatizer lens[3], thence through the left objective lens which images half of the target in the upper field of the centre prism cluster. The right side of the system is similar to the left, with the addition of a very accurate deviating wedge between the objective lens and the prism cluster. Traversing this wedge over a length of some 7 in. causes the image of the lower half of the target to travel across the focal plane of the lower field of the centre prism cluster, and the position of the wedge when upper and lower images coincide is a measure of the distance of the target.

Fig. 1—Optical assembly train in typical sighting telescope.

The centre prism cluster is a complex arrangement of four intricate prisms cemented together, with a cover glass cemented over the focal plane at the separating line between upper and lower fields. The eyepiece system comprises two achromatic doublets and a filter wheel with three colour filters. In addition there is a scale-viewing system, comprising a window, magnifying scale reflecting prism, Dove-type scale erecting prism and plano-convex lens, and a collimating viewfinder with plano-convex lens and opaque graticule. This instrument has 29 optical parts, many of them of the highest precision, while the different models necessitate variations in design raising this figure to 38.

The above outline gives a rough idea of the quantity and variety of optics required for representative types of instruments supplied in large numbers, but a better understanding of the nature of the problem will be gained by a brief consideration of the dimensional and surface accuracies involved. Actual tolerances on overall dimensions in most optical parts are well within limits commonly encountered in metal parts of similar size. That is, in prisms and lenses with maximum dimensions of about 4 in. (the great majority lying between ¾ and 2¼ in.) tolerances on lineal dimensions are rarely held closer than ± .001 in. and are often permitted to vary as much as ± 1/32 in. The only difficulty experienced here occurs when close tolerances are required between polished faces. As will appear later, not only is the measurement of such dimensions difficult during the polishing operation, but it is not easy to ensure that the desired

[1]See Col. W. E. Phillips—The Organization and Work of Research Enterprises Ltd. (*The Engineering Journal*, March, 1942).

[2]An achromatic doublet is a lens comprising two components cemented together. The double-convex component is usually made from 'crown' glass (index 1.510-1.615); the other component, usually concave-convex or plano-concave, is made from 'flint' glass (index 1.551-1.653).

[3]A plano-cylindrical lens which may be introduced into the system at will.

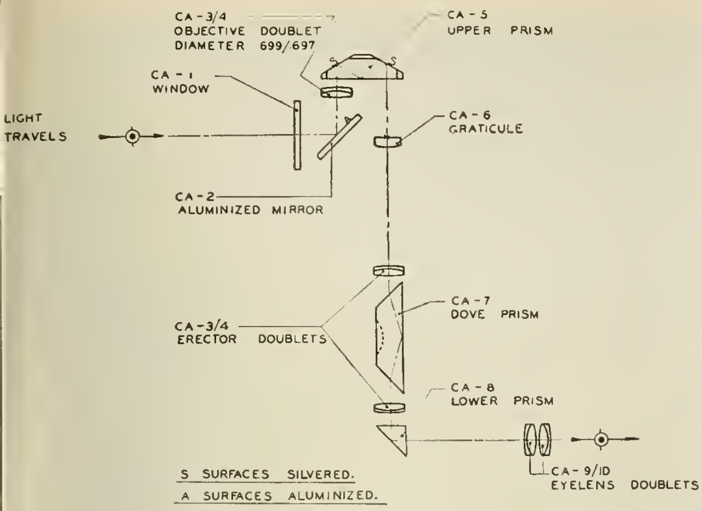


Fig. 2—Optical assembly train in typical panoramic sight.

surface quality will occur synchronically with the desired size.

The surface accuracy necessary in most optical parts is measured in wavelengths of light and varies from $^1/_{10}$ wavelength to as much as 5 wavelengths, depending on the position and function of the part. These figures may be converted into more familiar terms by remembering that one wavelength of white light measures roughly 2/100,000 in. Reflecting faces of prisms in the objective system are commonly held to $\frac{1}{4}$ λ in flatness, and entrant and exit faces from $\frac{1}{2}$ to 1 wavelength. With lenses, the curved surfaces of which are almost invariably spherical, actual sphericity is more important than exact radius of curvature and is usually held within $\frac{1}{4}$ λ on important image-forming optics, while the method of measurement entails holding the radius[4] to within $2\frac{1}{2}$ λ.

Angular tolerances in windows and prisms are of the greatest importance and vary from $\pm$ $\frac{1}{2}$ sec. for the end mirrors in the 12 ft. base rangefinder to $\pm$ 5 min. in binocular prisms. An angular tolerance of $\frac{1}{2}$ sec. may best be visualized by remembering that two surfaces parallel within this amount would diverge or converge by slightly over $\frac{1}{8}$ in. if extended a distance of one mile.

Surface quality is another factor of importance, apart from exact flatness or sphericity. The freedom from surface defects, such as scratches, pits and other blemishes, varies according to the position of the part in the optical train, but is in all cases of a very high standard. The quality of polish required in precision optics is far above that of ordinary plate glass or spectacle lenses, while for focal plane

[4]Or, to be more precise, the sagitta.

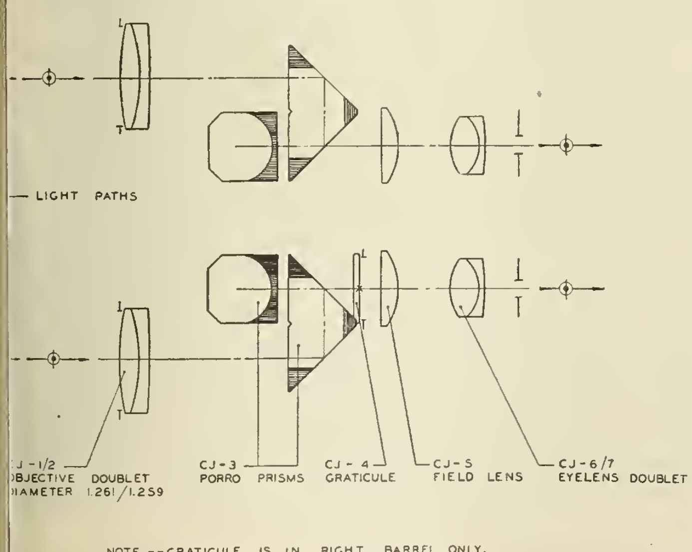


Fig. 3—Optical assembly train in typical prismatic binoculars.

surfaces optics are rejected for surface defects quite invisible to an untrained inspector even with a powerful magnifier.

There are of course other requirements for optical elements—exact composition as manifested in refractive index and dispersion, freedom from bubbles, stones and striae[5], correct annealing, etc., but these are glass-making problems and outside the scope of this article.

Some conception of the nature of the manufacturing difficulties involved may thus be gained by combining the quality and quantity requirements above outlined.

Preliminary Steps

Before production could commence, a number of preliminary steps were necessary. The most fundamental of these was the decision to standardize on English optical glass types, for this controlled the whole glass-making programme. It also affected the optical design of every instrument, since lens curvatures and prism angles vary according to glass composition. The fourteen main types of clear glass standardized ranged from Borosilicate Crown, index 1.510, to Extra Dense Flint, index 1.653.

The next important step was the selection of key personnel, and in this matter, the primary factor in the success or failure of any undertaking, Research Enterprises Limited was exceptionally fortunate. From the Optical Department of the National Research Council, Dr. D. C. Jones was procured as Director of Optical Shops, while from the University of British Columbia, Dr. A. M. Crooker was obtained on loan, as Chief Optical Physicist. Without the experience, skill and efforts of these two individuals the success of the whole programme might well have been jeopardized.

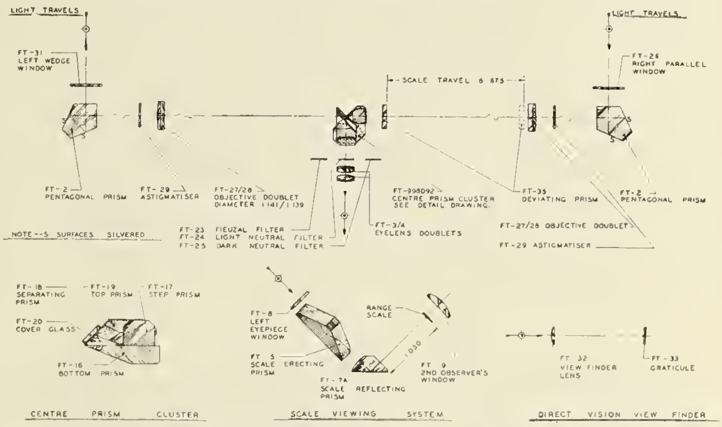


Fig. 4—Optical assembly train in typical short baselength coincidence-type rangefinder.

There were in Canada at that time no manufacturers of precision optics whatever. Work on a laboratory scale had been done at the National Research Council and there were a few spectacle lens manufacturers in Ontario. Furthermore there was then almost no printed information on large-scale production of optics of this type[6]: in fact, the methods and techniques of precision optics manufacture were generally confined to the few long-established firms whose work tended to be veiled by the same reticence as until recently surrounded the manufacture of optical glasses. Skilled technicians in this field simply did not exist in Canada. Our position for embarking on this difficult venture could therefore hardly have been worse.

From this predicament we were rescued by the generous co-operation of the Bausch and Lomb Optical Company, who volunteered to train a small number of men in the various

[5]Stria—a streaked or vein-like appearance caused by local variations in refractive index and composition.

[6]See references ②, ③, ④, and ⑤ in the bibliography at the end of this article, as representing the sum total of printed information then available.

phases of optical manufacture. Half a dozen capable individuals were therefore selected and assigned to different fields—grinding, lens polishing, planar polishing, hand correction, centering and cementing, and inspection. These men on their return, formed the main nucleus for a staff which was to grow within three years to over 1000 employees. At about the same time we were also lucky in being able to obtain from England, through the Department of Munitions and Supply, the services of a man experienced in English optical grinding methods and, by other means, an Austrian optical technician, with valuable experience in English, Swiss and German optical polishing shop methods. From all these sources we were therefore able to combine the good features from Continental and English practice, and ultimately many improvements of our own devising.

In this interim period, optical systems for the first few instruments were being re-computed under Dr. Crooker, while the necessary manufacturing facilities began to take shape under Dr. Jones' direction. It was thus that production began on a small scale in the early spring of 1941, in buildings barely completed, using optical glasses imported from England. Within three months, production was in full swing on our own glasses.

Before attempting to describe the results finally achieved, it is proposed to devote the major part of this article to an outline of the general methods used in the quantity production of military precision optics, since an appreciation of the manufacturing problems is essential to a proper evaluation of the results. This purpose may best be served by considering first the methods used with lenses, then prisms and flatwork. It should be understood that the methods described are not necessarily the ones adopted at first. In some cases several years were required to develop them into this final form. Other methods in use elsewhere will also be mentioned wherever of sufficient interest.

Production Methods—Lenses

The production of lenses, where large quantities are involved, begins with the receipt of mouldings from the glass plant. These mouldings are both thicker than the finished lens and of larger diameter, while the radii of the spherical surfaces are varied slightly from the final requirements, in a manner depending on whether the lens is to be ground or milled. It is assumed that the mouldings have already been inspected for correct refractive index, proper annealing, freedom from glass defects and serious moulding flaws. Where only small quantities are involved, the glass is supplied in slabs or plates which must first be cut into discs by methods to be described later. The lens is then worked to its final form by a succession of milling or grinding processes, each finer than the one preceding, until ready for polishing. In these operations, lenses are handled sometimes singly, sometimes in multiple on 'blocks', in a manner which will now be described in further detail.

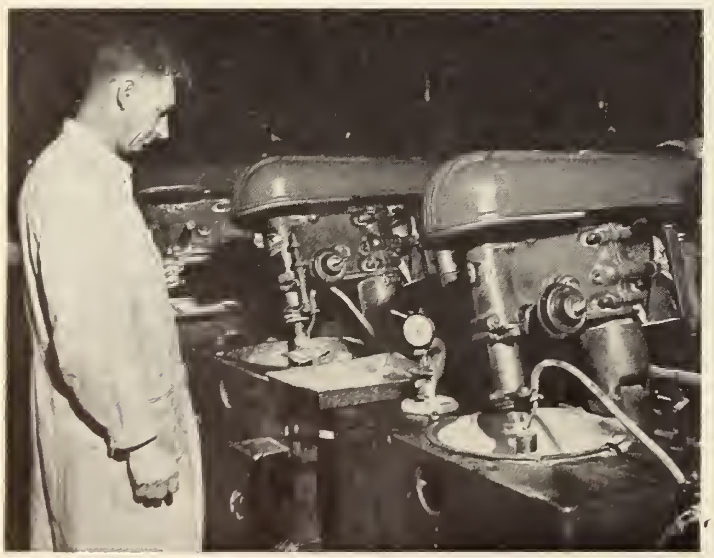


Fig. 5—Battery of Delta lens milling machines.

LENS HAND GRINDING

The simplest method of grinding lenses, and one which has been in use since the earliest times, is to shape them by abrasive action in concave or convex revolving tools of approximately the finished radius desired. This method is still used where small quantities are involved. The grinding tools are of a close-grained cast-iron, of diameter slightly larger than that of the lens blank itself. The revolving spindle may be either horizontal or vertical, the latter being preferred for larger lenses. Provision should be made for three-speed V-belt drive so that the peripheral speed of the grinding tool may be kept at about 200-500 ft. per min. The lens may be held in position by the thumb and fingers, or cemented to a wooden handle if difficult to hold. Two stages of grinding are usually necessary—rough grinding with abrasive of 90-125 micron grain size [7] and medium grinding with abrasive of 25-30 microns—the abrasive being applied to the tool by means of a small brush. Considerable skill is required with this hand-grinding method as the tools must be constantly trued to a brass gauge of the correct radius, and unless uniform pressure is applied, together with the proper random motion, the lens will assume some aspherical form. Trueing is accomplished by either relieving the tool wherever necessary with a carborundum stick, or selective grinding with loose abrasive and a cast-iron tool of correct and opposite curvature. As the grinding proceeds the lens is checked for correct radius across several diameters with a brass gauge. Care is also necessary during the grinding to prevent scratches. These may be caused by poorly graded abrasive or by too much pressure. Poor surface finish may be caused by failure to allow adequate time for the abrasive to break down. Care is also necessary to prevent development of 'prism', that is, the condition of unequal edge thickness caused by the centres of curvature of each side not lying on a line normal to the mechanical centre of the lens. The curvature of the successive grinding tools is so arranged that at each stage grinding starts at the edge and works in to the centre. Production rates with this method for the complete operation on both sides, with a skilled man, vary from 5 to 10 lenses per hour, for lenses ¾ in. to 2 in. diameter, depending on the size of the lens, curvature, and amount of glass removed. The latter may vary from .040 in. to .080 in. off each side.

LENS MILLING

Such methods, while entirely satisfactory in their results, are no solution to the problem of large-scale output by unskilled operators, and for such purposes have now been entirely superseded by lens milling techniques.

There are three methods by which lenses may be milled: the curve may be generated by revolving the lens and feeding into a groove of circular cross-section round the peripheral face of an abrasive wheel; or by revolving the lens beneath an inclined spherical-formed abrasive wheel of the same radius as is required of the lens; or by revolving the lens beneath an inclined cup-shaped abrasive wheel. The latter method is the most versatile, because by varying the inclination of the cutting wheel, and adjusting the offset so that either edge of the cutter is over the centre of the lens, any desired curve—concave, convex, or planar—may be generated, independent of the form of the cutter itself. Diamond abrasive wheels charged to a depth of ⅛ in. to ¼ in. or more, are in general use for this purpose and they may be of any of the three common types: hand-charged, where the copper wheel is grooved or nicked, charged with diamond-dust mixed with grease, and the grooves rolled over with a hardened roller in a lathe; resin-bonded, where

[7]The nomenclature used here for grain sizes will be clarified in a later section under 'Abrasives'.

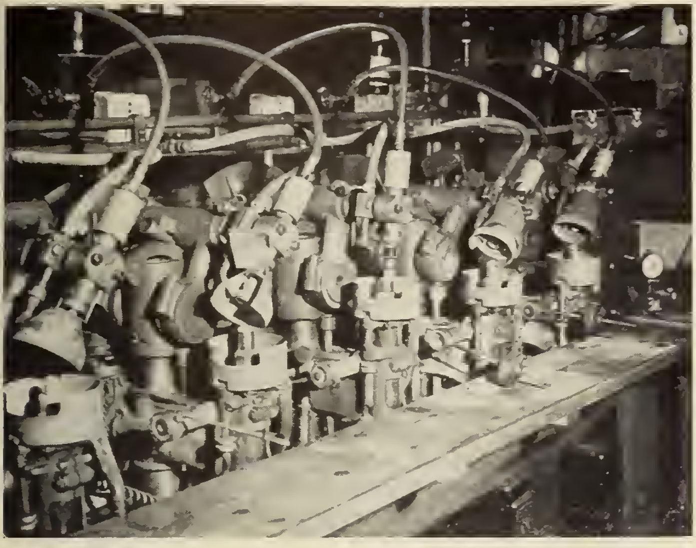


Fig. 6—Desoutter compressed air lens milling machine.

the diamond-dust is mixed with a phenolic resin and moulded to form; or metal-bonded, where the diamond-dust is mixed with powered bronze and moulded into the desired form by powder-metal techniques. The latter is the preferred type from the standpoint of cutting speed and life, although for well over a year we had to depend on the hand-charged type due to unavailability of the others. The diamond-dust may be of any desired mesh size depending on the finish required. As we used lens milling mainly for roughing lenses, wheels of 120-180 mesh (125-90 microns) gave the best compromise between speed of milling and finish. To a surprising extent, however, the latter is dependent on the rigidity of the cutter spindle and high peripheral speed. A speed of at least 4000 surface feet per minute is desirable, coolant of the oil emulsion type being used with a well-compartmented sump to permit settling of the powdered glass removed. Otherwise, this material will settle out in the coolant pipes and block them completely.

The first machines of this type which we built were designed and put into operation in 1942. These used Delta drill-press heads for both spindles—inverted for the bottom lens-carrying spindle, and upright for the inclined cutter spindle. Figure 5 shows a battery of these machines in operation. One operator can run two or more machines, since the lens thickness is controlled automatically by weights on the feed arm of the lower spindle, forcing it upwards until it reaches an adjustable stop. Cutter diameters of 1½ in. to 4 in. are used. These machines operated satisfactorily, but suffered from lack of rigidity in the cutter spindle at high speeds, resulting in some loss of surface finish.

To overcome this defect and to permit milling of small lenses with steep curves, we decided to risk a somewhat radical innovation, and ordered a similar type of machine using compressed-air Desoutter drills on the inclined spindles to give the cutter a speed of 20,000-30,000 rpm. These machines, shown in Fig. 6, were in operation towards the end of 1943, and proved extremely satisfactory. Deflectors were fitted to the exhaust air orifices to prevent the coolant being blown away, and thickness was controlled by automatic feed to separately adjustable stops on each of the five spindles. Using metal-bonded diamond cutters ½ to 1 in. diameter, the finish was so satisfactory that medium-grinding (normally the next operation) could be dispensed with entirely. About the only objectionable feature was the noise, which from 10 Desoutter drills running simultaneously was quite considerable. This type of machine was successfully used on convex and concave curves of 0.473 in. radius (Fig. 3, binocular eyelens cemented curves).

Methods of holding the lens during milling have considerable bearing on the speed of the operation and accuracy of curve. The problem is not a simple one because the lens mouldings vary in diameter by as much as .015 in., and chucks of the 3-jaw adjustable or collet type are slow and awkward to handle and apt to chip the lens. Furthermore, in milling the second side of double-convex lenses, there is almost no edge left whereby to grip the lens. Methods involving cementing or waxing the lens to steel discs which may be held in collet chucks are also very slow. We found the simplest and best solution was a type of chuck in which the lens is located in a shallow circular recess in the steel chuck, resting on a narrow band of fibre or hard rubber of the approximate curvature of the moulded or previously-milled surface. The lens is simply dropped into the chuck, milled to thickness and lifted out when finished, the drive being by friction from contact with the fibre locating ring. The recess is made to accommodate the high limit of moulding diameters. With very steep convex curves the slight wandering of loose-fitting lenses causes trouble in maintaining curvature which may necessitate correction by hand-grinding. This could be prevented by the use of vacuum-type chucks on which experiments are now proceeding. The amount of wandering is reduced to a minimum by so arranging the curves of the moulding that milling starts from the centre towards the edges. This also minimizes tendency to tip in the chuck and develop 'prism'.

Accuracy of curvature of milled lenses can with care be held to that of hand-grinding methods. As with the latter, curves are usually checked with brass gauges. When it is desired to omit medium grinding, however, a more accurate check on radii is desirable and is accomplished by means of a simple ring-type spherometer requiring no skill for its use. This locates the lens on a hardened and ground ring and measures its sagitta or bulge with a dial indicator graduated in 1/10,000ths, the latter being set to zero from a master lens of correct curvature. Two such spherometers of our own design are shown in Fig. 7, together with a variety of simple radius gauges. The Desoutter machines were quite capable of holding a sagittal tolerance of ± .0002 in., which, with a small lens of 0.500 in. radius, corresponds to a radius tolerance of ± .0004 in.

It should be mentioned that a rough bevelling operation is necessary on both sides of most lens mouldings before milling, both to remove moulding flash, and to reduce the tendency to chip. This is a quick operation, done by hand on a concave or shallow convex cast-iron tool with coarse abrasive or a similar diamond tool, at rates of about 200 pieces per hour for both sides.

The lens milling operations remove .040 in. to .080 in. from each side of the moulding and output varies from 40 to 64 pieces per man-hour for both sides, the time varying

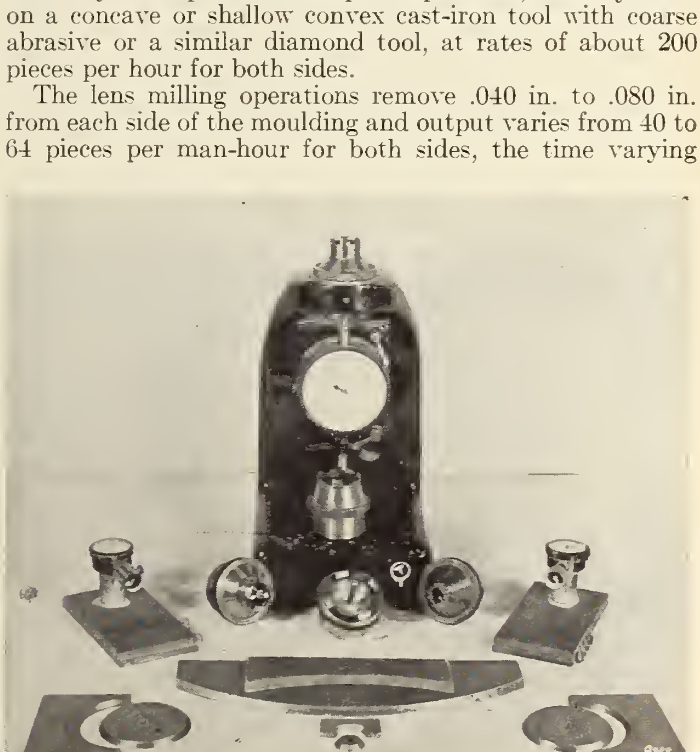


Fig. 7—Two types of shop spherometers and radius gauges.

surprisingly little for any lens up to 2½ in. diameter. Cutter life depends largely on the depth of charging of the milling cutter and the amount of glass removed, and normally lies between 5000 and 15000 sides, or as high as 25000 in exceptional cases. After milling, the lenses are inspected by wetting and examining for moulding flaws which may not have milled out, then fine bevelled preparatory to the subsequent operations.

LENS BLOCKING

What these operations are depends somewhat on the size of the lens and steepness of the curves. Wherever possible from this point the lenses are worked in blocks: that is, they are fastened on the surface of a spherical tool of as large a diameter as a hemisphere of the required radius, or if this is impracticably large, the largest size that can conveniently be handled—usually not over 12 in. diameter. It will thus be readily seen that small lenses with very steep curves can only be handled singly, while with slightly less steep curves it may be possible to get 3 to a block and with shallow curves 50 to 100 or more depending on the lens diameter. In practice, due to grinding and blocking difficulties, the spherical angle is usually limited to 160°. The exact number of lenses which may be placed on a block is a problem in spherical trigonometry, and the arrangement of the lenses—whether one or three are placed in the centre—must be so chosen as to give the maximum number and may considerably affect the cost per lens of block grinding and polishing.

There are numerous different ways of fastening the lenses to the block, but in all cases the main principles should be that the lenses are securely attached to the blocking tool by whatever cement or pitch is used, that the pitch should be hard enough that it will not cold-flow when the block is left standing overnight, that there is a uniform supporting thickness of this material between the lens and the tool, that the degree of support will obviate any distortion when the lens is removed from the tool, and that this removal may be quickly accomplished without damage to the lens. Of the many different methods tried, the most satisfactory appear to be those involving the use of pitch as a blocking medium. For double-convex or crown lenses of shallow curve a convex cast-iron blocking tool is used of radius somewhat less than that of the lens, to allow for the thickness of pitch. Where the curve of the underside of the lens is steep, the requirement of uniform supporting thickness may result in a pagoda or cusp-shaped, instead of spherical, blocking tool. This usually occurs only in 3-lens blocks.

The convex lenses are blocked by arranging them face downwards in a concave tool of the same, or slightly larger, radius as whatever grinding tool is to be used in the next grinding operation. This tool, and the lenses themselves, must be carefully cleaned to avoid tilting of the lenses which would result in 'prism'. The lenses are held in position in the concave tool by smearing it lightly with a thin grease or coal oil. The convex blocking tool is then heated in a gas flame, coated with liquid blocking pitch from a gas-heated pitch melting pot and the pitch formed to the desired radius by a concave pitch-forming tool in an arbor press. The blocking tool is thus coated with a uniform layer of pitch of thickness sufficient to retain the lens—from ¼ in. to ½ in. usually—and while still warm is pressed into the concave tool in which the lenses have been positioned. The lenses thus become firmly embedded in the pitch of the blocking tool yet remain raised above the surface of the pitch layer. When the pitch cools, any excess which has been displaced unduly close to the lens surfaces is removed by careful chipping, or dissolved by revolving the tool and rubbing with a kerosene-soaked cloth. For concave lenses, a convex instead of concave tool is used for positioning the lenses and the subsequent operations are the same as those described.

The quality of the blocking pitch is an important factor with this method. Trouble arises mainly from a pitch which is too soft. This may settle or cold-flow either before or during polishing, or may soften during polishing and cause distortion of the lenses through inadequate support. Yet if the pitch is too hard, trouble may develop when polishing concave lenses as it will not yield enough to accommodate deformations arising from the heat of polishing, with the result that the lenses are under strain and change shape when removed from the block. The types of blocking pitch furnished by optical supply firms were found to be more uniformly satisfactory than the various blocking pitches of our own to which, in times of shortage, we were obliged to resort.

With concave lenses of more than 1½ in. diameter, the thinness at the centre often causes trouble with distortion after removal from the blocking tool when polishing is complete. This trouble is apt to arise with such lenses no matter what blocking method is used. To overcome it, we made a practice of blocking thin concave lenses with sealing wax points. This is done by first melting the sealing wax and casting it into brass moulds to form little cylindrical sticks about ½ in. long and ¼ in. diameter. The lenses are then heated and the wax sticks fastened to the underside at about ½ in. centres all over the surface. The lenses, with these points attached, are next arranged face downwards on a convex tool and transferred from there to the blocking tool by heating the latter and picking them up. The hardness of the sealing wax and multiple supporting points reduce distortion trouble to a minimum and assist in maintaining an even temperature through the lens during polishing. A wide assortment of lens blocks of various types is shown in Fig. 8.

Other methods of blocking tried and discarded for various reasons included the use of individual 'mallets' or lumps of pitch for each lens (these may be cast like the sealing wax sticks), the use of cast-iron blocking tools with accurately machined recesses in which the lenses are cemented, and the use of recessed positioning tools to give even lens spacing and eliminate the necessity for chipping away the excess pitch.

Fig. 8—An assortment of concave and convex blocks.

LENS MEDIUM GRINDING

Once the lenses have been blocked, the next operation is medium grinding, which is done by hand on vertical-spindle machines, using a lever to apply pressure between the block of lenses and the grinding tool, and abrasive of 25-30 microns. This is an operation requiring much the same order of skill as individual lens grinding, and the same precautions must be taken to prevent scratches and maintain correct curvature. While the latter can be measured by large ring spherometers, our practice was to coordinate the medium grinding with the fine grinding by constant cross-checking, involving trial and correction when and as necessary. Control of the amount of glass removed can be effected by two methods: either by spotting[8] a few lenses in each block to the correct thickness in a drill press with a diamond tool, and continuing the grinding till the spots are removed, or by merely holding the thickness of the milled blanks to a close tolerance and limiting the time of medium grinding. On most telescope lenses, the tolerance on finished thickness is ± .010 in., so by holding the thick-

[8]Making a small conical indentation.

ness after milling to .005 in. over the high limit, and allowing .005 in. on each side for removal during subsequent operations, we found that thickness tolerances in the finished lenses can be met without the necessity for 'spotting', although for closer tolerances it is sometimes necessary.

Production rates for the medium grinding operation vary from 10 blocks per hour for 2 or 3-in. diameter blocks to 3 blocks per hour for the larger 10 in. or 12 in. diameter blocks. The time for each lens of course varies immensely, depending on the number per block.

LENS FINE GRINDING

The fine grinding which follows medium grinding is essentially the same operation, but requires more care and skill, because the radius of curvature of the lenses after fine grinding must agree with that of the test glass within a few wavelengths. The test glass, which is a thick polished disc of quartz with one surface perfectly spherical to the required radius, is used after polishing begins and permits variations in curvature, or other surface imperfections, to be measured by coloured interference fringes or rings which are formed between the test glass and the surface being tested. Each ring corresponds to a thickness of air film between the test glass and lens or other surface of one-half wavelength (say 0.28 micron or roughly 1/100,000 in.) and the method of use is now so general for precision work of all kinds as to require no further elaboration here. The method of preparing test glasses is of considerable importance, however, and will be discussed later under the heading of hand polishing. To maintain accurate curvature on the lens block after fine grinding to within say $2\frac{1}{2}\lambda$ or 5 rings requires considerable skill both in grinding and in keeping the grinding tools true, a condition which becomes more and more difficult to meet as the blocks become smaller and the curves steeper. After every few blocks have been fine ground, one is placed on a polishing spindle and given a 'shine' or rough polish just sufficient to permit readings to be taken with a test glass. The grinding tools are then corrected as necessary. It will thus be seen that the maintenance of correct curvature really starts with the test glass, each successive milling or grinding operation giving a curvature slightly steeper than the one preceding, until after fine grinding the curve is 5 rings or less shallow to the test glass in the case of convex lenses, or the same amount steeper for concave lenses. The appearance of interference fringes between a large lens and test glass is illustrated in Fig. 9.

Fig. 9—Showing the appearance of interference rings between lens and test glass.

The abrasives used for fine grinding start at about 18 microns and go down to 11 or sometimes 9, never finer. It is usually quicker, and causes less trouble with tools, to do the grinding in two stages, first with 15-18 grade and finishing with the finest abrasive. After each grinding stage the block must be very thoroughly washed off under a tap to make sure no particles of coarser abrasive are carried over to the next stage. This applies particularly after the last stage, to avoid trouble with scratches in polishing. The surface must also be carefully examined to make sure there are no deep pits which would not polish out subsequently. About .002 in. to .004 in. of glass are removed during both stages of fine grinding and production rates for the complete operation vary from 3 to 6 blocks per hour.

Fine grinding of lenses of very steep curve, which must be polished singly, can be done by hand, but this is a slow and costly process. Considerable time may be saved by using for this purpose similar machines to those used for lens polishing but running at much higher speeds, and this method is used by some firms for blocks of all sizes and for medium as well as fine grinding. It is doubtful, however, whether much time is saved except with 3-lens blocks or smaller and the machines take far more space than hand-spindles, when used for large blocks. In such machines, the emery feed may be made automatic by permitting the copper bowl surrounding the grinding spindle to rotate with it, causing the slurry of abrasive and water to be thrown by centrifugal action to the outside, whence it is picked up by a stationary scoop and directed as a jet onto the work. One operator may thus tend a large number of spindles.

LENS POLISHING

The block of lenses is now ready for polishing. This is done on machines which rotate the work on a vertical spindle while causing the polisher to oscillate over its surface, or conversely, the polisher may be rotated, and the lens block oscillate over it. The polishing machines vary in size and spacing between spindles according to the size of block to be polished. All however depend for their results on the random motion of the polisher over the work, and it is by controlling this motion that the operator is able to produce work of many times higher accuracy than that of the tools themselves. Figures 10 and 11 show two representative types of polishing machine, one suitable for single lenses, the other for large blocks. In all such machines there are independent variable speed drives to both the work spindle and oscillating arm, while the random motion of the latter is controlled either by varying the stroke of the arm or the amount of offset between the arm and rotating spindle, as well as by varying the relative speeds of arm and spindle. A selective polishing action can thus be obtained, permitting either the outside or centre of the block to be polished more heavily. Further control is possible by varying the amount of weight applied

Fig. 10—A typical single lens polishing machine.

Fig. 11—A typical lens polishing machine for large blocks.

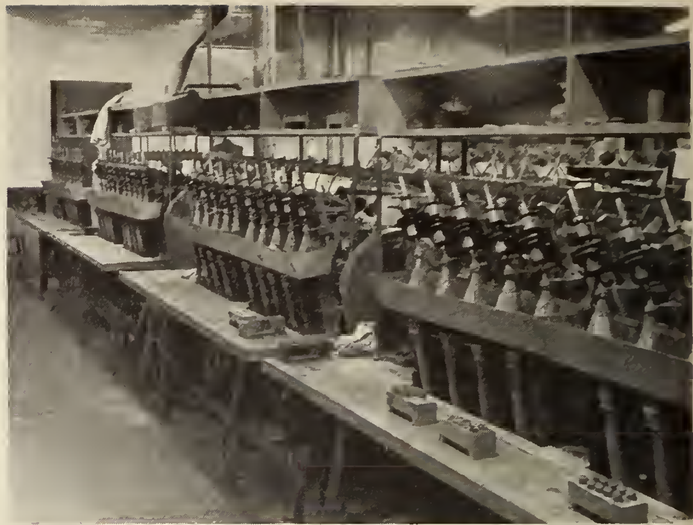


Fig. 12—A row of lens polishing machines equipped with automatic ceria feed.

to the polisher by means of the extension of the drive pin on the end of the arm, and by varying the size and contact area of the polisher itself.

The material commonly used for the polisher is pitch, which may be either Burgundy or Swedish (wood pitch), or asphaltic. Pure rosin is also used either alone or in combination with pitch. Other materials used include cloth impregnated with pitch or wax, laminated paper, and wood. For all precision work, however, pitch or rosin is used, since either of these materials are really viscous liquids at the temperatures used in polishing and can readily be formed to the correct curvature. The viscosity of the polisher must be so controlled as to maintain this condition, yet if the pitch is too soft, it will soon lose shape as polishing proceeds, causing bad curves and lost time for re-forming. If, on the other hand, it is too hard, there will be a tendency to scratch the glass surfaces either from dust or agglomerations of the polishing agent, nor will it as readily conform to the curvature of the lens block to polish it uniformly all over. The temperature of the room, amount of weight used on the polisher, speed and type of machine, size and type of block, are all additional factors affecting the choice of correct viscosity, so that very great experience is required in making the right choice. The pitch can usually be made harder by prolonged boiling, which progressively removes the more volatile elements, or softer by addition of such elements. Venetian turpentine is commonly used both with pitch or rosin for this purpose. Hardness may also be controlled by varying the proportions of rosin and pitch, since hardness increases as the percentage of rosin is raised.

For polishing convex lens blocks, a thin concave cast-iron shell is used, lined with a layer of pitch perhaps ¼ in. thick. This pitch surface is formed to the correct radius over a convex tool with curvature as close as possible to that of the finishing tool used in fine grinding, so that when the block is placed on the machine, polishing begins uniformly all over the surface.

The size of the polisher may be varied considerably. A diameter 80 per cent that of the block generally gives good results.

It is a standard practice, though not essential, to polish concave lenses upside down. That is, with concave lenses the blocking tool resembles the polishing shell used in convex lenses, while the polishing tool is convex and is mounted on the driving spindle of the polishing machine. Mention of this was omitted earlier, to avoid confusion.

After forming, the polishers are grooved radially and circularly with a sharp tool by hand or on an upright revolving spindle. These grooves assist in distributing an even film of the polishing agent over the surface of the block, and also, by breaking up the surface into facets, permit the polisher to conform more readily with the work.

Until a few years ago, rouge (ferric oxide, Fe_2O_3) was the material in practically universal use for glass polishing. We lay claim to the credit for having upset this tradition through the introduction of cerium oxide (CeO_2) to the English-speaking world late in 1941. More will be said of this later, but for the present it suffices that this material, properly made and used, will reduce polishing times to ⅔ or ½ of the times required with the best rouges. Hence since early 1942 we used cerium oxide exclusively for the polishing agent. As with rouge, ceria is applied to the work with a brush, after mixing a small amount of the powder with water. When this begins to dry up, the polishing pad makes a characteristic squealing noise, and under these conditions polishing proceeds at the maximum rate. Before the block dries up it is wetted again either with water alone or water and ceria. If the polisher is allowed to run too dry, 'burns' may result caused by the ceria seizing into the glass surfaces. These will usually polish out, but in bad cases, may necessitate re-fine grinding.

As the polishing proceeds, the polisher tends to lose shape and from time to time requires reforming. This is done by warming it under a hot tap and rubbing it with considerable pressure over the surface of the forming tool. By doing this repeatedly, the same polisher may be made to serve for many blocks and for large blocks may last 3 weeks or more; for small blocks, the life may be as short as 3 days. Regrooving is also necessary as the grooves gradually flow in and disappear. The work must constantly be checked with a test glass and adjustments made to the machine and the polisher to bring in the correct curve. For cemented lens surfaces, less accuracy is required than for outside surfaces, and for eye-lens components the sagittal tolerance may be relaxed to 10 rings on the cemented surface without danger. On other surfaces in medium-power telescope systems a 5-ring tolerance is usual. That is, with convex lenses, the radius is held shallow by this amount, but sphericity is always held within one ring or less. Lack of sphericity is indicated by non-circular shape of the rings themselves and cannot be accurately measured unless the curve is held within 5 rings or so. The lenses should also be checked for sphericity after de-blocking as distortions may not appear until this point. It is important when polishing cemented curves that the contact with the test glass should be at the outside of the lens rather than the centre, otherwise at cementing the lenses might rock at the centre and cause trouble. By applying pressure to the test glass the appearance of the rings will readily indicate whether contact is occurring at the outside or centre. By prolonged polishing a measurable thickness of glass may be removed and the radius of curvature considerably changed—the more readily so the smaller the block. Hence the accurate fine-grinding of large blocks is essential to rapid polishing. According to the latest theories, polishing is partly a chemical and partly a mechanical action, but far less mechanical than was formerly supposed, as the speed of polishing is considerably influenced by the chemical nature of the water base used—whether acid, alkaline or distilled, and the chemical composition of the glass itself.[9]

Sufficient has been said, it is believed, to give some idea of the number of variables involved in lens polishing. The difficulty lies mainly in analysing the trouble to find out which of the numerous possible factors is responsible. Bad curves may be due to the wrong blocking pitch, wrong fine grinding, wrong polishing pitch, poor shape or size of polisher, incorrect machine setting, or several of these in combination, and only long experience can determine which is to blame. Then, just as the block has been brought to correct curve, a scratch may develop which in severe cases will necessitate re-fine grinding. Deep curves, whether in single lenses or in blocks, are always the most troublesome, and because of the higher losses which result, it is wiser to polish the steeper lens curve first. Sometimes so much trouble is experienced with nearly hemi-spherical blocks, that it is found more economical to omit the outside ring of lenses, thus considerably reducing the number of lenses on the block, but with an overall saving.

After polishing, the lens blocks are inspected for surface accuracy and quality—freedom from grinding pits and scratches and for full polish. Reject lenses or lenses requiring reprocessing are marked and all lenses given a protective coating of shellac. The lenses are then removed from the blocks by chilling, cleaned, and reshellacked prior to blocking again for polishing the second side. The methods used in de-blocking and cleaning are of great importance and will be dealt with more fully later. Lenses marked for reprocess are simply blocked up again, re-fine ground, and repolished. The thickness tolerance on most finished lenses usually permits at least one reprocess on each side, sometimes two.

Polishing times for lenses using ceria average from 25-45 minutes for single convex lenses, 50-75 minutes for 3-lens convex blocks, and from 1½ to 3½ hours for convex blocks ranging from 4 in. to 10 in. diameter respectively. As the concave blocks are usually of flint glasses which are chemically less resistant than crowns, the polishing time is about 20 per cent less for a concave block than for a convex block of the same size and curve.

Of equal importance as affecting the cost of polishing is the number of spindles which may be run by one operator. This varies from 10 for single lenses and small 3-lens blocks to 6 or 8 for larger blocks. When using ceria, an operator tends to be able to run fewer spindles than with rouge because the curves change more rapidly and the machines require closer attention.

One approach towards reducing costs is through the use of automatic ceria feed. This is an adaptation of spectacle lens methods, which during the war was used by us only on the cemented curves of eyelenses where the minimum accuracy is required. A pump and piping system delivers a jet of ceria and water to each spindle. Heating of the water may be necessary to offset evaporative cooling from the numerous jets. The machine setting is left unchanged and after a fixed time (20-30 minutes) all lenses are removed and examined. While this is being done a fresh load is placed on the machine. One advantage of this method is that the flow of ceria cools off the polishers and enables the amount of weight to be increased, thus offsetting the less efficient wet polishing action. By this means, one operator may run as many as 40 single lens spindles. A row of polishing machines equipped in this manner is shown in Fig. 11. It seems very probable that the same principle could be extended for all the less troublesome blocks, with considerable cost saving.

The cost of tooling for lens production is by no means a negligible item, especially as blocking tools and grinding tools require considerable machining, and blocking tools especially are needed in large numbers to provide sufficient work in all stages of process. Ten blocking tools, for example, were found to be required for each polishing spindle in operation. As the number of spindles may run to 30 or more with quite large blocks, 300 or more blocking tools alone may be required for a particular curve. The variety, apart from the quantity, of tools required for a typical concave-convex objective flint component is illustrated in Fig. 13, which shows as well some tools and gauges required for auxiliary operations to be described later. After some years of operation, a large supply of tools in many different radii accumulates, and the lens designer usually attempts to repeat previously-used curves on new instruments, as well as duplicate curves within one instrument, in order to economize on tooling. An example of this is in the panoramic sight (Fig. 3) where the same doublet is made to serve both as an objective and for two erector lenses.

Before proceeding with discussion of subsequent operations on lenses, it will be convenient at this point to consider the analogous operations for planar optics.

(To be continued in the May issue.)

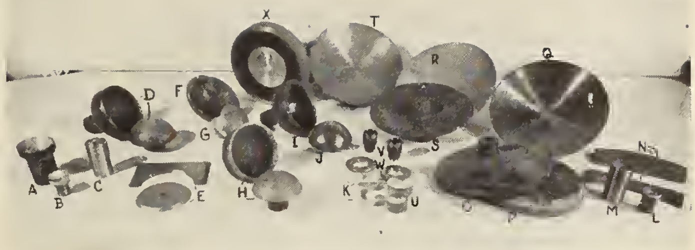


Fig. 13—Complete tooling on objective lens flint components (CJ-2, Fig. 3.)

First side tools, 2″ .020R. concave (7 per block)
- A—Moulding bevelling tool
- B—Diamond milling wheel
- C—Milling chuck
- D—Medium grinding tools
- E—Radius gauges
- F—Blocking tool
- G—Polisher
- H—Fine grinding tools
- I—Polisher forming tool
- J—Block forming tool
- K—Quartz master test glasses

Second side tools, 10″ .00R. convex (37 per block)
- L—Diamond milling wheel
- M—Milling chuck
- N—Radius gauges
- O—Polisher
- P—Blocking tool
- Q—Medium grinding tool
- R—Block forming tool
- S—Polisher forming tool
- T—Fine grinding tool
- U—Quartz master test glasses

Centering tools
- V—Centering chucks
- W—Go and no go ring gauges
- X—Diamond edging wheel

[9]For more detailed information on rates of glass removal under various conditions see: I.V. Grebenchikov—The Part Played by Chemistry in Polishing Processes (Moscow: Sotsialisticheskaya Reconstructsiya I Nauka, No. 2, 1935).

TRANS-CANADA AIR LINES' RADAR INSTALLATION

WALTER A. COLE
Ground station radio engineer, Trans-Canada Air Lines, Winnipeg, Man.

Introduction

The greatly accelerated impetus given to scientific research during the war years has added enormously to our knowledge in the field of electronics. In no phase of electronic development has progress been more remarkable than in that of radar.

We read on every hand that radar has ushered in a new era of air transportation. We are led to believe radar has *per se* solved all airline safety problems. Let us not forget, however, that present radars were designed for military requirements and that between military and civil needs there is a vast difference.

It is inevitable that the impact, on commercial aviation, of wartime electronic development will be far-reaching. But the transition from military to civilian use is no small task—it will take time. It is not accurately known today just where radar techniques will fit into airline operations. The magnitude and scope of the problem are not yet clearly visualized. There has been little co-operative effort on the part of the airlines, industry and government agencies to produce a clear statement of what is required. In view of the short time that has elapsed since the cessation of hostilities, this is quite understandable.

The economic aspect must, of course, be considered. Existing navigational facilities represent a considerable investment. To replace them or supplement them with radar equipment will require great expenditures, for not only is ground equipment affected but aircraft equipment is equally concerned. The change, if it comes, will undoubtedly be a gradual process.

In order to determine to what extent present military radars will meet airline requirements, Trans-Canada Air Lines has initiated a programme in which the following major applications are being considered:

1. Airways control
2. Airport control
3. Approach and landing control
4. Meteorological observation

The type of equipment being employed in the present investigation is the MEW (Microwave Early Warning) radar, designed and constructed by the National Research Council at Ottawa. A description of the equipment and the results achieved thus far are presented later in this article.

Basic Principles

A detailed description of radar principles is beyond the scope of this paper; indeed, most of the circuit details have not yet been released from security restrictions. However, in order that those less familiar with the subject may have a clearer grasp of the ideas involved, a brief discussion of some of the basic principles will be given.

Radar (from Radio Detection and Ranging) is possible because of two physical laws: 1. radio waves are propagated through space with constant velocity 2. whenever there is an abrupt change in the medium of propagation some of this energy is re-radiated or reflected back in the direction of the incident wave.

Essentially, radar for the dectection and location of aircraft consists of a transmitter to generate high-frequency, high-power oscillations, an antenna to radiate the energy into space (and generally to concentrate the radiated energy into a narrow beam), a receiver to pick up the reflected signal, a timing and co-ordinating system to measure accurately the time interval between transmission and reception in terms of distance, and, lastly, a display system to indicate visually the results of these processes.

Early radars operated in the very-high-frequency band (see Table I), but it was not until the cavity magnetron was developed by a group of British scientists in 1940 that the present degree of perfection was approached. One of the most closely guarded secrets of the war, the cavity magnetron made possible the generation of high-power radio waves in the super-high frequency or microwave region and permitted the greatly increased definition and accuracy exemplified in the radar bombsight and blind landing systems.

TABLE I

Radio Frequency Classifications

Frequency in Kilocycles	*Wavelength in Meters*	*Designations*	*Abbreviations*
10-30	30,000-10,000	Very Low	VLF
30-300	10,000-1,000	Low	LF
300-3,000	1,000-100	Medium	MF
3,000-30,000	100-10	High	HF
30,000-300,000	10-1.0	Very High	VHF
300,000-3,000,000	1.0-0.1	Ultra High	UHF
3,000,000-30,000,000	0.1-0.01	Super High	SHF

The energy in a radio wave diminishes greatly with distance. The strength of the radiation impinging on an object 100 miles away is very much less than that at the transmitter. The magnitude of the reflected signal arriving back at the receiver after another hundred-mile journey is so incredibly small that it is only through the phenomenal amplification properties of the vacuum tube that any signal is discernible at all.

To increase the energy content of the radiated wave the transmitting tube oscillates in short bursts or pulses of very high amplitude. By confining the period of oscillation to a few microseconds it is possible to produce tremendous power outputs without damaging the tube. A further increase in energy in a given area is obtained by concentrating the radiation into a narrow beam.

Figure 1 is a block diagram of a possible radar set-up. It is not meant to represent any particular system. As mentioned above, the transmitter oscillates in pulses, the frequency of repetition of the pulses being determined by the modulator unit. A waiting period between pulses must be provided to allow time for the reflected wave to be received before the next pulse is sent out. The length of the quiet interval depends, of course, upon the maximum range desired.

The transmitter output is fed into the antenna and thence into space. In the super-high frequency band, antenna systems usually include a reflector in the form of a paraboloid or parabolic cylinder (the MEW antenna is an example of the latter). A small fraction of the transmitted pulse is fed into the timing section and initiates the action by which the time interval between transmission and reception is measured. When it is realized that a few millionths of a second are measured quite readily, one can appreciate the progress that has been made.

The received signal or echo is picked up by the same antenna, amplified enormously and applied to the display system already set into operation by a triggering pulse from the timing unit. The echo is then displayed so that its distance from a predetermined origin is a direct function of the time interval between transmission and reception, or what is the same thing, a direct function of the distance between the aircraft and the radar.

A switch is provided to prevent the transmitted pulse from feeding into the receiver and conversely to prevent the reflected wave from feeding into the transmitter. In this way, both receiver and transmitter operate with

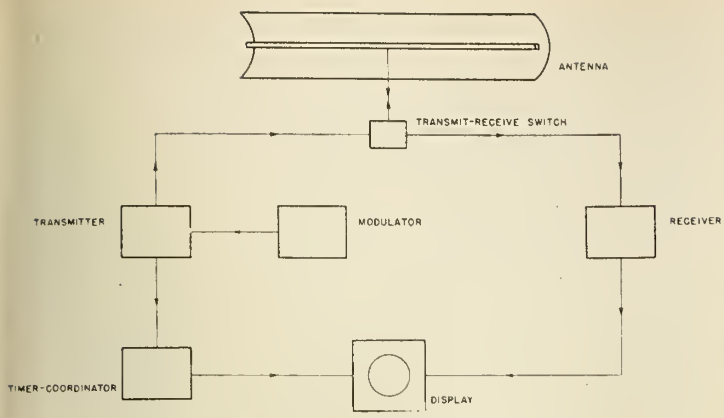


Fig. 1—Block diagram of typical radar.

maximum efficiency and the same antenna may serve for both functions.

Types of Displays

Many types of displays have been developed. Three of those more commonly encountered are shown in Fig. 2. Figure 2 (A) is called the A-display and indicates distance only. Echoes appear on the screen of the cathode-ray tube as sharp inverted V's or pips, above the base. The initial pip is caused by the transmitter pulse and locates the origin. Aircraft echoes are smaller pips displaced from the origin by an amount depending upon the aircraft's distance from the radar. This type of display is quite similar to that employed in the ordinary cathode-ray oscilloscope and uses a tube with a short persistence screen (that is, only slightly phosphorescent).

The obvious need for a presentation that indicated direction as well as range was met in the PPI (Plan Position Indicator) display, illustrated in Fig. 2(B). The PPI might be considered a plan view of the area surrounding the radar as seen from a high-flying aeroplane. Whereas in the A-display the electron beam in the cathode-ray tube starts its cycle at the left-hand side and sweeps across the tube to the right, in the PPI display the beam starts at the centre and sweeps radially outward. The direction of the sweep is rotated about the centre of the tube in synchronism with the antenna and the equipment is generally set up so that the beam sweeps toward the top of the screen when the antenna faces north. Pulses from the timing circuit cause the visual trace of the electron beam on the phosphorescent screen to brighten at intervals of, say, 20 miles, so that concentric circles (range markers) equally spaced from the centre are traced out on the screen. As the beam rotates, a switching system causes the whole trace to brighten every 10 deg. laying down a fan-like pattern of azimuth markers. Echoes appearing anywhere on the screen can then be located by means of the grid formed by the range and azimuth markers.

So that the echo may be more readily located, the screen of the cathode-ray tube is often constructed so that it glows or phosphoresces many seconds after the electron excitation has been removed. The electron beam causes a small bright spot to appear on the screen when an object is detected. As the beam moves away, the spot slowly fades, providing about 30 seconds for the operator to locate the echo.

A third type of display is shown in Fig. 2(C). It is the sector-B display. Here, approximately 90 deg. of the horizon is presented but with the azimuth markers parallel to each other, instead of converging as in the case of PPI. In this way a considerable expansion of the area close to the radar is achieved. There is an additional advantage because the echoes are elongated into small " blobs " while spots due to noise are not.

The range markers appear as equally spaced lines extending horizontally across the tube. Although a switching system enables any of four quadrants to be viewed, this type of display is generally used when it is desired to watch only a particular portion of the horizon.

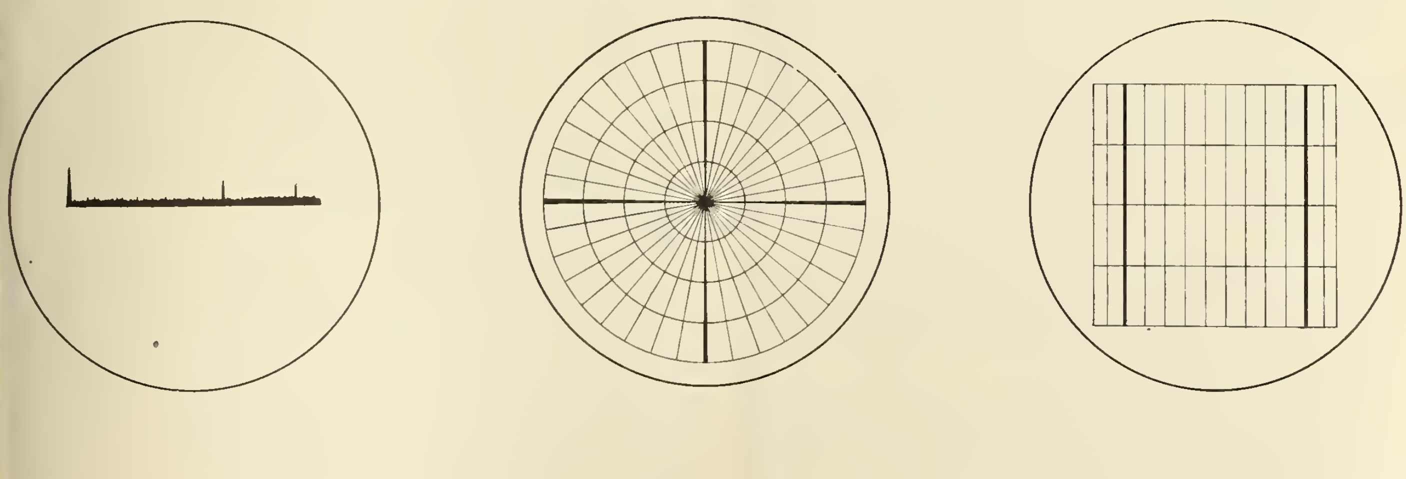
The PPI and sector-B display are intensely modulated; that is, the electron beam is practically invisible until an echo is received during which time the beam comes on to display a small, bright dot. The beam is also turned on to present the azimuth and range markers. Otherwise, the face of the tube is dark.

Height finding radar has, of course, been developed to an advanced state. Space limitations make it impossible to discuss it in this paper.

Description of Equipment

Early in June of this year Trans-Canada Air Lines, in co-operation with the National Research Council and the Royal Canadian Air Force, installed a MEW radar on the north-east corner of Stevenson Field, Winnipeg. Other MEW radars in almost exactly the same form saw wartime service on the east and west coasts as well as several stations across the Dominion.

This was probably the first radar to be exposed to the public gaze in this area and a considerable number of curious onlookers were often to be found on the road which passed outside the radar compound. During the course of installation and early operation many questions were asked. The personnel engaged on the project were hard put to answering in such a way as to allay suspicion of the true nature of their work. Railway tracks parallelled the road a few yards further removed. Passengers on the morning local were often seen straining their necks to



(A) (B) (C)

Fig. 2—Some radar display systems.

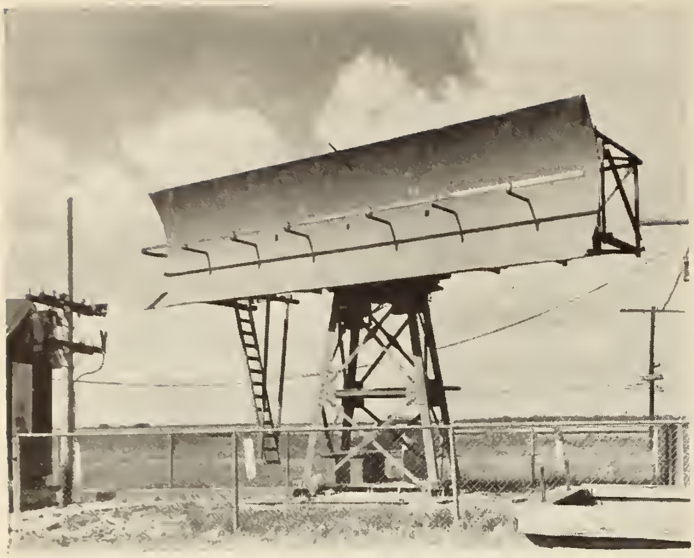


Fig. 3—Trans-Canada Air Lines' radar installation.

catch a glimpse of the strange structure turning slowly. On one occasion an unscheduled train stopped close by and the entire crew got down and came over to inspect the installation.

From Figure 3 it may be seen that the installation consists of a ground hut and a tower group. The latter is comprised of concrete footings, supporting gantry, turntable, tower hut and antenna. Inter-connecting power and signal cables are enclosed in the wooden trough seen on the ground between hut and tower. The long, thin metal tube extending across the centre of the sheet metal reflector is the antenna proper. Behind the reflector is the tower hut wherein are housed the modulator, transmitter, receiver and associated power supply and distribution panels. The antenna system and tower hut revolve on the turntable immediately below the hut. Alternating current power is supplied to the tower through a slip-ring unit. The video signals from the receiver are relayed to the ground hut via the same unit.

The large box at the base of the gantry contains the ground hut—tower hut junction strips and the Ward-Leonard tower turning system. Driven by an alternating-current prime mover, a direct-current generator provides the power for the turning motor mounted directly beneath the turntable. Controls in the ground hut allow a continuously variable tower speed of from zero to about seven revolutions per minute. In addition, the direction of rotation may be reversed at will. Both rate and direction of rotation are controlled from the ground.

The main power switch panels and radar display racks are located in the ground hut. A front view of the racks is shown in Figure 4. The left-hand rack contains the power switch panel for the radar equipment, the intercommunication amplifier and speaker, part of the display system and the video distribution chassis.

The timing and co-ordinating chassis, called the keying chassis, is located in the centre rack along with the PPI display.

The sector-B display is in the right-hand rack. All three racks have power supplies for their associated equipment.

The tower-turning controls and receiver-tuning controls are to be seen mounted on the panel between the centre and right-hand racks.

Two-way voice communication is provided between ground and tower huts by the intercom' system. By positioning the control switch so that sounds from the tower are heard over the downstairs speaker, a continuous aural check can be maintained over the equipment in the tower.

In addition to the two downstairs displays, there is an A-type presentation in the tower equipment. It is used primarily in tuning the receiver; the actual detection and location of aircraft are done on the downstairs equipment.

The phosphorescent characteristic of the main display tubes makes it necessary for the operators to work in almost complete darkness. In the T.C.A. installation. a partition between the top of the racks and the ceiling makes it possible to have the operating side dark but have the backs of the racks well lighted for maintenance work.

The transmitter employs a cavity magnetron. When " fired " by a high-voltage pulse of very short duration the magnetron oscillates at a frequency in the neighborhood of 3000 Mc. (wavelength 10 cm.), The modulator is of the spark gap type—reminiscent of radio's early days. The rate at which the modulator furnishes keying pulses to the transmitter is determined by the synchronous motor which drives the spark wheel and is of the order of three hundred per second. In this type of radar, the pulse repetition frequency of the modulator also controls the beginning of the timing cycle of the primary display systems.

The pulses generated by the magnetron are fed to the antenna through a hollow brass pipe called a wave guide. The pipe guides the radio-frequency energy in much the same manner as a ship's voice tube guides sound.

The antenna itself is a wave guide with narrow slots cut in the side facing the reflector. The radio energy flows from the slots and " floodlights " the reflector. Because of its shape and size the reflector concentrates the radiated energy into a very narrow beam.

The signal reflected from an object is picked up on the same antenna. An electronic transmit-receive switch of the type described earlier is employed to prevent inter-action between the transmitter and receiver.

Though considerably different in form, the receiver is the same in principle as the ordinary home radio receiver; that is, it is a superheterodyne. Since the receiver must function on infinitesimal signals, its amplification ratio is enormous, being of the order of ten billion.

As described previously, the output from the receiver is fed downstairs through coaxial transmission line, mixed with azimuth and range markers and displayed on the cathode-ray tubes.

The MEW radar includes no provision for height finding. As will be pointed out under operation of the equipment, a rough estimate of an aircraft's altitude is possible only at the time of initial pick-up. Before and after initial pick-up little or no altitude information can be obtained.

Operation of T.C.A. MEW Radar

Immediately after the equipment was installed a short period of time was devoted to removing " bugs " and restoring the set to first-class operating condition. No special difficulty was encountered in this regard. For most of the T.C.A. personnel working on the project, this was their first opportunity to see radar at first hand. The rapidity with which the equipment was put into operation and the smoothness with which it has been kept functioning is due in large measure to the R.C.A.F. personnel assigned to T.C.A. for this purpose.

Formal operations began when four T.C.A. radio operators were assigned as observers. With two men working an eight-hour shift the station was kept on the air about 16 hours a day. To those familiar with military radar operations an eight-hour shift must seem an intolerably long period for two men, but it must be remembered that conditions under which T.C.A. were operating were quite different. The operators were observers only. There was not the strain attendant with military work where any echo might represent an enemy aircraft or surface vessel. Flights were relatively few and far between, so that the time actually spent at the screen was not excessive. In any case, the operators alternated positions between the screen and recording table.

To facilitate collection of pertinent data, two forms were prepared. One was a flight record form on which were entered the flight involved (if known), time of observation, distance and bearing from the station, altitude (if known), strength of signal (weak, medium, strong) and remarks. The other form was used to record weather observations and included space for date, time, temperature, dew-point remarks, etc., as well as a representation of the PPI screen with the range-azimuth marker grid, upon which could be drawn the cloud echoes as they appeared on the cathode-ray tube. Lacking photographic equipment, the operators drew cloud patterns on these forms every hour or half-hour. In this way it was possible to record the development of cloud formations, frontal conditions, etc.

Direct communication between the radar operators and T.C.A. aircraft was made possible by installing a remote handset at the MEW hut, through which connection was made to the ground station transmitter and receiver control facilities in the Winnipeg station radio room. By talking to pilots the radar operators were able to get on-the-spot corroboration of weather being observed on the radar screens.

When the T.C.A. radar was first put into operation it was observed that responses from objects on the ground, generally called P.E.'s (permanent echoes), were surprisingly few. At the same time it was noted that ranges at which aircraft were first detected were quite short. This led to the conclusion that the angle of the beam of the antenna was too high. Once this situation was rectified, the extreme long ranges were considerably improved but the number of P.E.'s increased greatly.

On standard MEW radars three ranges are available: 0-40, 0-80, and 0-160, distances being in miles. Range markers appear every 20 miles. Fainter ten-mile markers are available if desired. The PPI and sector-B screens, depicted in Fig. 2, are set up for the 0-80 mile range. Ranges are changed simply by moving a switch. As will be brought out later, each range has its own special usefulness.

Observations were made with particular reference to the four applications stated in the introduction. These will now be discussed separately.

1. Airways Control

With the centre of the beam directed upward at an angle of about one degree, the maximum range achieved was about 115 miles. This was somewhat greater than what was usually recorded. Maximum range varied, of course, with the aircraft's altitude. At 8200 ft. (above terrain level at Winnipeg) the average first pick-up was about 79 miles; at 6200 ft. it was 67 miles; at 5200 ft. it was about 59 miles. Once detected, the aircraft could usually be followed into the vicinity of the field with little difficulty. Momentary fading was often evident but was not generally serious enough to cause the aircraft echo to be lost for any length of time.

It was in this particular application that the MEW radar functioned best, for it was for this purpose that the equipment was designed. Under normal conditions it was possible to monitor the movements of all aircraft above 3000 ft. within a distance of about 50 miles, with ranges of detection increasing as the altitude of the aircraft increased. As will be pointed out under meteorological observations, clouds containing precipitation could be detected out to much greater distances.

The chief use of the MEW radar in airways control was keeping the control tower officers informed of the position of non-scheduled aircraft and aircraft without radio. On several occasions the radar station has aided greatly in guiding both T.C.A. and Armed Forces aircraft around storms by telling the flight control authorities the extent of the more severe storm conditions.

During the months of July, August, September and October, a phenomenon occurred which had a pronounced effect on the operation of the equipment. This was a so-called "night effect" and was apparently caused by humidity inversion. The term "night effect" was given because the phenomenon occurred almost entirely at night. When it occurred, P.E.'s were observed out to 75 miles and the area within 20 miles of the radar was painted in almost solidly with P.E.'s. Under these conditions maximum ranges fell off appreciably, thereby reducing the efficacy of the radar as an airways monitor.

The 0-80 mile range and the PPI presentation proved most useful for this work.

2. Meteorological Observations

Here again, MEW radar fitted well into the operations picture. Cloud formations were often observed "right off the end of the tube" while on the 0-160 mile range. As in the preceding application, the PPI display was used almost exclusively.

Experience has shown that at the frequencies near those used in MEW type radars, only clouds containing precipitation cause responses on the cathode-ray tubes. The minimum size of droplet detectables varies with the frequency of the equipment; the higher the frequency, the smaller the droplet that may be detected. It has also been observed that radars in the 3000 megacycles per second (10 cm.) region give perhaps the best results in meteorological work. Lower frequency equipment can detect only fairly large drops, while with radars using higher frequencies the radio wave is attenuated very rapidly, resulting in poor penetration and consequently poor presentation of extensive cloud masses.

A great deal of "met" work had been done in Canada using MEW radar, particularly at Ottawa and Clinton, Ontario. With none of the elaborate teletype circuits for the rapid collection and dissemination of data on local weather conditions and lacking the experience of trained radar meteorologists, T.C.A. personnel were not in a position to exploit their observations to the fullest extent. They were, however, able on a number of occasions to inform flight control authorities of the extent and speed of fronts and storm areas. This aided local meteorological forecasts and permitted T.C.A. to give their passengers a quicker, safer and more comfortable passage to their destination. The 0-160 and 0-80 mile ranges were chiefly used for meteorological work.

A more extensive meteorological programme has been planned for the near future. The Department of Transport is to attach observers to T.C.A.'s radar. Working in co-operation with T.C.A. personnel, they will initiate an extensive schedule of observations utilizing more fully the existing weather facilities. Particular attention is to be directed to the vital problem of investigating icing conditions.

3. Airport Control

With airport control defined as the monitoring of all aircraft within 20-25 miles of an airport, experience showed that the capabilities of MEW radar were limited in this application.

The low angle of the beam created an extensive blind spot above the radar. This factor, together with the prevalence of P.E.'s, prevented the following of aircraft closer than about 3-5 miles from the station with any degree of ease. The higher the aircraft, the worse the situation became. It should be pointed out that a "high-looking" antenna would improve matters considerably by reducing the blind spot and missing most of the P.E.'s. The T.C.A. radar antenna was adjusted for long-range operation and there was no way to change the adjustment without physically raising or lowering the waveguide structure by means of blocks. It would have been possible to install an auxiliary high-looking antenna but this was not standard MEW equipment and was not done for the T.C.A. installation.

Despite these limitations, T.C.A. radar operators were able to assist the local Airways Traffic Control office on several occasions. At one time the position of a flight of R.C.A.F. bombers not making proper radio contact was relayed to A.T.C. along with that of a single aircraft approaching Winnipeg from a different direction at the same time. This allowed A.T.C. to maintain proper control of the airways. On other occasions the whereabouts of overdue and unreported aircraft have been determined and given to A.T.C. This information has been most useful when visibility was poor and when the aircraft carried no radio equipment.

One factor that proved seriously detrimental to airport control was the occurrence of night effect. When the effect was at its height, nearly the entire tube area out to 20 miles from the radar was painted solidly with P.E.'s. Under these conditions it was impossible to distinguish an aircraft echo.

There are a number of systems available by which clutter-free (no P.E.'s) presentation may be achieved. One such system, known as IFF (Identification, Friend or Foe), was used extensively during the war. Applied to airline work it might be described as follows. The aircraft carries a receiver tuned to the frequency of the ground radar transmitter. Each time the aircraft receiver intercepts a pulse from the ground transmitter an electronic relay in the aircraft trips, causing the aircraft transmitter to send out a pulse, but on a different frequency. The aircraft pulse is received by equipment associated with the ground radar and is displayed in the usual fashion. In this way an echo appears on the radar screen only from aircraft carrying responder equipment. The entire set up is usually referred to as a transponder system.

Aircraft without responder sets would not appear; nor would weather. A suitable switching arrangement might be provided, whereby either the clutter-free system or the ordinary system could be used. In this way weather and itinerant aircraft could be observed, while the transponder system could be switched in if necessary. The 0-40 mile range and a special 0-20 mile range were used in this application.

4. APPROACH AND LANDING CONTROL

Since MEW radar was designed for long-range detection, it was to be expected that its usefulness in monitoring aircraft movements in the immediate vicinity of the radar would be severely restricted. Experience at the Winnipeg installation confirmed this expectation.

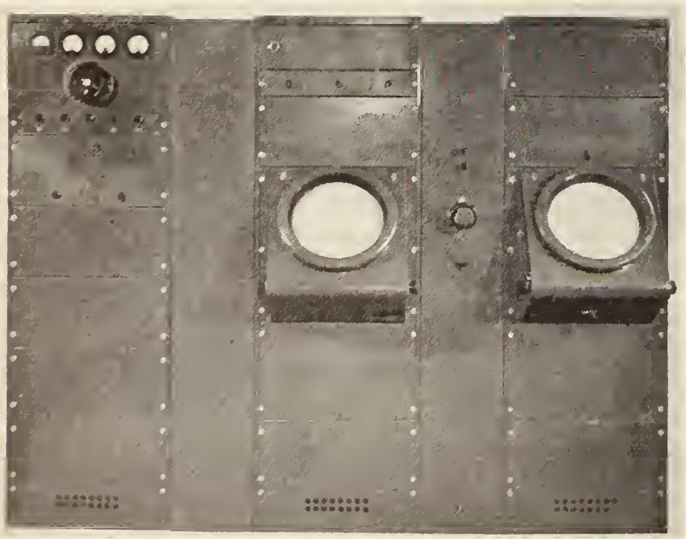


Fig. 4 Front view of ground hut display racks.

The limiting factors for this application were much the same as those encountered in airport control. With the antenna set for long-range operation, the number of P.E.'s prevented the following of aircraft closer to the radar than about 2-4 miles. The optimum results were achieved with aircraft approaching from the south and at best the minimum range was about one and a half miles.

An additional limiting factor was imposed by the design of the equipment. Even in the absence of ground returns, an aircraft echo would disappear into the sector-B tube baseline while the aircraft was still a mile away. The pulse recurrence frequency (about 300 per second) was not fast enough for close work. The type of tower turning drive was not satisfactory. The frequency and beam width were not optimum for this sort of work.

In an effort to extend the usefulness of the equipment, the normal 0-40 mile range of the sector-B display was expanded to a 0-10 mile range. Because of the type of presentation only slight advantage was gained thereby.

While lining aircraft up on a particular runway was beyond the capabilities of the equipment, it was possible to bring aircraft over the field quite readily by issuing verbal instructions to the pilot.

The results of several months' operation indicate that the MEW radar in its present form has only limited use for airline work but it is felt by those connected with the project that the experience gained will be very valuable in the considerations for future designs.

Future Prospects

No attempt at completeness will (or can) be made here. Space limitations prevent an evaluation of even the existing equipment, while a discussion of what might be evolved can only hint at the direction in which the development might progress. The entire field of radar application is so new that what can be stated now must be largely conjecture, but enough is known to indicate with some certainty the probable line of development.

The discussion that follows will be divided into the four classifications previously considered:

AIRPORT CONTROL

Airport control will probably receive the most attention in the immediate future, for it is in this application that the need is most pressing. There are many possible variations of a few basic set ups. Only a few can be mentioned here.

The fundamental unit will probably be the PPI. On its screen the control officer sees all aircraft in the vicinity of the airport. Clutter-free presentation can be achieved in a number of ways. A possible solution, the transponder system, has been outlined earlier. This system can be set up so that the frequencies transmitted from the aircraft depend on altitude and by having ground receivers tuned to different frequencies feeding into separate PPI's, the control officer can have a quasi-three-dimensional picture of what is in the air. This would be especially useful at airports handling large numbers of aircraft (e.g. New York), and would constitute an effective collision-warning device. By retransmitting the PPI display (perhaps by television) to all aircraft in that particular layer, the pilots thereof would be able to keep track of aircraft flying at the same altitude.

One radar device already well into the final design stage is the distance-rate indicator developed by the National Research Council. This light-weight (20 lb.) set enables a pilot to determine his distance from a ground station within two or three miles up to 100 miles away. Distance indication is obtained from a simple meter marked off in miles. A more accurate 20-mile scale allows the equipment to tie in very conveniently with the localizer beacons now employed in blind landing systems.

By including a feature to yield rate of change of distance, or velocity, the same equipment may be used for homing as well as airport control. The rate meter is calibrated from -50 m.p.h., through zero to + 300 m.p.h. A pilot can home on a station by keeping the needle at a maximum reading for a given throttle setting. By keeping the needle at zero the pilot is able to fly in circles around a station. This feature would be very important at busy airports where it may be necessary to "stack" aircraft before they can be cleared to land.

The PPI radar can be used in several ways as an omni-directional range in conjunction with the distance-rate indicator. One proposed system utilizes one SHF transmitter sending out omni-directional pulses and another with a revolving directional beam. The omni-directional pulse is transmitted at the instant the revolving beam passes through north. This omni-directional pulse is received and identified by the airborne equipment. The revolving beam turns at a constant known rate and the time interval between the reception of the omni-directional pulse and the revolving beam pulse can be measured to give an indication of the aircraft's bearing from the ground station.

AIRWAYS CONTROL AND METEOROLOGICAL OBSERVATIONS

Since both of these applications may be handled by the same type of radar, they will be considered together.

Experience with T.C.A.'s installation indicated that a radar similar to the MEW type might be used to monitor aircraft up to about 100 miles away and to observe weather out to 175-200 miles.

With equipment operating at a frequency of 10,000 megacycles per second and lower, fine drizzle and clouds cannot be detected. There must be precipitation (snow or rain) above a certain size before a response is secured on the radar screen. It has been noted, however, that all storms considered dangerous to flying can be seen on radars in this frequency band.

A considerable amount of weather data has already been amassed by military and governmental agencies during the war. It is likely that this work will continue on an even larger scale in the period that follows. The accuracy of short-range forecasting should benefit greatly from radar observation. Since a considerable number of flights are delayed much longer than necessary because of lack of information as to the extent and severity of storm areas, radar weather observation should aid considerably in the maintenance of scheduled operation.

The cost of installing enough radars to monitor the airways across Canada would be tremendous. Whether or not such a project would be feasible is a question that must be answered by the airlines and government agencies. To reduce operating expenses it may be possible to provide unattended radars in certain locations, relaying the information to control points by some suitable means.

INSTRUMENT APPROACH AND LANDING CONTROL

The approach and landing control problems dovetail one into the other and will be discussed together.

There are several systems in use today to land aircraft under adverse weather conditions. One that has seen extensive use in England during the war years is a radar device called GCA (Ground Controlled Approach). As the name implies, a ground controller directs the aircraft down by issuing verbal instructions over a radio link. The control officer reads altitude and bearing of the aircraft from two meters, which have data supplied to them by means of a complex system involving several operators manipulating controls at two PPI displays.

Though GCA has met with considerable success in military operations, it is felt that the "talk down" feature will not be well received in airline work. A pilot likes to fly himself down, following some instrument on his panel. The cost and complexity of the equipment and number of operating personnel required are also drawbacks. The fact that the equipment, far from being automatic, requires a human element in two vital positions is a further detrimental feature.

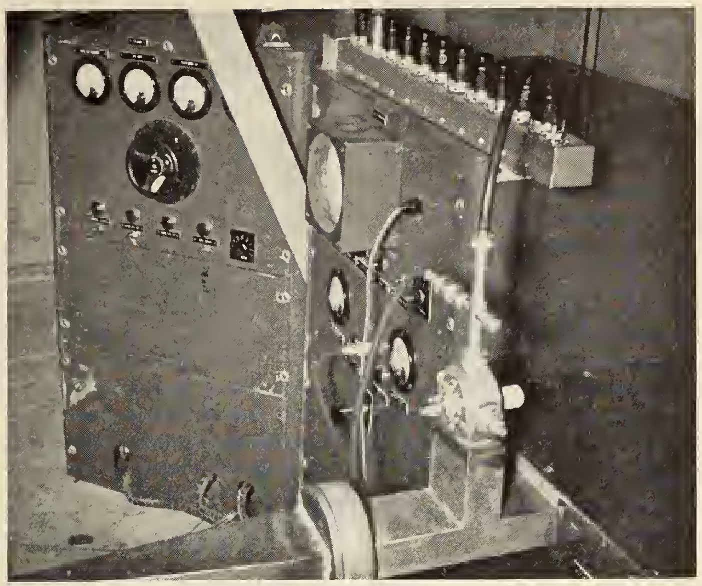


Fig. 5—Partial view of tower equipment. From left to right: control and distribution rack, receiver and A-scope rack, transmitter rack. Modulator rack is not shown.

A non-radar system, designated SCS-51, provides the pilot with an instrument which indicates the position of the aircraft relative to a fixed glide path by means of two intersecting pointers. The system has the advantage of being fully automatic as well as permitting the pilot to make his own decisions. In bumpy weather, it is quite difficult for a human pilot to fly the aircraft close to the ground with accuracy following the crossed pointers, but, coupled to the aircraft's automatic pilot, experience has shown it possible to land an aircraft quite readily.

SCS-51 suffers from a number of faults but at this writing, it appears to be the best system yet provided.

The final solution might possibly take the form of a dual system—SCS-51 to guide the aircraft down automatically and a simplified form of GCA to monitor the descent and to take over in case of emergency.

Concluding Remarks

There are, of course, a great many problems that have not been discussed here. One that might be mentioned is that of obtaining radar displays that may be viewed in daylight. Several solutions have been proposed. One is to photograph the screen with a movie camera, develop and fix the film by a special fast process that is available and project the image on a screen. This provides a daylight display with a permanent record of what has been observed. The ten-second time lag introduced is considered to be negligible.

A second solution is to have a television camera built into the cathode-ray display tube and to televise the information to the control tower where it may be displayed on a high-intensity, direct-vision television tube or projected on a screen.

Air transportation is assuming an ever-increasing importance in the world today. This relatively new mode of travel requires a new outlook; new ideas must be evolved, new methods developed, if commerce by air is to achieve the position it merits.

In radar, the aviation industry has a tool, which, if properly directed and utilized, will contribute much to air transportation. It should be emphasized, however, that despite the great advances made during the war, the final solution (if there be one) will not be forthcoming overnight.

This much we may expect in the not too distant future. Given a period of peaceful prosperity, the scientists and engineers of all nations working together will produce equipment that will take us a long way forward toward the goal of safe, speedy, scheduled air transportation.

ADVANTAGES OF HIGH STRENGTH STEEL AS REINFORCEMENT FOR CONCRETE

L. J. MENSCH
Civil Engineer and Contractor, Chicago, Ill., U.S.A.

The earliest modern users of the combination of concrete and steel turned to high yield point material. They were practical builders and considered the reinforcing as the main carrying member similar to the cables of a suspension bridge and the concrete only as filling to furnish the floor and ceiling of a building slab.

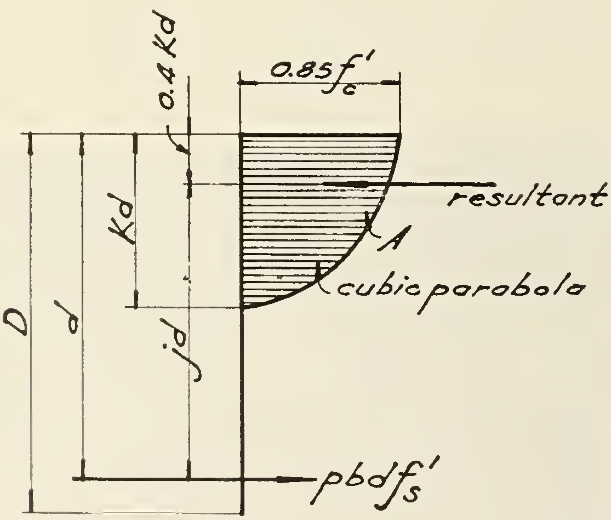
Wilkinson of Manchester, England, in 1854; Joseph Monier of Paris in 1867, Matrai of Budapest in 1890 and Cottancin of Paris in 1891 may be mentioned as early protagonists of this idea. It is interesting to note that Matrai used stresses in his wires of over 28,000 lb. per sq. in.

E. L. Ransome around 1890, then of San Francisco, was the first to have advocated high yield point steel on this continent and he proved its superiority by tests on slabs, in which he compared the efficiency of plain square bars with that of twisted bars of the same size and of the same material. The twisting raised the yield point and increased the strength of the combination of concrete and steel.

Around 1892, Mr. F. Hennebique, of Paris, first introduced reinforced concrete skeleton buildings and used, in his empirical formulas, working stresses on mild steel of 14,200 lb. per sq. in. and on higher yield point steel, stresses up to 21,300 lb. per sq. in.

The contractors thus mentioned and many others constructed empirical formulas based on their own tests of slabs to destruction and kept tests, formulas and their use of high yield point steel a business secret.

The most interesting formula established in the early days of reinforced concrete was that of Koenen & Wayss of Berlin in 1886. They tried to assess the strength of the slabs by assuming that, at the time of failure, the extreme fibres in compression reach the ultimate strength and that at the same time the tensile reinforcement reaches the yield point. They further assumed that the neutral axis is located at the middle of the depth of the slab and that the stress variation in compression follows a straight line. This led them to the formula $M = bd^2 \times f'_s \times 5/6$, an equation which agrees with modern tests for about one per cent of high elastic limit steel and about 2000 lb. per sq. in. concrete.



$$A = \text{Area} = \tfrac{3}{4}\,Kd \times 0.85\,f'_c$$
$$= 0.6275\,Kd\,f'_c$$
$$= \text{Sum of all compressive forces}$$

Fig. 1

Empirical formulas did not suit mathematically inclined engineers and they tried to analyse the molecular action of the combination of concrete and steel by the mathematical theory of elasticity. This theory aroused general interest in academic circles, although the theory of elasticity is evidently not applicable to heterogeneous materials; but the formulators were compelled to make arbitrary assumptions, not in accordance with observations, in order to obtain results which reasonably approached tests on the slightly reinforced concrete members mostly used at that time; and for reinforcement of over one per cent these so-called scientific formulas greatly underestimated the strength of reinforced concrete members mostly because of a faulty conception of the variation of compressive stresses and a faulty value of E for concrete under high stresses and long time loading.

Unfortunately, the magic in the name of elastic theory caused its adoption by the French Commission of Reinforced Concrete in 1906, and through the influence of this high standing commission and its 500-page report published in 1907, this theory was adopted by the building code authorities of the entire civilized world as a guide to reinforced concrete design. On the insistence of some of the most prominent French contractors who were members of the commission the mistake of adopting a theory which did not agree with tests to destruction was somewhat rectified by permitting high working stresses in concrete in compression and working stresses in the reinforcing steel equal to one half of the yield point (obtained by the drop of the beam in a testing machine), thus recognizing the value of high yield point steel. England and the rest of the continent and the Western Hemisphere did not adopt the liberal views of the French Commission, but adopted the elastic theory with lower permissible stresses on concrete and steel and made no rulings for high yield point steel. It is curious how tenacious the life of a false and disproved theory can be after it is once generally adopted; it may go on bidding defiance to truth for 50 or 100 years.

A notable exception in building codes on reinforced concrete was that of the City of Chicago of about 1910. It also adopted the theoretical principles of the French Commission but allowed working stresses in concrete more nearly as great as the latter and allowed steel stresses equal to one-third of the elastic limit, thus being the first code in the United States which recognized the value of high yield point steel in reinforced concrete construction. This code was so much superior to other codes in the States that engineers adopted it for use in localities where no code prevailed and did this for 25 years, until experience showed that still more liberal stresses were justified, especially with the better cement in the market and with the better knowledge gained to produce good concrete work.

The author first used high yield point steel in 1903 when the Inland Steel Company of Chicago began rolling bars from old rails in its plant at Chicago Heights, Illinois. In the same year the Expanded Metal & Corrugated Bar Company of St. Louis had its patented corrugated bar rolled by the same company and proved by tests on slabs that its bars were superior to the mild steel bars then in use. The majority of practising engineers did not make any tests but relied on the elastic theory for their designs, and this faulty theory did not give them any indication that high yield point steel was of advantage in reinforced concrete. To prove this clearly, it may be well to discuss the formulas derived from this theory, and using the standard notations, they are:

$$kd = d\left[\sqrt{2pn + (pn)^2} - pn\right] = \frac{d}{1 + n\,f_s/f_c} \quad \ldots\ldots (1)$$

$$jd = d\,(1 - k/3) \quad \ldots\ldots (2)$$

$$f_s/f_c = k/2p \quad \ldots\ldots (3)$$

$$M = A_s\,jdf_s = pbd^2\,jf_s \quad \ldots\ldots (4)$$

(As long as f_s/f_c is not greater than $k/2p$)

These equations have been believed by most of their formulators and their followers to be fundamentally scientific and correct. Nothing of that kind is true; they have a mathematical background, greatly falsified by the arbitrary and semi-empirical factor, n, which affects all proportions of the design.

Table I gives the result of these formulas for the concrete mixtures mostly in use.

TABLE I

f'_c	= 2000 to 2400		2500 to 2900		3000 to 3900		5000	
n	= 15		12		10		6	
% Reinf.	j	f_s/f_c	j	f_s/f_c	j	f_s/f_c	j	f_s/f_c
½	0.893	32	0.902	29.3	0.91	27	0.91	21.7
1	0.861	20.9	0.87	19.25	0.88	17.9	0.90	14.65
2	0.823	13.1	0.837	12.35	0.866	11.6	0.87	9.61
3			0.813	9.3	0.823	8.67	0.851	6.45

The value of f_c commonly adopted before 1937 was 0.325 f'_c as given in the Final Report of the Special Committee on Concrete and Reinforced Concrete of the American Society of Civil Engineers, January 17, 1917, and for 2000 lb. per sq. in. concrete and one per cent of steel, Table I leads to $f_s = 20.9\,f_c = 20.9 \times 0.325 \times 2000 =$ 13,600 lb. per sq. in for any kind of steel, implying a factor of safety of $1/0.325 = 3.1$, provided that the yield point of steel be $3.1 \times 13600 = 42000$ lb. per sq. in.

In heavily loaded beams, frequently two per cent of reinforcement is employed and Table I leads to $f_s = 13.1 \times 0.325 \times 2000 = 8520$ lb. per sq. in.: certainly a very small and unlikely value, which does not give any indication that high yield point steel is of any particular advantage in this case.

The Building Regulations of the American Concrete Institute of 1941 and the Concrete Specifications of the Joint Committee of 1940 allow more liberal values of f_c namely 0.45 f'_c, for use in formulas 1 to 4, which would increase the steel stresses in the last two examples in the ratios of 0.45/0.325, that is to 18900 and 11,800 lb. per sq. in. respectively. A true believer in the elastic theory must be under the impression that the assumption of $f_c = 0.45\,f'_c$ means a factor of safety of only 2.2 and that, therefore, a material with a higher yield point than $2.2 \times 18900 = 41500$ lb. per sq. in would be of no advantage in a concrete beam with one per cent of reinforcement; conditions are still more unfavourable for the use of high yield point steel in the minds of the believers of this false theory where the formulas require a safe stress of only 11,800 lb. per sq. in., implying the necessity of a yield point of only $2.2 \times 11800 =$ 26000 lb. per sq. in.

In 1914, the author in a paper entitled "New-Old Theory of Reinforced Concrete in Bending" (December 1914, *Journal*, A.C.I.) discussed the restrictions which the application of the so-called elastic theory imposed upon the practical and economical design of reinforced concrete members. The standpoints were adopted: (1) that in order to judge the strength of a reinforced concrete beam we have to consider the status of the beam near failure, long after any possibility of a straight line deformation of the compressed concrete fibres has vanished; (2) that a parabolic law of variation of compressive stresses fits tests to destruction much better than any straight line variation; (3) that we have to assume that the steel reinforcement reaches its ultimate useful strength at the same time as the concrete reaches the failure point. In a later discussion of the same subject (Vol. 33, *Proceedings* A.C.I. 1937, page 498) it was shown that, in accordance with the observations of the most experienced investigators, the stress in the steel rods at the point of failure is considerably higher than the so-called yield point found by the drop of the beam of the testing machine on a bare bar. It is somewhat the mean of the yield point and the ultimate strength and is probably the point where the strain in a very slow tension test reaches the value of 0.005 in. per in. at which point the modulus of elasticity is only a fraction of the initial modulus. This stress we called the useful limit point. Further, the assumption of a third degree parabolic stress variation for the compression fibres was recommended and, as concrete is considered the less reliable material in the conbination of concrete and steel, the top fibres were assigned an ultimate strength of only 0.85 f'_c instead of f'_c.

Conservative values of the useful limit points, f'_s may be assumed as follows:

43,000 lb. per sq. in for mild steel.
52,000 lb. per sq. in for intermediate grade steel.
72,000 lb. per sq. in. for hard grade high carbon billet steels cold drawn wire and ordinary rail steel.
100,000 lb. per sq. in for special alloy steels and hard rail steel (over 120,000 lb. per sq. in. tensile strength)

Figure 1 shows the fundamental assumptions of stress distribution in accordance with the ultimate strength theory for a cross section of a reinforced concrete beam just before failure, and equilibrium requires that the sum of all horizontal forces be zero, or that the tensile forces must equal the compression forces.

Therefore, $p\,b\,d\,f'_s = 3/4\,kd \times b \times 0.85\,f'_c$

$$\text{or } kd = 1.57\,d\,p\,f'_s/f'_c \quad \ldots\ldots (5)$$

$$jd = d - 0.4\,kd = d\,(1\text{-}0.6275\,p\,f'_s/f'_c) \quad \ldots\ldots (6)$$

and the ultimate moment:

$$M = A_s\,jd\,f'_s = bd^2\,p\,f'_s\,(1\text{-}0.6275\,p\,f'_s/f'_c) \quad \ldots\ldots (7)$$

We have calculated the maximum bending moments in terms of bd^2 in accordance with the new standpoint by formulas 5 to 7 for 4 grades of steel and for 5 grades of concrete, together with the corresponding values of k and j and they may be found in Table II. The values of j are listed in this table in order to facilitate the computation of the ultimate moment by the more convenient formula $M = A_s\,jd\,f'_s$. By dividing the ultimate moment by the factor of safety desired, two, three or more, the safe working moments may be obtained; and the member will be safe both in compression and in tension.

This table shows the overwhelming influence of the useful limit point in all cases used in practice. High yield point steel is superior to milder steel whether the concrete strength is high or low, whether the percentage of reinforcing is 1/4 or whether it is two or more, provided that the compression zone, kd, does not become greater than $0.8d$, the point where nearly all longitudinal fibres of the concrete are in ultimate compression which leads to a minimum value of $jd = d-(0.4 \times 0.8d) = 0.68d$, a critical indication of over-reinforced slabs.

For example, for ½ per cent of mild steel reinforcement and 2000 lb. per sq. in concrete we find $M/bd^2 = 200$; for ½ per cent of intermediate grade steel, $M/bd^2 = 238$; for ½ per cent of ordinary rail steel $M/bd^2 = 319$ and for ½ per cent of hard rail steel, $M/bd^2 = 421$, showing the enormous economy in the use of high elastic limit steel, even with what is now considered low grade concrete. For one per cent of reinforcement and 3000 lb. per sq. in concrete we find as great differences when we advance from mild steel to the hard rail steel, M/bd^2 being 386, 463, 612 and 792, respectively, and the same we find for higher percentages of steel and for higher grades of concrete.

We shall now proceed to prove that the ultimate theory as here developed and embodied in Table II rests on a very solid foundation, namely, on the tests of a great many experienced investigators. Professor H. J. Gilkey of the Iowa State College, in his report of the Project Committee on the Use of High Elastic Limited Steel as Reinforcement of Concrete (see Proceedings of the Fourteenth Annual Meeting of the Highway Research Board, Dec. 1934), lists 58 references of investigations made to establish the merit of high yield point steel as reinforcement. We shall present only a few series of tests made on members where failures due to shear and diagonal tension were carefully guarded against by using hooks at the end of the bars, by bent-up bars and by stirrups where necessary or where the shear at failure was very low, say of the order of around 100 to 200 lb. per sq. in.

We consider the most convincing series of tests that made by Professor Inge Lyse and George R. Wernish at the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa. (see Vol. 33, *Proceedings* of the American Concrete Institute, 1936, Pages 1 to 16). About 30 slabs, 34 in. wide and 4 in. thick, of various concrete strengths reinforced by various percentages of steel of widely different yield points (found by the drop of the lever of the testing machine) were tested, some as continuous slabs and others as simple spans and the maximum bending moment at failure is given by the authors together with other important factors for every case. Table III presents all the data, rearranged from the authors' paper and also gives the j and the f'_s calculated by the ultimate theory, using formulas 5 to 7. It shows that in every case the stress in the tensile reinforcement at the point of failure is considerably greater than the commercial yield point, and the greater the yield point, or more exactly the useful limit point, the greater is the strength of the member for the same concrete strength. The last column in Table III shows the ratio between the useful limit point calculated by the ultimate theory and the yield point of the bars determined in the testing machine. This ratio is as a rule not as great for the medium steel bars as for the harder grades of steel, but is always considerably greater than 1, varying in fact from 1.15 to 1.70 with an average of 1.40.

In order to use our formulas 5 to 7, we had to guess at the probable value of the useful limit point, as the authors did not give the ultimate strength of the bars, only the yield points being listed. This guess was rarely much out of the way and affected the calculated stresses only to a minor extent; a variation of 20 or 30 per cent in the assumed ratio of f'_s/f_c affects the value of jd only a few per cent.

Wide-awake engineers long ago realized the discrepancies between the results of the elastic theory and the tests to destruction; in order to save money for their clients they went somewhat around the codes by using the elastic theory

TABLE II

Table of Ultimate Moments for Grades of Steel and Strengths of Concrete

$f_s=$	43000 (Mild Steel)								52000 (Intermediate Grade)							
$f'_c=$	1000		2000		3000		5000		1000		2000		3000		5000	
f_s/f'_c	43		21.5		14.33		8.6		52		26		17.33		10.4	
% of Tension Reinforcement	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$
¼	.169 .933	100	.084 .967	104	.056 .977	105	.034 .987	106	.204 .917	119	.102 .959	125	.068 .974	127	.041 .984	128
½	.337 .865	186	.169 .932	200	.112 .955	205	.068 .973	209	.408 .833	216	.204 .918	238	.136 .945	245	.082 .967	251
1	.675 .73	313	.338 .865	371	.225 .91	386	.135 .946	406	.8 .68	346	.408 .837	435	.272 .891	463	.164 .934	485
1½	.80 .68	346	.505 .798	514	.338 .865	558	.202 .919	592			.611 .756	590	.407 .837	652	.245 .902	703
2			.675 .739	635	.45 .82	705	.27 .892	767			.8 .68	692	.544 .782	813	.327 .869	904
3			.8 .68	692	.675 .739	942	.405 .838	1081					.8 .68	1038	.49 .804	1250
4					.80 .68	1038	.54 .784	1345							.653 .739	1538
5							.675 .73	1570							.80 .68	1730
6							.80 .68	1730							.80 .68	1730

only for the determination of jd and allowed on the high elastic limit steel the maximum working stress permitted, regardless of the limitation imposed by the codes on the allowable compressive stresses on the concrete. Of course, in most T-beams the compressive stresses in the concrete are low, and there is rarely any conflict with the codes for use of high elastic-limit steel especially where the working stresses permitted are a fixed percentage of the yield point.

Table IV presents a similar series of tests on slabs, 34 in. wide and 4 to 6 in. nominal thickness, made by Professor T. D. Mylrea, Head of Civil Engineering, University of Delaware, and published in the Proceedings of the 16th Annual Meeting of the Highway Research Board, Nov. 1936. The concrete strength of the slabs varied from 2000 to 6000 lb. per sq. in., the yield point of the steel from 44000 to 112000 lb. per sq. in. and the percentage of reinforcing from 0.34 to 2.11. Professor Mylrea gave both the yield point and the ultimate strength of his reinforcement and we assumed the useful limit point about the mean of the two values; and calculated the values of j and f'_s by formulas 5 to 7 and again found that the calculated useful limit stress, f'_s, was higher than the yield point and the ratio $f'_s/Y.P.$ averaged about 1.3, except for items 36 to 38 which failed by defective concrete at the supports, but still showed higher steel stresses than the yield point.

It is desirable to cite the very interesting series of test beams made by Mr. Conde B. McCullough, Assistant Chief Highway Engineer of the Oregon Highway Department, Salem, Oregon (see *Engineering News-Record*, Sept. 19, 1935). The series consisted of 20 beams 24 in. wide and of an effective depth of 10 in., reinforced by 1 to 4.6 per cent of steel of a yield point which varied from 45000 to 55000 lb. per sq. in., tested on a span of 12 ft. 6 in. by two concentrated loads 5 ft. distant from the supports. All bars were hooked and some of the beams had bent-up bars and stirrups as noted in Table V. The author did not give the yield point or ultimate strength of the reinforcement for the individual members, therefore it was necessary to guess at an average useful limit point of 63000 lb. per sq. in.

The ultimate theory according to formulas 5 to 7 gave results which showed the useful limit point derived from these tests averaged about 20 per cent more than the average yield point of 50,000 lb. per sq. in. Item 55 is an example of an over-reinforced beam. The computed j is smaller than 0.68 previously referred to as the minimum value possible in any concrete beam, and this value was used instead of the value of 0.661 computed from formula 6. This particular beam would have sustained the same load if the reinforcement had been 10 per cent less.

By means of Tables III and IV we can now easily prove that Table II based on the ultimate theory leads to safe and conservative results.

Let us take as first example Item No. 1 in Table III. $M/bd^2 = 172600/(34 \times 3.12^2) = 525$, wherein 34 in. is the width and 3.12 in. is the effective depth d of the slab.

In Table II we find for 3000 lb. concrete and one per cent of intermediate grade steel reinforcement $M/bd^2 = 463$, adding to this value about 11 per cent on account of the

TABLE II—*Continued*

Table of Ultimate Moments for Grades of Steel and Strengths of Concrete

$f_s =$	72000 (Ordinary Rail Steel)								100000 (Hard Rail Steel)											
f'_c	1000		2000		3000		5000		1000		2000		3000		4000		5000		10000	
f_s/f'_c	72		36		24		14.4		100		50		33.33		25		20		10	
% of Tension Reinforcement	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$	k j	$\frac{M}{bd^2}$
¼	.282 .887	160	.141 .944	170	.094 .962	174	.057 .977	176	.393 .843	210	.196 .922	230	.131 .948	236	.098 .961	240	.079 .969	242	.039 .984	246
½	.565 .774	278	.282 .887	319	.188 .925	333	.113 .955	343	.785 .686	343	.393 .843	421	.261 .895	447	.197 .921	460	.157 .936	468	.079 .969	484
1	.80 .68	346	.565 .774	556	.376 .85	612	.226 .91	655	.80 .68	346	.785 .686	686	.521 .792	792	.392 .843	843	.314 .874	874	.157 .933	933
1½			.80 .68	692	.565 .774	835	.339 .864	934			.80 .68	692	.781 .688	1030	.588 .765	1147	.470 .812	1215	.235 .906	1359
2					.753 .699	1005	.452 .819	1179					.80 .68	1038	.785 .686	1372	.628 .749	1498	.314 .874	1748
3					.80 .68	1038	.678 .729	1574							.80 .68	1384	.80 .68	1730	.471 .811	2433
4							.80 .68	1730											.628 .749	2996
5																			.785 .686	3430
6																			.80 .68	3460

1.11 per cent of reinforcement in Item 1, we obtain the figure 511, which is about 3 per cent smaller than the test figure. As another example take Item No. 8 in Table III. $M/bd^2 = 88700/(34 \times 3.4^2) = 225$. In Table II we find for 3000 lb. concrete and ¼ per cent of rail steel reinforcement $M/bd^2 = 174$, which value increased in the ratio of 0.3/0.25 gives 209, again less than the test, and shows Table II to be conservative. Item 13 in Table III was a highly reinforced slab and $M/bd^2 = 305400/(34 \times 2.75^2) = 1190$. In Table II we find for 3000 lb. concrete and 2 per cent of rail steel reinforcement, $M/bd^2 = 1005$, which will increase to only 1025 for 2.62 per cent reinforcement, showing again that Table II gives conservative values, although this table recommends much higher moments than the straight line theory would allow.

For Item 31, Table IV, $m/bd^2 = 81025/(34 \times 3^2) = 264$. From Table II we learn for 3000 lb. concrete and ¼ per cent rail steel $M/bd^2 = 174$; this value increased by 0.34/0.25 gives 236, demonstrating again that Table II is conservative.

Item 40, Table IV can provide an example of another highly reinforced slab. $M/bd^2 = 319000/(34 \times 3^2) = 1040$. From Table II we learn that for 3000 lb. concrete and for 2 per cent of rail steel reinforcement, $M/bd^2 = 1005$, again a conservative figure.

Item 44 in Table IV has $M/bd^2 = 148000/(34 \times 3^2) = 484$, while in Table II we find for 3000 lb. concrete and for the average of ½ and 1 per cent of rail steel reinforcement $M/bd^2 = 473$, again a few percent smaller than the test result.

As a further indication of the adaptability and easy application of the ultimate theory, a design example is given.

The computations for the design of a T-beam according to the strict rules of the straight line theory as required by all codes are quite formidable affairs; the ultimate theory and Table II will enable engineers to produce a more economical and more correct design in a few minutes. As an example, take a beam of 24 ft. span, simply supported, connected to a slab 4 in. thick, to carry a total load of 1500 lb. per lin. ft., $f_s = 24000$ lb. per sq. in., $f'_s = 72000$ lb. per sq. in. $f'_c = 3000$ lb. per sq. in and assume $j = 0.9$ as a trial figure.

$M = 1500 \times 24^2/8 = 108000$ ft.-lb.
$V = 1500 \times 12 = 18000$ lb.

We have now to make some decisions regarding the total depth of the beam, D, the effective depth, d, the width of flange, b, and the width of the web, b'. We select $D = 24$ ft./15 = 1.6 ft., say 20 in.; $b = 16 \times 4$ in. = 64 in, $d = 20 - 3 = 17$ in. and $b' = 18000/100D = 9$ in., which on account of the commercial width of the 2 × 10 in. plank for the bottom form we shall assume as 9½ in.

$$A_s = M/jd \times 24000 = \frac{108000}{0.9 \times 17/12 \times 24000} = 3.54 \text{ sq. in.}$$

which is 0.32 per cent of the area of the rectangle 64 × 17 in. From Table II we find for $f'_s = 72000$ and $f'_c = 3000$, and for a percentage of reinforcement between ¼ and ½, $j = 0.95$ and $k = 0.125$. Hence A_s may be slightly reduced in the ratio of 0.9/0.95 to 3.35 sq. in.

The value of the unit shear $v = V/b' \times jd = 118$ lb. per sq. in. showing that hooks at the end of the straight and bent bars are necessary and that a moderate amount of stirrups should be used.

A careful designer will check the somewhat shallow beam of a non-continuous member for deflection, and will consider that the E for concrete for time loading should be taken as one-half to one-third of the initial E in cylinder tests; it should be also remembered that the moment of inertia of the rectangle $b' \times D$ should be increased about 50 per cent on account of the help from the flange of the beam, so that $I = 1.5 \times 9.5 \times 20^3/12 = 9000$ in. and assuming $E = 1.5 \times 10^9$, $E \times I = 13.5 \times 10^9$.

$$\text{The deflection} = \frac{1500}{12} \times \frac{5}{384} \times \frac{(24^4 \times 12^4)}{E \times I} = 0.835 \text{ in. or}$$

TABLE III

Item No.	Slab No.	Type	Span Ft.	Total Thickness D Inches	Effec. Depth d Inches	REINFORCEMENT: Test Data: Bars	Area sq. in.	%	Yield Point Kips	Assumed Useful Limit Point f'_s Kips	Conc. Str. P.S.I. f'_c	Assumed f'_s/f'_c	Moment at Failure in. lbs.	Computed by Ultimate Theory: j	f'_s P.S.I.	f'_s/yield point
1	2	S	5	4¼	3.12	6½φ	1.18	1.11	47	55	2720	19.7	172600	.863	54500	1.16
2	3	S	8	4 1/16	3.06	6½φ	1.18	1.15	46	55	2700	19.7	165300	.859	53000	1.15
3	4	S	8	4 7/32	3.00	Mesh	.56	.55	62.9	80	2600	30	142300	.897	87000	1.38
4	5	S	8	4 5/32	3.08	15¼φ	.735	.70	56.6	80	2690	30	153800	.869	78000	1.37
5	6	S	8	4⅛	3.00	7⅜φ	.772	.75	47.5	55	2780	19.7	143300	.908	68000	1.43
6	7	S	8	4 3/16	3.12	4½φ	.785	.73	50.	55	2640	19.7	155300	.911	70000	1.40
7	9	S	8	4 5/32	3.10	7¼φ	.344	.33	46	55	2890	19.2	72500	.96	70300	1.54
8	10	S	8	4¼	3.40	7¼φ	.344	.30	55	80	2800	28.7	88700	.946	80500	1.46
9	11	S	8	4⅛	3.06	7¼φ	.344	.33	75	100	2600	38.5	104500	.920	108000	1.45
10	12	S	8	4⅛	3.00	7¼φ	.344	.336	95.5	130	3300	30.4	120000	.936	124000	1.31
11	13	CON.	8	4⅛	3.00	7⅜φ	.772	.77	44.3	55	5500	10.0	146200	.952	66000	1.49
12	14	CON.	8	4 3/16	2.88	7⅜φ	.772	.79	93	130	5500	23.6	272400	.884	137000	1.47
13	15	CON.	8	4⅛	2.75	8⅝φ	2.45	2.62	49.3	72	2900	25.0	305400	.59	77000	1.56
14	15A	CON.	8	4	2.88	6⅝φ	1.84	1.89	47.	72	2700	26.7	260000	.682	72000	1.53
15	16A	CON.	8	4 1/16	3.0	6⅝φ	1.84	1.80	47.2	72	5850	12.3	260400	.861	56500	1.19
16	17	CON.	5	4⅛	3.0	6½φ	1.18	1.16	46.0	72	2800	25.8	222000	.812	78000	1.70
17	18	CON.	8	4⅛	2.82	6½φ	1.18	1.23	47.0	72	2640	27.3	200000	.792	76000	1.62
18	20	S	12	4⅛	3.0	Mesh	.92	.90	60.5	80	2750	29.0	204400	.835	88800	1.46
19	21	S	12	4⅛	3.0	13⅜φ	1.43	1.40	53.1	72	3100	23.2	225400	.796	66000	1.24
20	22	S	12	4 5/32	3.1	7½φ	1.38	1.31	48.5	72	3140	22.6	206700	.814	50000	1.22
21	23	S	12	4⅛	3.06	5⅝φ	1.53	1.50	47.1	72	3080	23.3	209400	.781	57000	1.22
22	24	S	12	4 3/16	2.94	3¾	1.32	1.32	50.3	72	3110	23.2	198900	.808	63500	1.26
23	25	S	12	4⅛	3.06	6½φ	1.18	1.15	47.0	72	3085	23.3	180400	.832	60100	1.28
24	26	S	8	4 1/16	3.00	5½φ	.984	.97	50.0	72	3000	24.0	181300	.854	72500	1.45
25	28	S	16	4	2.75	2-1″□	2.0	2.14	39	45	3200	14.1	205750	.810	46000	1.18
26	29	S	8	4⅛	2.94	7⅜φ	.772	.77	93	130	5260	21.9	219300	.895	107500	1.15
27	31	S	16	3 15/16	2.94	8½φ	1.58	1.58	47.9	72	2880	25.0	218000	.752	62500	1.30
28	32	S	8	4¼	3.12	7⅜φ	.772	.73	50	72	5750	12.5	147500	.943	65500	1.31

f'_s/f'_c replaces n of the straight line theory.

1/345 of the span. It is clear that a rectangular beam without flanges would have a larger deflection, and as an example for such a beam, we shall assume $D = 24$ in., $d = 21$ in. and $j = 0.8$. From equation 7, $A_s = 108000/0.8 \times 1.75 \times 24000 = 3.23$ sq. in. or 1.62 per cent of the rectangle 21×9.5 in. From Table II we can find by simple interpolation that $j = 0.76$, therefore A_s should be increased in the ratio of 0.8/0.76, or $A_s = 3.4$ sq. in.

Both examples would result in factors of safety of about 3 both in compression and tension when ordinary rail steel is used and in a factor of safety over 4 in tension when hard rail steel is used.

The author being a great believer in the use of high tensile steel, turned to the rail steel bar mills as a source of supply as early as 1904 and has been a consistent and successful user of rail steel over a period of over forty years. In this practice there has been no unfavourable instance that this material is less reliable than mild steel. Although job fabrication was the rule on most of his constructions, breakage in bending always proved a minor concern. It is true, the men were strictly trained and, in accordance with the author's belief that stresses do not turn sharp corners and further that tight bends subject enclosed concrete to extreme compression stresses, radii of ten diameters or larger were used on trussed bars.

Other occasionally encountered objections to the higher carbon steels were likewise unsupported in this experience and it is the author's firm conviction and experience that concern over reversal of stresses, vibration, and shocks are unfounded and the only limitation in proper design is brittleness of the concrete. The percentage of reinforcing is always comparatively low and the much greater mass of concrete is first affected and fails long before the steel rods can fail. This has often been observed on orders to make shock tests on structures, in driving reinforced concrete piling, in the continuous satisfactory performance of railroad trestles in steel mills, and in reinforced concrete industrial plants distinctly subject to impact and vibration; for instance that of the Seng Co., 1450 Dayton Street, Chicago, built in 1905, where rail steel with rather high stresses was used (no code for reinforced concrete was in force and the building department required that floors be tested to 4 times the live load of 100 lb. per sq. ft.) the building behaved splendidly and to date has been in continuous operation with stamping machines on all floors. Similarly the Utah Copper Company separating mill at Garfield, Utah, built in 1906, was designed with stresses never less and often, where possible, greater than present day limitations. The structure, still in use and reinforced with over 900 tons of rail steel, has 240,000 sq. ft. of floors which support shaking tables that subject the entire structure to continuous vibration. These typical experiences are also confirmed by tests made by Professor Mylrea (see Volume 6, *Proceedings* of the American Concrete Institute June 1940, pages 581-594) on a large number of beams, 10×16 in. in size and 8 ft. span, by letting a weight of 560 lb. repeatedly fall from a height of 8 ft. 4 in. The repeated blows shattered the concrete and it was impossible to break the reinforcing. The author concludes—Rail steel and other "brittle" steel reinforcements are quite as resistant to impact as is structural grade reinforcement.

Concerning factors of safety in reinforced concrete construction: In the light of the tests here presented, the French Code led to a factor of safety of 2×1.3 or 2×1.4, that is 2.6 to 2.8, according to whether low or high yield point steel be used. The old Chicago ordnance led to a factor of safety of $3 \times 1.4 = 4.2$ for rail steel. The new codes allowing stresses of 20,000 lb. per sq. in. on both intermediate grade and high elastic limit steel mean in the light of this paper allowable factors of safety of $52000/20000 = 2.6$ for intermediate grade and $72000/20000 = 3.6$ for ordinary rail steel. During the war, the U.S. Government directed that a stress of 24000 lb. per sq. in. be used in reinforced concrete construction, which corresponded to factors of safety of 2.17 for intermediate grade steel, 3.0 for ordinary rail steel and 4.17 for hard rail steel.

We believe presenting more proofs will tire the general practitioner; the specialist should study the previously mentioned references noted by Professor Gilkey. We believe we have demonstrated that Table II, based on the formulas

(*Continued on page 246*)

TABLE IV

Item No.	Slab Design	Type	Span Ft.	Thickness of Slab Inches	Reinforcement: Bars	Area	%	Yield Point Kips	Ult. Str. Kips	f'_s Assumed Useful Limit Point Kips	f'_c Conc. Str. P.S.I.	$\frac{f'_s}{f'_c}$	Moment At Failure in. lbs.	Computed by Ultimate Theory: j	f'_s P.S.I.	$\frac{f'_s}{\text{y.p.}}$	Shear at ult. P.S.I.	* %
31	1D1	CONT	8	4	7¼φ	3.44	.34	53.3	72.8	80	3000	26.7	81025	.943	83100	1.53	45	67
32	1D2	CONT	8	4	7¼φ	3.44	.34	60.8	88.8	80	3000	26.7	75900	.943	77900	1.28	42	53
33	1D3	CONT	8	4	7¼φ	3.44	.34	58.2	82.8	80	3000	26.7	81025	.943	83100	1.40	45	49
34	1D4	CONT	8	4	7¼φ	3.44	.34	72.9	115.0	80	3000	26.7	86025	.943	88300	1.21	47	67
35	1D5	CONT	8	4	7¼φ	3.44	.34	112.	152.0	130	3000	43.3	136000	.908	14500	1.30	78	43
36	2D1	CONT	8	4	7⅜φ	.772	.76	44.0	62.9	58	6000	9.67	106275	.954	47700	1.03	57	47
37	2D1X	CONT	8	4	7⅜φ	.772	.76	49.5	68.4	58	3000	19.33	126525	.908	60200	1.21	68	55
38	2D2	CONT	8	4	7⅜φ	.772	.76	95.5	142.9	115	6000	19.15	228010	.909	108000	1.14	118	28
39	3D1	CONT	8	4	7⅝φ	2.15	2.11	61.3	98.7	80	2000	40.0	243000	.470	80000	1.30	244	58
40	3D2	CONT	8	4	7⅝φ	2.15	2.11	61.7	98.1	80	3000	26.7	319000	.646	76800	1.24	235	15
41	3D3	CONT	8	4	7⅝φ	2.15	2.11	61.7	98.8	80	4500	17.8	369000	.764	74600	1.21	232	28
42	3D4	CONT	8	4	7⅝φ	2.15	2.11	59.9	97.8	80	6000	13.3	379000	.823	71400	1.20	220	40
43	4D1	S	5	4	7⅜φ	.772	.76	63.5	94.2	80	3000	26.7	186700	.873	92000	1.43	140	36
44	4D2	S	8	4	7⅜φ	.772	.76	58.7	86.5	80	3000	26.7	148000	.873	73200	1.25	69	50
45	4D3	S	12	5	5½φ	.98	.72	59.4	87.2	80	3000	26.7	257000	.879	75000	1.26	61	—
46	4D4	S	16	6	6½φ	1.18	.69	60.1	99.6	80	3000	26.7	373000	.885	71500	1.19	52	—

In Items 31 to 38 Billet Steel was used; in Items 39-46 Rail Steel.

Evidently no measurements were made in the series for the exact value of d, which was assumed as 1″ less than the nominal total thickness D.

Slabs 36 to 38 failed due to crushing of concrete at the supports.

Slabs 39 to 42 showed signs of diagonal tension failure; shearing stresses were high for beams without trussed bars or stirrups.

*Percent of total load at which first crack was observed.

THE EDUCATION OF ENGINEERS

C. R. YOUNG, M.E.I.C.
Dean of the Faculty of Applied Science and Engineering, University of Toronto

An address delivered at the Thirty-First Annual Dinner of the Graduates Society of Ecole Polytechnique, at Montreal on February 9th, 1946, and reproduced here with the kind permission of the Society.

We whose days are devoted to educational pursuits derive constant inspiration from our association with young men. For nearly forty years I have been engaged in teaching and administration, and every year I experience a new impetus, a new animation. There is a great deal to be said in praise of the freshmen who come up to the universities and colleges. Abbott Lawrence Lowell, at one time president of Harvard University, said that he always rejoiced in the coming of freshmen to Harvard because they brought in a great deal of knowledge and the seniors never took any away. So, on the balance, the university profited.

A Perennial and Changing Subject

I am to speak to night of the education of the engineer, a subject that is very close to my heart. It is a perennial subject. People will be making speeches about it a century from now—perhaps many centuries from now. It is a subject that is always changing. We are confronted with the ceaseless tide of civilization as it moves on, charged with all its trials and difficulties. We never have the same problems two years in succession. There is an uncurbed and turbulent stream of human dilemma rolling past us and, as Heraclitus said, " We can never step twice into the same river ". It is always a different river, and so we must modify our practices and methods. In seeking to serve well the community and the country in which we live, we must address ourselves to this constantly resurgent, ever fresh problem of what constitutes a proper education for engineers.

It is scarcely necessary to argue the justification for higher education. A century and a half ago a clever but cynical English essayist, Sydney Smith, presumably in no way related to the distinguished president of the University of Toronto, observed that the only consequence of university education was a growth of vice and a waste of money. I cannot subscribe to the first indictment, nor do I think that there is a waste of money. In fact there is so little available for educational institutions that it can scarcely be wasted.

Higher education affords an opportunity for young men to prepare themselves effectively for the tasks of life. They are enabled by it to put their educational houses in order and to deal with whatever situations may confront them. We can do only so much in the universities and colleges. Students and graduates must themselves do the rest. I often reflect on the words of the late Dr. Olivier Lefebvre, who used to point out that the young engineer who had just graduated had learned how to read. He could now discover things for himself. He could wend his way through the literature of his profession and find out how to solve his own problems. That is perhaps all that any of us in educational work can hope to do. You must do the rest.

Beginnings of Engineering Education

In days gone by there was little less than hostility towards the engineer trained in universities or colleges. In English-speaking countries the profession developed from lowly origins. The first engineers in Britain were the millwrights—clever mechanics, often with more than a touch of genius, who, with no formal education, were able to solve difficult problems with uncanny accuracy. One such was James Brindley, the man who made the great inland waterways system of Britain possible. He was able to solve engineering problems by going to bed for three days and thinking about them. Then there came George Stephenson, Thomas Telford, the Rennies, and many other great figures. It seemed that the proper way to develop an engineering practitioner was through constant contact with men and materials in the shops and in the field. And so the collegiate form of training progressed slowly in Britain. In the United States it was different. There was an urgent need to train large numbers of young engineers to carry out the great western expansion in the early part of the 19th century. They had few experienced engineers who could train large numbers of apprentices in a short time, and so they met the situation in another way. They followed the French system of collegiate training.

One might truthfully say that the first engineering school was established in France as a result of the appointment, by Louis XV, in 1747, of Perronet as chief engineer of bridges and highways. He was charged with " instructing the designers in the sciences and practices needful to fulfilling with competency the different occupations relating to the said bridges and highways ". Thus began the study of the sciences that lay behind the sound construction of bridges and roads. Then there were the French artillery schools, which played a great role. They, with the celebrated government-sponsored Ecole des Ponts et Chaussées, gave the most advanced training that had been available up to that time. Out of them came many able French mathematicians and engineers, such as Lagrange, Laplace, and Monge.

Along with many other engineering graduates, I have had occasion to speak flippantly of Monge, the inventor of descriptive geometry. I remember a distinguished graduate of the University of Toronto who, after listening to a few lectures in descriptive geometry, characterized it as " lines and planes and a horrible mess ". Actually, that is not exactly what he said but, out of respect to Monseigneur Maurault, I shall not give the actual version.

Based on the French concept, the American people developed formal engineering education in colleges. The first of them was the Rensselaer Polytechnic Institute. at Troy, N.Y., established in 1824. Your own Ecole Polytechnique is an outcome of that first pioneer college. I have on several occasions visited your great school and I compliment you, Mr. President, and Mr. Director, on the excellent institution that has been developed over the years. With fine classrooms, excellent laboratories, and an able and devoted staff, your school is contributing impressively to the sound education of young men in engineering in this country.

Objectives of Modern Education

It may be useful to examine briefly some of the objectives of modern engineering education. First of all, there is the need of bringing to young men a familiarity with the fundamental sciences that lie at the base of engineering. One cannot practise engineering in these enlightened days purely as an art. It would take too long. The young practitioner must find some principles to guide his judgment. That faculty may be developed by long experience and practice, but we know that careful study, tests, and experiment reveal certain principles that hold with reasonable accuracy. It is our business in the engineering schools to find them out and to communicate them to those young men who hope some day to practise engineering as a profession.

If we were to neglect scientific nourishment of the professional engineer, we should very soon come to a situation such as arose from the long stagnation of the middle ages. By the beginning of the 16th century, industry and the crafts had reached a stalemate. The few formal principles, the same limited technology, had been applied over and over again. Improvements had been made, but no outstanding progress was possible until the great scientific upsurge of the 16th century broke upon the world.

We cannot afford to rest upon our oars. We must be constantly moving on, making new applications of principles that the scientists have developed for us. Some idea of practice needs to be imparted in the engineering schools. It is not enough merely to study the philosophy and the theory of engineering. We must acquaint ourselves with those things that are found by experience to be practical within the limits of time and costs that are imposed by our employers or clients. At least rudimentary skills must be developed. It is not merely a matter of book study; some deftness of hand and some accuracy of manipulation will serve a young man in good stead when he enters the professional field. The acquisition of skills cannot be left wholly to the years following graduation. Those associated with drafting, testing, experimentation, and computation, may in substantial measure be acquired in college.

Dr. Baulne, one of your distinguished graduates, who is here tonight, did not reach eminence merely by relying on his efforts as a student of theory. He found out many things by trial and close observation, and so it is with all successful engineers. Practice must be had, but it needs rest on a sure foundation of theory.

In some respects, engineering is and always will be, an art. Unfortunately, science lags behind our needs. There are still many problems that confront the engineer for the solution of which there are no thoroughly recognized principles. Sound judgment and enlightened approximation must be brought to our aid. If we pursue theory too closely, without the tempering of judgment, we are likely to encounter unexpected difficulties, if not danger. Conclusions may be reached which are at wide variance with practical circumstances.

In the course of the last year, I have, with others spent much time in the study of mine hoisting safety in Ontario. Our Committee has received many proposals with respect to safety devices for the stopping of a cage if the cable should break. Some of them would undoubtedly arrest the fall of a cage in a very short distance but with the embarrassing feature that the stopping would be so sudden that the occupants of the cage would be killed. Such proposals ignore common sense. One must remember that there are limits to the endurance of the human organism. One must have some regard for anatomy and physiology, which lie outside the realm of engineering, but not outside common human experience.

There is need for acquisition in college of a fresh, firm understanding of those ethical principles that must guide every faithful practitioner of a learned profession. No hard and fast rules of conduct exist in it but there are certain standards of faithful service to the public and to the community, standards of fairness and consideration for colleagues and for rivals. Unless the young practitioner recognizes these things, he is in no true sense a member of a learned and enlightened profession. He must possess an appreciation of the larger role of the engineer as a member of a democratic society. It is not sufficient merely that he become accomplished and proficient in certain techniques of which he has gained some knowledge in college.

Technologists are valuable members of society. We depend vitally upon them and shall continue to do so; but the practice of engineering does not consist merely of the mechanical application of techniques. The engineer is above all a member of society and as such it is his duty to cooperate with other men of earnestness and good faith to advance its interests, to improve the welfare of his community, to do all in his power to make this world a better place in which to live. If he ignores these obligations and confines himself to his laboratory or to his office, letting the world go by, he may yet be set down as a clever technologist but not as a real engineer.

Post-War Trends

Certain trends are definitely apparent when we examine the recent progress of engineering education on this continent. The Society for the Promotion of Engineering Education, in its report of 1944 on Engineering Education After the War, identified three of them.

First, there is the strong current of traditional training with which we are all familiar. In most institutions it involves an undergraduate course of four or five years, basic and general in character, without marked specialization. That will continue to be the main stream along which most engineers will proceed to graduation and practice.

But there has come about, particularly in the last decade or two, a marked tendency for engineers to enter the field of management and administration. The recent war showed to a very remarkable degree the extent to which the engineer has taken part in management, direction, and control. It has shown that by reason of his technological background, his commonsense point of view, and his direct methods, the engineer is unexcelled as human material for managerial pursuits, provided that he has the personal characteristics that are associated with the successful handling of men. Many of the engineering colleges of the United States have recognized this and have introduced courses to give a type of training that is particularly suited to those who are, or appear to be, fitted for this type of activity. We have done this in the Universtiy of Toronto and look forward confidently to the outcome of the experiment.

A recognized need exists, too, for a moderate number of men who are trained much more rigorously in the sciences and in mathematics than those who pursue the other programmes that have been mentioned. These men will work at a very advanced level. A high order of achievement will be theirs. They are in the class of scientist-engineers to whose services we owed so much in the late war. I am happy to say that Dr. Dunsheath, President of the Institution of Electrical Engineers of Great Britain, who is here tonight, is one of those scientist-engineers. Another is Sir Robert Watson-Watt, with whose name will be forever associated the amazing development of radar. And there is Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, one of your honorary alumni. With unrivalled knowledge of the facts, he has vigorously pointed out that in the solution of unusual problems in the recent war the scientists did rather better than the engineer trained in traditional courses. The latter did better in production, in the development of an idea, in the manufacture of devices, in devising sound financial and operational bases, but in the creation of the original concept the scientist-engineer has had the edge on the ordinary engineer.

It is not everybody who can function effectively in this field. Only a comparatively small percentage of young men, rarely endowed with native talent and interest, are able to serve in it with distinction and success. But I feel that we should have in our universities and colleges a small proportion of men who will not only take a particularly rigorous training in the undergraduate years but proceed to graduate work of two or three years duration. Upon them we may well rely for outstanding creative achievement, for those devices, methods, and processes that have meant so much to us in times of stress.

Selection of the particular type of college course that is to be pursued is not so vital a matter as some young men think. Actually, it makes but little difference in the long run whether the student selects this or that branch of engineering. With remarkable frequency prospective employers of our own graduates for permanent positions will say simply: " What I want for my organization is a bright, interested boy with a good personality. I do not care very much what course he has taken. We will see to his development and mastery of our methods, but he has to be good material—with a sound fundamental education. We will start from there."

I am often reminded of the practice said to have been followed by Sir John A. Macdonald when appointing judges. " My policy ", said he, " is to find a gentleman first of all. If he knows some law, so much the better ". Attractive personal qualities constitute a powerful reinforcement of whatever technical proficiency a young man may possess.

The Need of Humanities

Much was said at the recently concluded Annual Meeting of The Engineering Institute of Canada concerning the desirability of humanizing and liberalizing our engineering courses. I am entirely in agreement with the observations that were made in that respect. We have confined ourselves in the engineering colleges too narrowly to the scientific principles of engineering. We ought to remember that those who serve as professional engineers should take their full part in the society to which they belong. Unless we are able to mingle freely, naturally, and effectively with other educated persons and contribute as they do to the public service, we shall not receive full recognition as professional men.

I was struck with the remark of Dr. Dunsheath last evening to the effect that there is no point in the young man who seeks recognition and distinction in the profession clamouring for that recognition.* He will get it in due course if he is worth it. If he is not, all the striving in the world will not bring it. And so he should put his general educational and cultural house in order and acquire those personal interests and qualities that will make him an acceptable citizen, a creditable representative in any society, an effective champion of any cause that merits a champion.

There is need for young men while still in college to acquire some familiarity with the raw materials of thought on social and economic questions. If he has no material to work with, if he is charged with no ideas on these subjects, he cannot get very far in developing a philosophy pertaining to them. So, while in college he should do what he can to assimilate ideas about non-technical things with a view to his career as an effective citizen. If he develops a sympathetic interest in others and can broaden his point of view to include theirs, so much the better. Then when he comes out into the workaday world he will have laid a foundation of ideas, a basis for enthusiasm, and some qualifications for assuming his share in attempting to solve the difficult problems that will everywhere confront him.

He should acquire some familiarity with cultural matters. He should develop an interest in art, in the drama, in literature, in music, in social work, in things that educated, cultured, and refined people find to their liking the world over. He may never be a practitioner in the cultural field but he may at least develop and maintain an interest in it and be able to further the contribution of those who are creators therein.

Yes, humanistic interests and studies are of vital consequence to engineering students, quite as much as they are to any other students. They impinge on the fundamental questions of life.

I like to think of something that Lucien Price wrote a couple of years ago for *The Atlantic Monthly* in justification of the humanistic subjects of study in the universities and colleges. Said he

> " Here, in the subjects mentioned are charted the successes and failures of human society, with reasons for both. Here is a manual of civilization, examples of what has been tried, of what works and what does not. Here are the implements of long-range wisdom, hammered out on the ringing anvil of time ".

Education to be effective has to be broad, comprehensive, inclusive. We are citizens of a great country and our education should fashion us to serve it.

I like to muse, too, on the words of a great patriot, a stalwart figure in other days of testing and trial, words of John Milton:

> " I call, therefore, a complete and generous education that which fits a man to perform justly, skilfully and magnanimously all the offices, both private and public, of peace and war ".

*See *Engineering Journal*, March 1946, p. 157.

A BRIEF FOR ENGINEERS

Institute Makes Representations to Royal Commission

This brief was presented by the Institute Committee on the Engineer in the Civil Service to the Royal Commission on Administrative Classification in the Public Service, at Ottawa, on April 9, 1946

April 9th, 1946.

The Royal Commission on
Administrative Classification
in the Public Service,
Ottawa, Ontario.

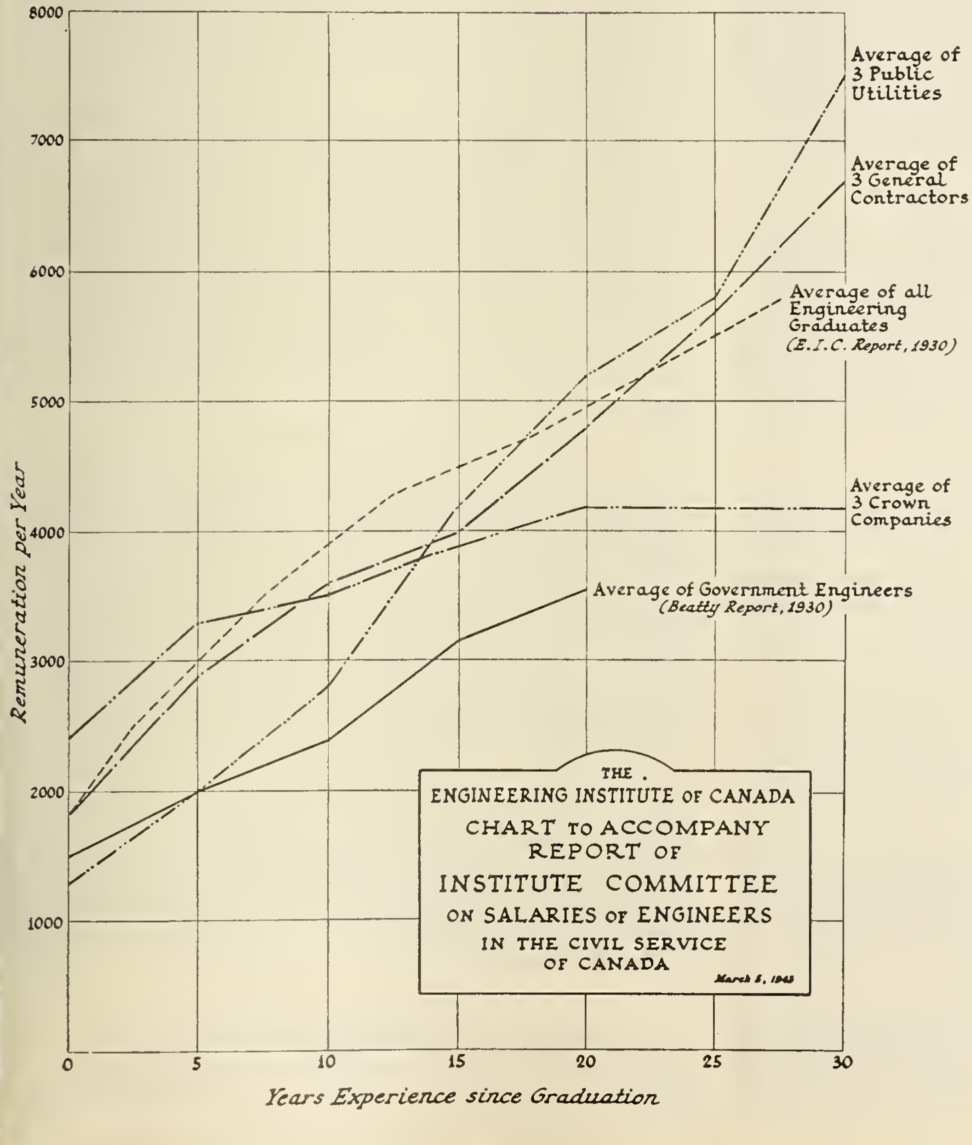
Gentlemen:

The Council of The Engineering Institute of Canada is appreciative of your invitation to present a brief on "matters relating to the senior personnel in the public service". The Institute is interested primarily in the case for the engineers, and herein confines itself entirely to that field, although it realizes the case for other professional workers is equally pressing. For over three years the Institute has had a special committee working on such matters and has entrusted the preparation and presentation of this brief to that committee.

The past action on reports of Royal Commissions in Canada does not encourage us to believe that the solution of the vitally important problem of supply and maintenance of technical services by the Federal Government will be found that way. We are not deprecating the personnel of the Commission or its work, but are generalizing on the record of the various governments that have used such agencies in the past. The work of the commissions has been excellent, but the failure of Government to implement the recommendations has been deplorable. If in this instance the same treatment is to follow, it is apparent that many busy people desirous of assisting in the solution of a serious problem will have wasted their time. May we asure this commission that it has the support of The Engineering Institute of Canada in anything which it may be able to do to correct this situation.

The problem facing the Commission is one that has existed for many years. The Institute has been working on it for over thirty years, and in that time has made surveys, proposed solutions, presented briefs and urged action, all to no avail.

The Institute's interest is easily understood. It is the national body representing employer and employee engineers of all classifications, and a large portion of its membership of 8,000 is made up of employees of the government. It has operated an employment service for over 25 years, through which it has kept in close contact with Civil Service affairs as they affect the engineer. Further, throughout its sixty years of existence it has always been interested in the financial welfare of the members of the profession, and has built up a specialized knowledge of the relationship between employer and employee in this field.



History

No organization outside the Civil Service itself has been as keenly or as continuously interested in employment conditions for Government engineers as has the Institute. The creation of the Professional Institute of the Civil Service over 25 years ago sprang from the interest of the Ottawa Branch of the Engineering Institute, in securing some amelioration of salary conditions of that time.

As far back as 1919 the Institute submitted a scale of remuneration which was eventually adopted by Griffenhagen and Associates in their recommendations, although it was not accepted at that time by the Government.

In August, 1929, the Engineering Institute submitted a sixty-five page brief to the Royal Commission on Technical and Professional Service, now referred to as the Beatty Commission. This brief was based on months of study and search, and dealt in detail with almost every angle of the problem. Thirty-one leading employers of engineers were consulted in order to give the Commission the true picture of employment conditions outside government circles. The Commission in its final report quoted from the brief as a basis for increased salaries of professional workers. The report was disregarded! To read that brief today in the light of the inaction which followed is to perceive the futility of such endeavours.

In 1943 the Institute again presented a brief, this time to the Sub-Committe of the Treasury Board, known as the Coon Committee. The report of this committee too was disregarded—in fact, its contents were not even made public. The valuable time of so many earnest and busy people should not be wasted again!

Limitation of Brief

The Institute's committee does not propose in this brief to go into job evaluations, departmental structures and procedures, or wage schedules. The committee believes that within the Civil Service Commission are the people most competent to do these things, providing their knowledge and efforts are not nullified by superimposed restrictions. The committee does propose to offer evidence that the present scales of remuneration are hopelessly inadequate, and that increasing inefficiency and attendant criticism will follow if substantial changes are not made immediately.

The graph prepared for the Coon Committee is resubmitted with this brief (Appendix A). It shows clearly and simply how far government salaries fall below those for comparable service elsewhere. Further, it shows the salaries actually paid by the government to crown companies, which indicate the scale necessary in that service, to meet the competition of other employers. Crown companies could not have been operated successfully with salaries at the Civil Service level. This admission should mean something for the post war thinking of government officials.

Pensions

For many years, the Civil Service scales of pay have been defended with the claim that the pension compensates for the lower rates of remuneration. This is an unsound claim. Many private employers have pension schemes as good or better than that of the Government, and at the same time they pay much higher salaries. The " security of tenure " and the value of pensions should not be offered as substitutes for proper salaries.

Far Reaching Effects

There are three phases of the problem which we would like to emphasize:

1—The fundamental necessity of securing and retaining an adequate supply of the best engineering skill the country affords.

2—The evil effect that low wages have on an entire profession.

3—The despoiling and frustrating of individuals by low wages.

These phases are dealt with in the following paragraphs.

1—Economics

Every intelligent citizen wishes to have his tax money spent wisely. He does not encourage government to employ low grade personnel for he knows that the most costly employee on any job is the one who commands only a low salary. The best man obtainable is the least costly, whatever his compensation.

It should be kept in mind that the work carried out by engineers requires the heaviest financial outlay of any service operated by the government. For instance, it is reported that the Department of Public Works has a programme for the year 1946-7 totalling over $20,000,000. A good engineer as compared to a poor one can save his employer many times the additional compensation which he may receive. Why then quibble over salaries? The objective of good business is find the best man for the job, and to pay him adequate compensation, not to find someone small enough to fit a small salary.

2—The Profession

The policy of the Dominion Government towards the remuneration of engineers has done a serious injury to the engineering profession. The provincial and municipal governments have tended to follow the federal example. With this large field of employment offering only low wages a cloud hangs over the profession. It is difficult, if not impossible, to attain professional status when earned income is less than or little more than that of an unskilled artisan. This youngest of the professions is being retarded in its professional development and in its advancement in the service of the people by the humiliating salaries offered by Canada's largest employer.

Fortunately for the profession, it is now possible to find full employment without entering civil servants ranks. This forecasts disaster for the government engineering services. Today the government stands discredited as an employer of engineers, and every encouragement is being given to young graduates not to enter the service. The time has come when responsible government officials must become practical business men, and adopt business methods. The government cannot long continue to face the situation which recently it seems to have seen for the first time. Engineering openings are going begging in all departments, and will continue to do so until decent wages are offered—and work vital to post-war recovery will remain no more than an idea in rough outline in somebody's mind.

The short sighted policy of the government has been an important factor in the recent development among engineers towards trade unionism. If not otherwise obtainable, it is natural for people to organize themselves to secure their just dues. Under present government policy, it is not unreasonable to expect the professional workers in due course to rise up as an organized body and demand their rights, under what may be embarrassing conditions. If trade unionism is the only means by which justice can be obtained, no one can blame the workers for resorting to it. They have waited long for justice and fair treatment.

3—The individual

The effect of the present salary policy on the employee is serious. Many men who entered the service in high hopes have found themselves caught in a trap. Without realizing fully what was happening, and still expecting the illusive promotion and attendant increase, they have let time slip by so that before they knew it they had reached an age where employment elsewhere was not easy to secure. As well, they had built up a substantial equity in a pension fund which would be lost if they made a change. This situation has kept them at their posts at salaries which pinched their very lives, and frustrated them in all their plans for the full development of themselves and their families. It is remarkable that under such circumstances they have been able to continue their faithful service to an unappreciative and unwise employer. It is not reasonable to expect from impoverished and frustrated people the high degree of efficiency required in engineering work, which is possible only in an atmosphere free from economic fear and worry.

Confusion In Terms

The terms of reference for your commission state you are to "examine into and make recommendations to the Government upon the scales of salary, classifications, and conditions of employment of the senior administrative officers in the public service." From that description, the Institute finds it difficult to draw a line across the organization. Where does "administrative" work begin with a professional worker? Years of study by many organizations and individuals have not produced a satisfactory answer.

Today in several departments, all or many senior officers are ready for retirement, and there is no person below them ready for promotion to senior responsibility. This is one result of the government's short sighted policy. Dealing only with senior appointments now will not solve the problem either for today or for the future.

The Institute believes there is only one problem, not two, as the terms of reference would imply. That problem begins with the most junior engineer and finishes with the Deputy Minister. It is folly to attempt to deal only with "senior officers", because there won't be any senior officers if competent staff cannot be recruited at the lower levels. Senior officers must come from promotion, and the lessons to be learned from today's critical situation must not be wasted.

Some Comparisons

The only reference the Institute wishes to make to specific salaries is related to the graph shown in Appendix A. A study of this is informative. It shows actual salaries being paid in 1943. Today's rates are somewhat higher. The line representing the "Average for Government Engineers (Beatty Report 1930)" is essentially correct for today for permanent positions. The only change the committee can discover is that the starting salary is now $1,800.00 per year instead of $1,000.00.

The average compensation of "all engineering graduates" in 1930 was approximately $1,500.00 a year higher than the "Average of Government Engineers." Today, according to the graph, a senior engineer can earn from $1,700.00 to $2,000.00 a year more in private industry than he can with the government. A survey conducted in Montreal in 1944 by officers of the Civil Service Commission and the Department of Public Works showed that for senior men such as described in the new Grade IV, private industry paid from $6,000 to $8,000 per year whereas the upwardly revised scale of the Department of Public Works (available only for those on post-war projects!) was only $3,600 to $4,200.

Again referring to the Department of Public Works let us look at the salary limitation of the Chief Engineer. He cannot receive more than the Deputy Minister, who apparently gets $10,000.00 a year. A study of the qualifications necessary for the position, and of its responsibilities, reveals requirements that would command not less than $15,000 and probably $20,000 in private industry. This is one of the most important engineering posts in Canada, and should be so recognized in dollars and cents. The Institute recommends that the salary of the Chief Engineer of this department be set at $15,000.00 to $20,000.00. With this for the top position, it would be possible to grade senior assistants and others at rates that would be attractive to competent men. The same basis would apply to other departments. The present rates will not secure or hold the best engineers.

Plan The Future From The Past

In recommending new scales of compensation, it should be kept in mind that generally speaking there have been no increases in the scale for engineers for almost 25 years. Any scale adopted now that is to be fair and adequate for the next 25 years should not be at today's minimum figures.

Changes In The Civil Service Commission

In addition to making representations regarding salaries, the Institute desires to make recommendations regarding the Civil Service Commission itself, which it is believed will be of real assistance in meeting the present problem of finding additional professional workers and of the even greater problem of retaining them after they are found. These proposals are intended to be constructive and are based on modern practice elsewhere.

When the Civil Service Commission was established in 1908, there were about 8,000 employees. Today there are about 140,000, of which 2,700 are professional. The Institute believes that this great increase justifies and requires an increase in the commission itself. Back in 1930, the Beatty Report said "the responsibilities borne by the three members of the Civil Service Commission are extraordinarily heavy". The Institute recommends that at least one more commissioner be added, and that he be taken from the professional ranks. In view of the preponderance of engineers in the professional group, we suggest that he be an engineer.

With so many professional workers and with such a variety of training and experience, we believe it is not fair to the present commissioners to ask them to handle these problems without the assistance of a professional man at their own level. It is not enough that there should be engineers in the office of the commission. At least one should be a member of the commission to specialize on this increasingly important phase of the commission's work. He should be someone who has been active in the affairs of the Professional Institute of the Civil Service and in fact that Institute should be consulted in his selection.

A Professional Panel

Further, the Institute recommends the creation of an Interdepartmental Professional Technical Panel. Such a panel should be of splendid assistance to the various departments and to the professional personnel. It should be made up of the heads of the departments using professional personnel, and should meet regularly to establish standards for promotion, consider promotions and transfers, and receive representation from employees. This would assure that a promising worker would not be overlooked or left to stagnate in some inconsequential job away below his capacity. The exchange of ideas between departments would also be of assistance in developing a greater utilization of the professional worker. It should also promote the transfer of personnel from one department to another to the advantage of the departments and the individual.

The panel would be of inestimable service to the Commission in examining, selecting, and grading applicants for new positions or for transfers.

This proposal is not unique. The Scientific Service of the British Civil Service has adopted such a panel. In announcing the plan, the Chancellor of the Exchequer stated "The Government proposed that the functions of the Panel shall be rather wide—They will include responsibility for keeping under review the well being and efficiency of the Government Scientific Service and for making proposals for any changes in the organization or conditions of service which would promote the well-being or increase the efficiency of the Service".

With the general increase in appreciation of the work of engineers and scientists in all phases of living, it is reasonable to expect that the Canadian Government should be prepared to utilize such service more efficiently in the business of Government. A technical panel such as the Institute recommends would go far towards making that possible.

Action Is the Need

The main purpose of this brief is to urge that constructive action be taken. There are no difficulties in the way of determining proper salaries, the best organizational set-up, and working conditions. Almost anyone reasonably familiar with conditions could set up suitable regulations. The great work to be done is to initiate action. Present scales are a disgrace not only to the government but to all of Canada. Someone must do something to overcome the lethargy and indifference of responsible officials who do not seem to appreciate their responsibility. If your Commission can do this, the citizens of Canada, and the professional workers in particular, will be eternally grateful. Whatever is done should be done quickly in order to stem the outward flow of the very best technical personnel in the services.

Gentlemen, may we assure you of the genuine interest of The Engineering Institute of Canada in the affairs of the engineers in the Civil Service. The Institute is the largest professional society in Canada, and accepts the responsibility which this imposes. If it can be of further assistance to your Commission, we assure you of its readiness to serve.

Respectfully submitted,

(Signed) N. B. MacRostie, M.E.I.C.
Chairman of the Institute's Committee.

Members of the Committee

N. B. MacRostie, M.E.I.C., R.P.E.O., Consulting Engineer, Ottawa, Ont., Chairman of the Institute's Committee.

deGaspé Beaubien, M.E.I.C., R.P.E.Q., Consulting Engineer, Montreal, Que.

Allan C. Ross, M.E.I.C., President, Ross & Meagher Limited, Ottawa, Ont.

L. Austin Wright, M.E.I.C., R.P.E.Q., General Secretary, The Engineering Institute of Canada, Montreal, Que.

ADVANTAGES OF HIGH STRENGTH STEEL AS REINFORCEMENT FOR CONCRETE

(*Continued from page 239*)

of the ultimate strength theory, equations 5 to 7, gives values which are on the safe side. If this contention is admitted, then the straight line theory should be discarded in codes and text-books. We believe we have also demonstrated that the old dictum that a reinforced concrete member fails when the steel reaches the elastic limit does not hold.* We have shown, that, where no bond or diagonal tension failure occurs, the steel stress may reach values 30 to 40 per cent greater on the average than the commercial yield point; we further believe that it would be much more advisable to introduce tests to find the useful limit point, which is the stress at a strain of 0.005 in. per in. As previously mentioned this should be a very slow test.

If Table II is accepted as correct, then engineers who refuse to use high elastic limit steel simply waste their clients' money, and it is up to them to defend their standpoint by clearly showing with proved data the possible disadvantages to their clients' structures introduced by the use of high elastic limit steel; and, whether these supposed disadvantages are incurred by the chemical composition of the steel or by the manner of rolling or are supposed to lie in less resistance to shocks or in the production of wider cracks. All these questions have been thoroughly discussed and the fabled disadvantages exploded in the paper by Professor H. J. Gilkey previously referred to.

*This is further confirmed by Professor F. E. Richart in University of Illinois, Engineering Experiment Station Bulletins: No. 314-Pages 47 & 60, No. 346—Pages 56 & 57, No. 345—Page 30.

TABLE V—TESTS BY CONDE B. McCULLOUGH

Item No.	Beam Desig. Type	Simple Span Feet	Effec. Depth of in.	Bar Reinf't	Area Sq. In.	%	Assumed f'_s P.S.I.	Conc. Str. P.S.I.	$\frac{f'_s}{f'_c}$	Bending Moment at Failure in. lb.	Computed by Ultimate Theory j	f'_s	Unit Shear P.S.I.	Bars Straight Bent	Stirrups	Supposed Kind of Failure
50	1	12.5	10	8-5/8φ	2.45	1.06	63000	4270	14.7	131420	.904	59500	101	8-S	None	Tens.
51	1	12.5	10	8-7/8φ	4.81	2.0	63000	4250	14.8	245045	.814	62800	210	8-S	None	Diag.
52	2	12.5	10	8-7/8φ	4.81	2.0	63000	4092	15.4	249500	.806	64200	274	4-S 4-BT	None	Diag.
53	2	12.5	10	9-1"φ	7.07	2.94	63000	4370	14.4	283300	.733	54600	272	4-S 4-BT	None	Diag.
54	3	12.5	10	9-1"φ	7.07	2.94	63000	3707	16.9	289600	.686	59600	279	4-S 4-BT	3/8φ 6"c.c.	Tens.
55	3	12.5	10	9-1 1/8φ	8.95	3.73	63000	4342	14.5	356400	.661 .68*	58500 ...	309	4-S 4-B	3/8φ 6"c.c.	Compr.

From Month to Month

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

A BRIEF FOR ENGINEERS

What the present committee hopes will be its last act was staged at Ottawa on Tuesday, April 9th. A brief was presented to the Royal Commission on Administrative Classification in the Public Service. The document, reproduced in this number of the *Journal*, stresses three things. (a) The need of immediate and substantial increases in remuneration for the professional worker in the Civil Service. (b) The desirability of adding to the Civil Service Commission an additional commissioner who will be a professional technical employee, and (c) the advantages of setting up an Interdepartmental Professional Technical Panel to consider and advise on all matters relating to the use and welfare of the professional workers.

The delegation presenting the brief was headed by Norman B. MacRostie, chairman of the committee, deGaspé Beaubien and the general secretary. They had an hour with the Commission and received an excellent hearing. The impression was gained that the Commission already appreciates the necessity of adequate increases, and that the real problem is to determine from the vague terms of reference the field that is to be covered and the best form for their recommendations.

The commissioners are Chairman W. L. Gordon, of Toronto, a graduate of Royal Military College and the administrative head of a company of industrial engineers, Sir Thomas Gardiner, from England, a retired civil servant who has had extensive experience with engineers in different departments of government in the United Kingdom, and Major-General E. de B. Panet, of Montreal, former Officer-Commanding Military District No. 4

As the brief points out, this is at least the third time that the Institute has made formal representations on the same subject to commissions and committees since 1919. It is with all this in mind that the committee expressed the hope that at long last something sensible would be done that would make unnecessary the continuance of such a committee. At the same time, the Commission was informed that if an acceptable solution is not offered, the Institute would continue to press for action.

ENGINEERING JOBS GO ABEGGING

Specific examples are always more effective than generalizations, and therefore the *Journal* publishes an editorial from the Vancouver Sun of February 14th, which deserves the attention of Institute members. This is but another case of "penny-wise and pound-foolish", added to the long history of municipal, provincial and federal employment policy—or lack of policy.

"Who'll Work for the City?"

The City Council has advertised for applicants for City Engineer Brakenridge's job, but it hasn't made an appointment. It seems that men who are well established in the profession can't afford to work for the city.

At the peak of his municipal career, Mr. Brakenridge received a $6,846 salary in 1945. Now he wants to quit to enter private practice but few people want to quit private practice to succeed him. Salaries in private industry or fees earned by consultants are far more attractive.

This situation is all too characteristic of the civil service. The best men in government employ are usually those who started young and worked their way up. They either get the habit and enjoy the security or else they are so far out of touch with commercial conditions that they don't appreciate how underpaid they are. Many of the more enterprising strike out for themselves before they are undermined by the system.

Which is one reason why there is no one in the employ of the City of Vancouver today who is a standout candidate for Mr. Brakenridge's place.

The job calls for the highest technical knowledge, great organizing ability, uncommon talents in policy-making and diplomacy, and prudence in the expenditure of tens of millions of dollars of the public's money. All for $6,800 a year. No wonder the opening is still vacant when any one of these qualities will command comparable rewards in industrial pursuits.

Successive City Councils have striven to keep salaries down. They have "held the line" to the point of false economy. It appears that the line will have to bend sometime before Mr. Brakenridge walks out on June 30th.

STAFF CHANGES

It is with mixed feelings that the *Journal* records a change in the administration of the Institute's rehabilitation and employment service. It will be a matter of regret to all who have used the service in the last year to know that Major D. C. MacCallum is resigning. He has been in charge of rehabilitation since April 1945, and in that time has rendered an outstanding service to the Institute and to members. Attacking the situation with energy and intelligence, he has in that year re-organized the department and greatly increased its usefulness. He has won for the Institute praise and recognition in many circles, including the press and radio.

Major MacCallum's departure was not unexpected. He accepted the appointment originally to assist in doing something for the members retiring from the active services, and his interest has always been chiefly in such persons. Now that most members are back in civilian occupation he feels he is free to return to the industrial field. He is going to Canadair Limited in Montreal as Administrative Engineer. Everyone will wish him well in his new duties, but he will be missed by the many friends he made in the Institute, and particularly by his associates on the staff.

Fortunately, there is a bright side to the picture. The Institute has secured the services of Colonel A. J. Kerry, O.B.E., M.E.I.C., to take on the department, beginning early in April. After many years with the Royal Canadian Engineers, he has retired recently to take up civilian employment.

Col. A. J. Kerry, O.B.E., M.E.I.C.

Colonel Kerry was born in Montreal, son of J. G. G. Kerry, M.E.I.C. He attended Bradfield College, England, for four years, after which he entered the Royal Military College, graduating in 1927 with honours. From there he went to McGill where he was graduated in 1929 with a B.A.Sc. in civil engineering. From 1929 to 1931 he attended the School of Military Engineering in England. He joined the Institute as a Junior in 1931, transferring to Associate Member in 1934 and to Member in 1940

In 1931 Colonel Kerry was appointed Works Officer for Military District No. 5, Quebec, with the rank of Captain. In 1936 he was tranferred to M.D. 4, Montreal, as District Engineer Officer with the rank of Major. From this appointment he went overseas in 1940 with the 1st Bn. R.C.E. While overseas, he held various engineer staff and command appointments, including 12th Field Company, 1st Bn. R.C.E., and C.R.E. 2nd Cdn. Army Troops, and served in England and on the Continent, for which he was awarded the O.B.E. At the beginning of 1945 he was posted to command the Engineer Reinforcement Unit with the rank of Colonel, returning to Canada in July to take up the appointment of Director of Works and Construction at National Defence Headquarters, which appointment he has recently vacated on retiring from the Army.

Col. Kerry has been an active member of the Institute since 1931. His contacts go back farther than that as he is the son of J. G. G. Kerry, the well-known consultant who delivered such an excellent paper at the recent annual meeting on consideration of all year transportation on the Great Lakes. Mr. Kerry, Sr., joined the Institute in 1888.

It is planned that Col. Kerry will visit many of the branches shortly so that he may study the employment situation in various fields, and get to know the membership over a wide area.

CONFERENCE OF DEANS

When the president of the Institute, Dean Fetherstonhaugh, invited all the deans of engineering to meet in Montreal at the time of the annual meeting of the Institute, it was agreed that the conference would be more or less a private one. It was Dr. Fetherstonhaugh's idea that the time had come for these educationalists to get together for a discussion of their many common problems. Therefore there was in attendance no official representative of the Institute, and therefore also, it is not possible to publish details of the conference beyond whatever the deans themselves desire to report in due course.

However, it is interesting to know who was there. The following list supplies that information:

Dean C. R. Young, University of Toronto
Col. L. F. Grant, Royal Military College
Dean D. S. Ellis, Queen's University
Dean H. W. McKiel, Mount Allison University
Prof. René Dupuis, Laval University
Dr. E. O. Turner, University of New Brunswick
Dr. A. F. Baird, University of New Brunswick
Dr. Arthur Caron, University of Ottawa
Dean J. J. O'Neill, McGill University
Prof. A. E. Flynn, Nova Scotia Technical College
Prof. B. Cain, Acadia University
Rev. W. P. Fogarty, St. Francis-Xavier University
Dean I. Brouillet, Ecole Polytechnique
Dr. E. Brown, McGill University
Prof. R. M. Hardy, University of Alberta

One piece of business has been submitted to the Council of the Institute by Dr. McKiel on behalf of the conference in the form of a resolution as follows:

"That this meeting of deans and teachers of engineering expresses the willingness of its members to participate in a study of engineering curricula and engineering education in general.

"It further suggests that any such study should be cooperated in by all interested bodies, as, for example, the universities and schools of engineering, The Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, the Canadian Institute of Chemistry, the Dominion Council of Professional Engineers and the various provincial professional organizations."

This was discussed at the March meeting of Council, and after reference to the opinions of three deans who had written on the subject, the general secretary was instructed to advise Dr. McKiel that the Institute is ready and willing to support the deans in whatever way they think the most help can be rendered. Any time a conference of deans desires assistance from the Institute, Council will be glad to see that it is given wholeheartedly. In the meantime, Council supports the suggestion made to it, that the educationalists themselves as a group, investigate the situation before consulting engineers in other fields.

Council is wise in leaving educational matters to educationalists. The time will come when the opinion of the practising engineer and the employer will be useful, and at that time doubtless they will be consulted. In the meantime, it is to be hoped that the National Conference of Canadian Universities will afford a proper forum for the further discussions which the deans desire.

LESSONS FROM THE STUDENTS CONFERENCE

Members will recall that during the annual meeting a conference was held in Montreal to which was invited the president of the undergraduate engineering society of every Canadian university, and certain observers drawn from the vice-presidents and immediate past-presidents. The minutes of the conference have been completed recently, and therefore some further observations can be made on the conference and what it accomplished.

There were six separate sessions, held during three days, and a very exhaustive agenda provided a wide field of relevant subjects for discussion. The verbatim account is actually more revealing than the minutes because it gives the thinking of each individual, much of which did not result in decisions for further action. There were nine resolutions finally approved for presentation to the Council of the Institute, but other points of equal importance were agreed upon as recorded in the minutes, which were not included in those sent to Council, and printed on p. 264 of this *Journal*. The full value of the conference is not indicated clearly in the nine resolutions but it is in the written record.

Chief among the purposes of the conference was the desire of the Institute to discuss with the students themselves the many means by which the graduate engineer can help the undergraduate. This topic has been under discussion for years by senior engineers, but there has been no unanimity of opinion. and even less evidence of a successful policy. To get some helpful decision, the Institute took the bold course of bringing the leading students together for the specific purpose of getting first hand information from those best fitted to know.

It was an interesting experience to sit with these young men while they wrestled with the problems that loom so large in their sphere of activity. It was an inspirational and satisfactory experience. The enthusiastic and intelligent manner in which they dealt with every subject on the agenda—and some not on it—was a delight to see and hear. Seventeen keen young minds attacking problems that are close to each of them and important to all, developed a conference rich in immediate results and promising for the future.

The chairmanship of the sessions was shared by Vice-President J. E. Armstrong and Lt.-Col. L. F. Grant, chairman of the Committee on the Training and Welfare of the Young Engineer. For some sessions the group elected one of their own number, Léo Scharry of Ecole Polytechnique. It was planned that the discussions would be left entirely to the students, the Institute officers serving only as guides and consultants. This produced excellent results, as it promoted free and open discussion of all subjects. It is apparent from the record that none of the delegates felt himself under any restrictions.

The students' principal interest was in employment—an opportunity to learn and earn. Concern was expressed for the future of the Wartime Bureau of Technical Personnel. The Bureau had done an excellent service in gathering together hundreds of employment opportunities for the summer months, and the need was felt for a continuation of this service. It was requested that the Institute take up the work if, as and when the Bureau had to discontinue it.

Other decisions recommended that a similar conference be held annually; that technical institutes be inaugurated by provincial governments; that a post-graduate college of outstanding merit be established on a national basis; that more encouragement be offered to staff for teaching purposes, particularly increased remuneration; that a portion of *The Engineering Journal* be devoted to news of the students and the profession, and to technical papers from students; that encouragement be given to the proposal of the Institute to establish an educational fund; that a survey of universities be undertaken with the ultimate objective of promoting uniform courses, standards, and degrees; that further consideration be given to enlarging the curricula content of the humanities.

It is a little early yet for a decision to be made, but shortly Council must decide if such a conference is to be an annual event. It has been an expensive experiment to bring representatives from such divergent points as Halifax and Vancouver, but if it enables the Institute to get a better grasp of the needs of the students, it will be a justifiable one. Some of the revenue from the proposed increase in annual fees could be used to good advantage here.

The delegates and observers were as follows:

University of British Columbia: Delegate: Tom Scott, Engineers' Undergraduate Society.

University of Saskatchewan: Delegate: Bob Shore, President, Engineering Society.

University of Alberta: Delegate: James A. Clow, President, Engineering Students Society.

University of Manitoba: Delegate: Eric Bergenstein, Senior Stick, Engineering Society. Observer: Ritchie Ward (held office in Students' Council—now 3rd year Mech. at McGill).

University of Toronto: Delegate: Murray D. McCulloch, President, Engineering Society. Observer: R. F. Moore, Past-President, Engineering Society.

Queen's University: Delegate: W. L. Hayhurst, President, Engineering Society. Observer: B. J. McColl, Past-Pres., Engineering Society.

McGill University: Delegate: Chas. J. Fox, President, Engineering Undergraduate Soc. Observer: Philip Laporta, Vice-Pres., Engineering Undergraduate Society.

Ecole Polytechnique: Delegate: Léo Scharry, Undergraduate Engrg. Society. Observers: Fernand Noiseux, Representative Junior Sect, Montreal Br. E.I.C. and Laurent Gendron, Vice-Pres., Undergraduate Engrg. Society.

Laval University: Delegate: Gilles Perron, Science Students Association.

University of New Brunswick: Delegate: Ottis I. Logue, President, Engineering Society. Observer: Fred W. Davidson, Past-Pres., Engineering Society.

Nova Scotia Technical College: Delegate: C. Macdonald, President, Students' Society.

PRESIDENTIAL TOUR OF ONTARIO AND WESTERN BRANCHES

The itinerary has just been completed for the presidential visit to branches in southwestern Ontario and in the western provinces.

President and Mrs. J. B. Hayes will inaugurate their tour at Toronto on April 26th and will return in time for the Semi-Annual Meeting of The American Society of Mechanical Engineers to be held in Detroit, June 17th to 20th. The presidential party will also include Councillor G. J. Currie of Halifax and General Secretary L. Austin Wright of Montreal.

A regional meeting of Council will be held in Toronto on Saturday, April 27th. The May meeting of Council will also be held away from Headquarters, this time at Trail, B.C., on May 18th. Occasion will also be taken of the president's visit at Trail to officially inaugurate the Kootenay Branch of the Institute whose establishment was authorized by Council a few months ago and which is now organized to function.

Present and past officers of the Institute are invited to accompany the president on all or part of this tour.

ITINERARY

Lv. Montreal	Thursday, April 25th	11:00 p.m.	
Arr. Toronto	Friday, April 26th	7:30 a.m.	
	Branch Meeting, Friday, April 26th		
	Council Meeting, Saturday, April 27th		
Hamilton	Branch Meeting, Monday, April 29th		By motor
Niagara Peninsula	Branch Meeting, Tuesday, April 30th		
Lv. Welland	Wednesday, May 1st	9:16 a.m.	
Arr. Windsor	Wednesday, May 1st	12:56 p.m.	
	Branch Meeting, Wednesday, May 1st		
London	Branch Meeting, Thursday, May 2nd		
Woodstock	Meeting, Friday, May 3rd		
Arr. Windsor	Friday, May 3rd	p.m.	
Lv. Detroit	Saturday, May 4th	12:50 p.m.	
Arr. Chicago	Saturday, May 4th	5:00 p.m.	
Lv. Chicago	Monday, May 6th	11:00 p.m.	
Arr. Minneapolis	Tuesday, May 7th	8:35 a.m.	
Lv. Minneapolis	Tuesday, May 7th	8:40 p.m.	Soo Line
Arr. Winnipeg	Wednesday, May 8th	9:15 a.m.	Soo Line
	Branch Meeting, Wed., May 8th, or Thurs., May 9th		
Lv. Winnipeg	Thursday, May 9th	6:15 p.m.	C.N.R.
Arr. Saskatoon	Friday, May 10th	8:40 a.m.	C.N.R.
	Branch Meeting, Friday, May 10th		
Lv. Saskatoon	Saturday, May 11th	4:30 p.m.	C.P.R.
Arr. Edmonton	Sunday, May 12th	7:05 a.m.	C.P.R.
	Branch Meeting, Monday, May 13th		
Lv. Edmonton	Monday, May 13th	11:55 p.m.	C.P.R.
Arr. Calgary	Tuesday, May 14th	6:20 a.m.	C.P.R.
Arr. Lethbridge	Tuesday, May 14th		By motor
	Branch Meeting, Tuesday, May 14th		
Lv. Lethbridge	Tuesday, May 14th	9:30 p.m.	C.P.R.
Arr. Trail	Wednesday, May 15th	12:35 p.m.	
	Branch Meeting, Friday, May 17th		
	Council Meeting, Saturday, May 18th		
Lv. Trail	Sunday, May 19th	10:10 a.m.	
Arr. Penticton	Sunday, May 19th	10.30 p.m.	
	Meeting at Kelowna, Monday, May 20th, noon		
Lv. Penticton	Monday, May 20th	11:00 p.m.	C.P.R.
Arr. Vancouver	Tuesday, May 21st	10:00 a.m.	
	Branch Meeting, Thurs., May 23, or Fri., May 24		
Lv. Vancouver	Saturday, May 25th	10:30 a.m.	
Arr. Victoria	Saturday, May 25th	3:45 p.m.	
	Branch Meeting, Monday, May 27th		
Lv. Victoria	Wednesday, May 29th	12:00 midnight	
Arr. Vancouver	Thursday, May 30th	7:00 a.m.	
Lv. Vancouver	Thursday, May 30th	10:30 a.m.	C.P.R.
Arr. Kamloops	Thursday, May 30th	7:40 p.m.	
Lv. Kamloops	Friday, May 31st	7:50 p.m.	
Arr. Sicamous	Friday, May 31st	11:05 p.m.	
Lv. Sicamous	Saturday, June 1st	7:25 a.m.	
Arr. Banff	Saturday, June 1st	6:00 p.m.	
Arr. Calgary	Monday, June 3rd		By motor
	Branch Meeting, Tues., June 4th, or Wed. June 5th		
Lv. Calgary	Thursday, June 6th	9:05 p.m.	C.P.R.
Arr. Regina	Friday, June 7th	9:35 a.m.	
	Branch Meeting, Friday, June 7th		

Lv. Regina	Sunday, June 9th	8:55 a.m.	
Arr. Fort William	Monday, June 10th	6:10 a.m.	
	Branch Meeting, Monday, June 10th		
Lv. Fort William	Tuesday, June 11th	4:00 p.m. C.P.S.S.	
Arr. Soo	Wednesday June 12th	11:30 a.m.	
	Branch Meeting, Wednesday, June 12th		
Lv. Soo	Thursday, June 13th	4:25 p.m.	
Arr. Sarnia	Friday, June 14th	1:15 p.m.	
	Branch Meeting, Friday, June 14th		
Detroit	A.S.M.E. Semi-Annual Meeting, June 17th to 20th		

E.I.C. INVITED TO PARTICIPATE IN A.S.M.E. DETROIT MEETING

The American Society of Mechanical Engineers has invited the Institute to participate in its Semi-Annual Meeting to be held in Detroit, June 17-20, 1946. Council has accepted this opportunity to implement the spirit of co-operation between the two societies already recognized in a formal agreement.

Several officers of the Institute, including the president and the general secretary, will be present and they expect that a large number of members will join with them. The programme, which is published in tentative form on another page, indicates a wide variety of interests and should appeal to a large section of our membership, particularly in Ontario. It is hoped that our participation in the meeting will extend to the point where our members will contribute to the discussion of papers. Those who feel qualified to do so are requested to inform Institute Headquarters, as soon as possible. It is expected that preprints of most of the papers will be available well in advance of the meeting.

A committee of the Border Cities Branch of the Institute has been formed to co-operate with the Detroit committee of the A.S.M.E. in making local arrangements, A visit is being organized to the plant of the Ford Motor Company of Canada in Windsor, while the ladies will be entertained, also on this side of the border.

The final programme, together with the necessary forms for reservations, will be mailed to all members shortly.

MARITIME PROFESSIONAL MEETING

Digby, Nova Scotia, has been chosen as the place for the revival of Institute summer professional meetings, which, before the war, were held alternately in the Maritimes and in the west. The dates have been set for September 5, 6 and 7th, 1946.

A joint committee of the Institute and the Associations of Professional Engineers in Nova Scotia and in New Brunswick is being formed to take care of the planning and the local arrangements.

These regional professional meetings are intended especially for the benefit of members who cannot conveniently attend the annual general professional meetings of the Institute. They provide an opportunity for meeting with fellow-members and for keeping in touch with Institute affairs.

The last meeting was held in Pictou, N.S., early in September, 1939, and was ended abruptly because of the outbreak of war. Since then, the Institute has concluded co-operative agreements with the professional associations in both provinces and the resultant closer relations are a guarantee of unprecedented success for the meeting.

In making plans for their holidays, members in other provinces should keep in mind that the Maritimes are known as the " Playground of the Atlantic ". All sessions will be held at the famous hotel " The Pines ".

Further details about the meeting will be published as they become available.

PUBLICATIONS OF OTHER ENGINEERING SOCIETIES

Exchange arrangements exist between The Engineering Institute of Canada and engineering societies in the United States and Great Britain 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 is given below, and subscriptions should be sent to Headquarters of the Institute.

	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 Jan. 1st, otherwise $5.00.*		
† *If subscription is received before Jan. 1st, otherwise $10.00.*		
‡ *If subscription is received before Feb. 1st, otherwise $8.00.*		
¶ *If subscription is received before Feb. 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 $1.00.)		
(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.)		
American Institute of Mining and Metallurgical Engineers		
Mining and Metallurgy, single copies	$ 0.50	$ 0.50
Per Year	3.00*	3.00*
(* Plus $1.00 postage.)		
Metals, Technology, single copies	1.25*	1.25*
(* Plus 10c postage.)		
Per Year	7.00*	7.00*
(* Plus 80c postage.)		
Transactions, per volume	5.00* to 10.00	5.00* to 10.00
(* Plus 50c postage.)		
Technical publications: Supplied at 1c per page, with a minimum charge of 25c for single copies, or at a subscription rate per year of	2.50	2.50

Subscriptions to the above publications are payable in U.S. funds.

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

ON KEEPING CANADIANS IN CANADA

It is a commonplace that Canada's greatest export is brains. It is equally acknowledged that the profit on this export is nil. Thus we have a problem that has remained unsolved since the beginning of time—Canadian time. Like Mark Twain's frequently quoted comment on the weather, everybody talks about it but nobody does anything about it. Is it like the weather, too, in that nobody *can* do anything about it?

The problem becomes more pointed for engineers and scientists because of the present large enrolment at universities. Is this extra production to be forced to go elsewhere to get suitable employment, or will Canadian employers absorb it? There is a great shortage in the United States, and it is inevitable that thousands of our best young men will go there and be lost forever to Canada, if employment at adequate remuneration is not offered here.

In the March 2nd issue of the *Financial Post,* a page is devoted to expressing the opinions of many Canadians on the question "What specific steps would you suggest for checking shift of young Canadians to the United States?". The *Journal* herewith reproduces many of the opinions in abridged form. It is interesting, though not surprising, that almost every answer states that better wages must be offered. It is interesting, too, to see how many replies refer particularly to engineers and scientists, although the editor's question spoke only of Canadian youth. It is evident that many citizens outside the profession are concerned about the great potential loss of technical manpower that seems to be just around the corner.

A dollar is worth more in Canada than in the States. There are social and cultural values here that may not be so easily secured there. There are other advantages to being in Canada that must not be overlooked, but they are harder to explain to a young man than is the difference between one hundred dollars and two hundred dollars. To offer equal or better opportunities, Canadian salaries do not have to equal American, but in too many cases they must be higher than they are now. If we lose this forthcoming bumper crop of engineers—the best in quality and quantity that we have had since the last war—it will be largely the fault of the employers, the federal and provincial governments being themselves the greatest offenders. There are other factors, too, which are important but remuneration will always be the prime one. There is still time to prepare to meet the situation, but will any of the suggestions gathered by the *Financial Post* be implemented before it is too late?

Herewith the opinions and suggestions:—

A. G. Bailey, Deputy Chairman, Petroleum and Natural Gas Conservation Board, Calgary.

"Canadian engineers should be shown by education that they need not take a back seat to American engineers either in scholastic training, research ability, or engineering practice. Canadian employers should be made to realize the value of properly trained technical personnel in industry. Technical salary levels should be generally raised to be commensurate with the value of technical service."

Henry J. Foster, Managing Editor, Tribune, Welland.

"One way to encourage young Canadians to remain in Canada is to work from the top. By this I mean that leaders of industry and commerce and heads of institutions and organizations should give the preference to men educated in Canadian universities when seeking employees to be trained for executive posts."

Rex Frost, News commentator, Radio Station CFRB, Toronto.

"Many young Canadians are drifting to the United States because in school and social training they are not being sold on the opportunities of their own country. The reflected glitter of U.S. publicity methods here, plus the effect of Americanized radio, movies and magazines, created the impression in many junior minds that the big money is to be picked up across the border."

R. M. P. Hamilton, President, General Engineering Company (Canada) Limited, Toronto.

"To avoid young Canadians moving to United States, older men in business, industry and government should stop preaching to youngsters and take steps to help meet their personal problems Such steps should include establishment of more attractively paid government positions bringing men of affairs into the government councils so their opposites in private life are not depressed by government contacts. Leaders in private life should recognize young Canadians' potentialities and actively search in and out of their own businesses for opportunities to train younger men at attractive income levels. Making opportunities for learning and taking responsibilities will be the most effective aid."

John T. Hackett, K.C., Hackett, Mulvena, Foster, Hackett & Hannen, Montreal.

"The dazzling prizes of reputation and fortune will ever draw to a rich and prosperous state the spirited and strong of lesser and poorer communities. Thus Canada has lost millions of native Canadians to the U.S. Policies tending to equalize opportunity and accentuate the growing importance of the Canadian position in international affairs would check, if it did not entirely stop, the drift of young Canadians to the U.S. Canada has done much for the weak and weary but not so much for the able and aggressive, who seek opportunity rather than state aid, and freedom from monopoly rather than assured revenue."

R. M. Harrison, Columnist, Daily Star, Windsor.

"So long as 'money talks' there'll be little appreciable diminution in the south of the border stampede. On the score of financial returns it is doubtful if the Dominion will be able to compete with the United States for a long time to come.

Therefore the task would seem to be to sell Canada to Canadians from other angles: Love of a wonderful country, pride in the British connection and its inherent security, comfort, peace, neighborliness, fresh air, the greater freedom of the individual even though the U.S.A. preens as democracy's show window, the chance to join in making this a land worth sticking to. These things at forty a week are worth more than Uncle Sam has to offer at double. Let's stress 'em."

Louis G. Howard, Dominion President, Army and Navy Veterans of Canada, Selkirk.

"If Canada is to retain the cream of her graduating youth, industry and the civil service must make administrative and executive positions more attractive by higher salaries and opportunities for advancement."

Col. C. H. L. Jones, President, Price Brothers & Co., Quebec, Que.

"It is impossible to cover completely in a few words the ideas, reasons and remedies which drift young Canadians to the United States. Outstanding is the desire to improve living conditions and enjoy maximum luxuries and pleasures of life which depend largely on net income, or take-home pay. There are similar jobs on both sides of the border. This net is affected primarily by three items: gross wages, salaries paid, cost of living and net amount retained after taxation. The average Canadian wages are lower than in United States, but the cost of living is correspondingly lower and a raise of wage rates would increase the cost of living without achieving the objective of increased take-home pay."

Dean Sinclair Laird, School of Teachers, McGill University, Montreal.

" Retention of our own skilled young workmen, professional men, scientists, writers and other talented young people can best be secured by these steps:

1. Varieties of opportunity for talent, attractive salaries and rapid promotions.
2. Private and public encouragement of research in science, industry and education.
3. Development of pride in Canadian designs, crafts, materials and products.
4. More gambling by industrialists on new inventions and new enterprises and encouragement of individual inventors' and employees' suggestions.
5. Development and extension of vocational education in schools and colleges.
6. Giving prestige to careers in business and industry commensurate with that in the established professions.
7. Increased immigration to help carry our burdens and buy our products."

John L. Lang, Past-President, Ontario Professional Engineers, Sault Ste. Marie.

" Restricting the scope of my reply to young engineers, I believe that higher salaries are essential. The movement of technical personnel to United States is still minimized by requirement of exit permits under wartime controls, but this can be only a temporary expedient. The first step should be increased salaries, which are now inadequate, for engineers in Government employ, both Dominion and provincial. There can be no objection to interchange of technical personnel between Canada and the United States, but it should not be one-sided."

Ed Maloney, Program Manager, Radio Station CFCN, Calgary.

" Canada will always remain a United States reservoir for keen brains and willing hands unless a vigorous policy of selective immigration is undertaken to provide the Dominion eventually with an additional 20 or 30 million people. Also needed will be capital to develop fully our natural resources and industries by exclusively Canadian private and public enterprise to such an extent that living conditions, wages, luxuries and opportunity are on a par with those of the United States."

Pearson McCurdy, Business Manager, Halifax Chronicle & Star, Halifax.

" The absolute driving power of American publicity has completely sold the youth, not only of America, but of this country, too, on the advantages of life in the United States. We, generally, as Canadians, build up Americans and America far above our own people and our own country. A Canadian actor, to take a popular conception of success, is only a success when he receives an offer from Hollywood. And where does the fault lie? It lies squarely upon the shoulders of the governments, the newspapers, the industrialists and individuals that comprise our country's people. We've got to advertise Canada's academic, financial, industrial and social glamour thoroughly."

D. R. Moffat, Vice-President and General Manager, Moffats Limited, Weston, Ont.

" Canada is not growing rapidly enough to absorb production of Canadian factories. Large exports are essential. I recommend that industries separately or in conjunction with the Government triple expenditures on research and engineering with the object of producing products equal or in advance of those turned out by other countries. This is the only way Canada can develop a substantial and permanent export trade in spite of trade restrictions. We must be prepared to face and thereby keep our young Canadians at home."

Professor E. H. Morrow, University of British Columbia, Vancouver.

" The drift to United States is inevitable due to attractive opportunities, common language and similarities of business. Youth fortunately is ambitious and naturally impatient. If we wish to keep youth in Canada, we have only to encourage young men with quick promotion and earlier opportunity. The war shows young men can carry great responsibilities. With young people as with everyone else, ' money talks '."

H. R. Morgan, Editor, Recorder and Times, Brockville, Ont.

" I doubt if the migration of young Canadians to the United States will be checked until comparable opportunities are open to them in their own country. To that end we should, in my opinion, do our utmost to provide employment at satisfactory salary or wage levels, especially for technical personnel, through the continued development of natural resources and the introduction of new industrial processes, and strive towards the attainment of a larger population and the enlargement of markets for our products."

Dr. Fletcher Peacock, Department of Education, Fredericton, N.B.

" To check the drift towards United States, Canada should—

1. Thoroughly acquaint her youth with conditions and possibilities in each country, showing Canada's potential resources, high cost of living in the States, and large numbers who do not prosper there as well as if they remained in Canada and worked as hard.
2. Universalized vocational and cultural education emphasizing skills needed to build up Canadian industry.
3. Raise Canadian incomes and provide full employment with modern homes and communities all having amenities for full living.
4. Increase manufacturing through export duties on raw materials such as pulp, long lumber, gypsum.
5. Encourage Canadian culture through intensive development of appreciation and skills in arts and handicrafts."

Dr. L. M. Pidgeon, University of Toronto, Toronto.

" My remarks apply only to scientific workers. Ultimate salaries in terms of purchasing power must be reasonably close to those obtainable in the United States at the present time. The ultimate salaries for research workers in government and university laboratories are too low. A research worker to receive a reasonable maximum must take an executive position, giving up research. Specifically, the ultimate salary goal for scientific workers must be increased. Canadian manufacturers must carry out a larger fraction of research and development work in this country rather than importing technical information."

MORE OF THE SAME

And while we are on the subject, let us quote from an editorial in the *Montreal Herald* of February 9th:

> " Canadian industry must raise its premium on brains and technical training. When it is prepared to pay Canadian economists, engineers, scientists, technical personnel, salaries equal to those with which American industry has hitherto lured them south of the line, it can hope to retain a sufficient reserve of brain power to meet its own needs of today and tomorrow. The Dominion Government might well take the lead by upping the incomes of brain workers in its service. And we do not refer to M.P.'s and senators."

DEAN YOUNG RECEIVES DEGREE

Dean C. R. Young of the Faculty of Applied Science and Engineering of the University of Toronto has had added to his list of distinctions an honorary degree of Doctor of Applied Science from the University of Montreal. The degree was granted upon the recommendation of the Ecole Polytechnique and conferred at the Thirty-First Annual Dinner of the Ecole's Graduates Society, at the Windsor Hotel, Montreal, on February 9th.

Dr. Young was the guest speaker. The address on engineering education which he delivered appears elsewhere in this issue.

The degree was conferred by Monseigneur Olivier Maurault, Rector of the University. The following is a translation of the citation which, according to the translator, does not do justice to the author:

" We are honouring today a civil engineer of great repute, a builder of bridges.

" There is something about bridges that is fascinating. Ever since that day, now lost in the night of time, when primeval man noted a fallen tree joining the banks of a ravine, or a liana twining from tree to tree, he has applied his talent to joining river banks and walls of valleys with spans more and more audacious and powerful. Streams in flood and abysses have not prevented him throwing into space formidable structures of masonry, steel and concrete.

"Ancient bridges of Asia combine grace and strength. Those of the Roman Empire and of the Middle Ages still span European rivers with their sturdy and graceful arches and their picturesque silhouettes: bridges of Rome and of Toledo, bridges of Cahors and Avignon. The Renaissance gave us the Rialto bridge, the Bridge of Sighs, the bridges of Florence and those of all the capitals of the western world. When steel appeared, it gave beauty an almost fatal blow, but beauty triumphed. We owe to the combination of both, the bridge of the Forth, those of the East River and of the Hudson at New York, of Philadelphia and Charleston, of New Orleans and San Francisco; the bridges of Detroit and Quebec and that of Sydney, Australia; structures enormous yet light which remain unshaken in spite of tempests or the traversing of the heavy loads of commerce.

" Their sight brings to my mind the verses of an anonymous poet:

I like a bridge:
It breathes romance . . .
. . . .
I like a bridge:
It makes me think. . . .

" Mr. Young is not unconscious of the stirring beauty and the intellectual significance of bridges. In 1911 he published a study on ' Aesthetics in Bridge Design '. This consciousness was developed in a beautiful region of our sister-province of Ontario. He was born in Picton, on Prince Edward peninsula. It was this peninsula, known formerly as Kenté, which received as early as 1668 Sulpician missionaries coming from Montreal, who established themselves at the Consecon portage, unless it was at East Lake. It is interesting to note that it was at the point of embarkation of these missionaries at Lachine that Mr. Young had his first position in the offices of Dominion Bridge, from 1902 until 1904.

" His progress was rapid. He went shortly to the Toronto and York Radial Railway, then to Canada Foundry Company of Toronto, and later to the firm of Smith, Kerry and Chase. He then became lecturer in steel construction at the University of Toronto. He continued the same course until 1929 when he taught civil engineering. Since 1941 he has been dean of the Faculty of Applied Science and Engineering. His academic activities have not kept him from practising his profession. In the capacity of consulting engineer he has advised on problems relating to the bridges at Brockville and Detroit and to the Victoria bridge; he has built factories and schools and, in many legal disputes appeared as an expert witness. This role of expert led him to write, in collaboration with Hon. Justice Laidlaw, a volume entitled " Engineering Law ".

Msgr. O. Maurault, H. Gaudefroy, I. Brouillet, Dr. C. R. Young and Edouard Montpetit, secretary-general of the University.

" Three other books and two dozen articles in engineering periodicals have won him recognition throughout America; he has shown himself to be a theorist of wide scope, an excellent practitioner, an economist and a legist, a master of his art. Governments have had recourse to his services, and professional associations of Canada, the United States and England have enrolled him among their members and in 1942 The Engineering Institute of Canada elected him president. Finally, to add the finishing stroke to this portrait, I may say that Mr. Young is a pastel and landscape painter.

" To this very congenial dean and writer, the University of Montreal takes pleasure in awarding, at the request of its Ecole Polytechnique, the honorary degree of Doctor of Applied Sciences."

In acknowledging the honour, Dr. Young spoke as follows:

" Monseigneur le Recteur—

I am deeply grateful to your University for the honour that you have conferred upon me at the request of the Corporation of the Ecole Polytechnique—a school that occupies an honourable place amongst the institutions of higher learning constituting the great university that you are building on the slopes of Mount Royal. I am particularly appreciative of this evidence of good neighbourliness with respect to my own University, as well as the mark of esteem on the part of the staff of the Ecole Polytechnique, with whom I have enjoyed most pleasant relations in the course of past years.

Your engineering school has a long and honourable history. Fruit of the soil of this ancient province, it was founded four years before my own Faculty of Applied Science and Engineering. Its graduates are known throughout the length and breadth of Canada and beyond its borders. I am honoured to be able to count amongst my best friends many of them with whom I have often worked on common tasks.

May I be permitted, Monseigneur le Recteur, to express to you, your University, as well as to the graduates and the staff of the Ecole Polytechnique, the most cordial wishes of my University for your success, and the hope that your influence may grow in the training of young men for positions of responsibility in the service of Canada—a full-grown nation which now occupies a high place in the councils of the world."

SEMI-ANNUAL MEETING

OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

WITH

THE ENGINEERING INSTITUTE OF CANADA

PARTICIPATING

HOTEL STATLER, DETROIT, MICH.

June 17th to 20th, 1946

Tentative Programme

MONDAY, JUNE 17

REGISTRATION - - - - - - - - - - **9.30 a.m.**

COMMITTEE MEETINGS

GENERAL LUNCHEON - - - - - - - - - **12.30 p.m.**

1. Welcome.
2. Scope of Meeting.
3. Response.

I. AVIATION (Joint meeting with Society of Aeronautical Weight Engineers) - - - - **2.30 p.m.**

(a) Integrated Program for Weight Control PALMER KELSEM, *Group Engineer, The Glenn L. Martin Co., Baltimore, Md.*

(b) Civil Air Regulation as they affect Weight Control, WILLIAM H. DOWNS, *Engineer, Republic Aviation Corp., Farmingdale, N.Y.*

(c) Airline Compromises with Maximum Possible Pay Loads, WILLIAM DAVIES, *Asst. Chief Engr. United Air Lines, Chicago, Ill.*

II. HEAT TRANSFER - - - - - - - - **2.30 p.m.**

(a) Theory of Moving Sources of Heat and Its Applications to Metal Treatments, PROF. D. ROSENTHAL, *Dept. of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.*

(b) Heat Transfer in Connection with Refrigeration and Involving Finned Coils. HUGH SCULLEN.

III. PRODUCTION ENGINEERING - - - - **2.30 p.m.**

(a) Carbide and Other Cutting Metals, ARCH MASON, *Ternstedt Division, G.M. Corp., Detroit, Mich.*

(b) Cutter Life Obtained from Carbide Blanks Mechanically Held Versus Brazed to Cutter Blades. FRED W. LUCHT, *Carboloy Co., Inc., Detroit, Mich.*

IV. GREAT LAKES CARRIERS - - - - - **2.30 p.m.**

(a) Diesel Power of Motorship "Henry Ford II" MALCOLM McLAREN, Ford Motor Co., Dearborn, Mich.

(b) Geared Turbine Bulk Carriers, R. C. STANBROOK, *Marine Engineer, Pittsburgh Steamship Co., Cleveland, O.*

V. MACHINE DESIGN - - - - - - - **2.30 p.m.**

(a) Application of Tables for Helical Spring Design, H. F. ROSS, *United Shoe Machinery Corp., Beverly, Mass.*

(b) High Speed Chain Developments, A. W. MYER, *Brown and Sharpe Mfg. Co., Providence, R.I.*

(c) Self Locking Nuts Applied to Industrial Equipment, WM. E. HORENBURGER, *Elastic Stop Nut Co. of America.*

GENERAL DINNER - - - - - - - - - **7.00 p.m.**

Joint Meeting with The Engineering Institute of Canada.

TUESDAY, JUNE 18

I. AVIATION (Gas Turbine Session) - - - - **9.30 a.m.**

(a) Aircraft Gas Turbines for Propeller Drive, ALLAN HOWARD and DR. C. J. WALKER, *Turbine Generator Engineering Division, General Electric Company, Schenectady, N.Y.*

(b) Combustion and Ignition in Aircraft Gas Turbines, A. J. NERAD, *Research Laboratory, General Electric Company, Schenectady, N.Y.* and W. D. CRATER, *Engineering Division, General Electric Co., Los Angeles, Calif.*

II. HEAT TRANSFER - - - - - - - - **9.30 a.m.**

Symposium of Recent Advances in Furnace and Kiln Technology Chairman: E. D. GRIMISON, *Babcock and Wilcox Company, New York, N.Y.* (Chairman Committee on Industrial Furnaces and Kilns.)

III. POWER - - - - - - - - - - **9.30 a.m.**

(a) Experiences with Automatic Air Soot Blowers, HAROLD L. SMITH, *Mechanical Engineer, Buffalo Niagara Electric Corp., Buffalo, N.Y.*

(b) Burning Low Grade Midwestern Coals on Spreader Stokers with Continuous Ash Discharge, JOHN M. DRABELLE, *Mech. and Elec. Engr., Iowa Electric Light and Power Co., Cedar Rapids, Iowa.*

IV. PRODUCTION ENGINEERING - - - **9.30 a.m.**

(a) Pressure of Solid Phase Welding, Representative of Linde Air Products Company.

(b) Resistance Welding with Storage Batteries, J. G. GORDON, *Progressive Welding Company, Detroit, Mich.*

V. GREAT LAKES CARRIERS - - - - - **9.30 a.m.**

(a) Hull Design, PROF. L. A. BAIER, *University of Michigan, Ann Arbor, Mich.*

(b) Self Unloaders, GEORGE PALMER, *Consulting Marine Engineer, Detroit, Mich.*

GENERAL LUNCHEON - - - - - - - - **12.30 p.m.**

Air Transportation and World Understanding, J. PARKER VAN ZANDT, *Director of Aviation Research, The Brookings Institution, Washington, D.C.*

I. AVIATION—Instruments and Regulators - **2.30 p.m.**

(a) Aerial Cameras, TALBOT ABRAMS, *President Abrams Instrument Corp., Lansing, Mich.*

(b) Radar Photogrammetry, R. G. SANDERS, *Asst. Vice-Pres., Fairchild Camera and Instrument Corp., Jamaica, N.Y.*

II. MANAGEMENT - - - - - - - - **2.30 p.m.**

(a) Works Standards, GUY BATES, *General Motors Corp., Detroit, Mich.*

(b) To be announced.

III. PRODUCTION ENGINEERING - - - **2.30 p.m.**

(a) High Frequency Induction Heat Treating, H. A. STRICKLAND, JR., *Chief Engineer, Budd Wheel Co., Detroit, Mich.*

(b) High Frequency Heating and Non-Conducting Materials, FREDERICK J. JOLLY, *Detroit Edison Company, Detroit, Mich.*

IV. OIL AND GAS POWER - - - - - - **2.30 p.m.**

(a) Metallurgical Consideration of Gas Turbines, NORMAN L. MOCHEL, *Westinghouse Electric Corp.*

(b) Control of the A K Closed Cycle Gas Turbine Power Plant, DR. KURT KELLER, *Kocher Wyss Engineering Works, Zurich, Switzerland.*

(c) Subject to be announced.
A. D. HUGHES, *Allis Chalmers Company, Milwaukee, Wis.*

V. FUELS - - - - - - - - - - - **2.30 p.m.**

(a) Lubrication and Sludge Removal Problems of Automotive Type Engines, J. MUSSER MILLER, *Standard Oil Company, Detroit, Mich.*

(b) To be announced.

GENERAL DINNER - - - - - - - - **7.00 p.m.**

(a) Air Industrial Planning in Postwar Period, MAJOR GENERAL B. W. CHIDLAW, *Deputy Commanding General Engineering T-3 Wright Field, Dayton, Ohio.*

(b) Subject to be announced.
J. CARLTON WARD, *President, Fairchild Aircraft Corp.*

WEDNESDAY, JUNE 19

I. AUTOMOTIVE - - - - - - - - 9.30 a.m.

(a) Emergency Engine Design for Medium Tanks, H. K. WOOLSON, *Executive Engineer, Chrysler Motor Corp., Detroit, Mich.*

(b) Application of Diesel Engines for Tank Warfare, F. G. SHOEMAKER, *Diesel Engine Division, General Motors Corp., Detroit, Mich.*

II. INSTRUMENTS AND REGULATORS - - 9.30 a.m.

(a) Latest Developments in Aircraft Controls, A. E. BAAK, R. A. FRANZEL and R. A. BROWN.

(b) To be announced.

III. PRODUCTION ENGINEERING - - - 9.30 a.m.

(a) The Influence on Tool Life and Power of Chamfer, Nose Radius and Peripheral Cutting—Edge Angles When Face Milling 40,000 psi Cast Iron, O. W. BOSTON, *University of Michigan, Ann Arbor, Michigan, and* W. W. GILBERT, *University of Michigan, Ann Arbor, Mich.*

(b) Specific Studies Pertaining to Tool Wear, Chip Characteristics and Surface Finish of Free Cutting Steels, G. P. WHITTEMAN, *Asst. Metallurgical Engineer, Bethlehem Steel Company, Bethlehem, Penn.*

IV. AVIATION—NOISE CONTROL - - - 9.30 a.m.

(a) Aircraft Acoustical Problems and Possible Solutions, K. R. JACKMAN, *Consolidated-Vultee Aircraft Corp., San Diego, Calif.*

(b) To be announced.

V. POWER - - - - - - - - - - - 9.30 a.m.

(a) Internal Cleaning of Boilers with Acid, SHEPPARD T. POWELL, *Consulting Chemical Engineer, Baltimore, Md.*

(b) Boiler Design for Extreme Load Variations, M. H. KUHNER, *Chief Mechanical Engineer, Riley Stoker Corp., Worcester, Mass.*

GENERAL LUNCHEON - - - - - - - - 12.30 p.m.

Subject to be announced.
Col. E. H. Gray, Aberdeen Proving Grounds.

I. AUTOMOTIVE - - - - - - - - - 2.30 p.m.

(a) Redesigning Ford Engines for Tank Service, P. PONTA, *Ford Motor Company, Dearborn, Mich.*

(b) Problems in Tank Engine Design, J. F. GORDON, *Cadillac Motor Car Div., General Motors Corp., Detroit, Mich.*

II. INSTRUMENTS AND REGULATORS - - 2.30 p.m.

Conference on Controller Air Supply.
Chairman to be announced.

III. PRODUCTION ENGINEERING - - - 2.30 p.m.

(a) The Results of an Investigation of the Removal of Metals by the Process of Grinding, R. E. MCKEE, *University of Michigan, Ann Arbor, Mich.;* R. S. MOORE, *Quaker Chemical Products Co., Consbocken, Penn.;* O. W. BOSTON, *University of Michigan, Ann Arbor, Mich.*

(b) What is New in Honing, L. S. MARTZ, *Asst. to President, Micromatic Hone Co., Detroit, Mich.*

IV. AVIATION—VARIABLE SPEED DRIVES - 2.30 p.m.

(a) Application of Variable Speed Drives, ERWIN R. BOYNTON, *Aeronautics and Machine Div., General Electric Co., West Lynn, Mass.*

(b) To be announced.

V. RUBBER AND PLASTICS - - - - -

(a) The Rubber Phenolio Cements As Structural Adhesives, Loughborough and Snyder.

(b) Analysis of Mechanical Properties of Plastic Laminates, R. K. WITT.

GENERAL DINNER - - - - - - - - 7.30 p.m.

Chairman: K. T. KELLER, *President, Chrysler Motor Corp., Detroit, Mich.*
Speaker: GENERAL J. DEVERS, formerly Commander 6th Army Corp., Washington, D.C.

THURSDAY, JUNE 20

I. PRODUCTION ENGINEERING - - - 9.30 a.m.

(a) Arc Welding of Alloy Steels, ROBERT J. HUSSELL, *Fisher Body Div., General Motors Corp., Detroit, Mich.*

(b) Photo Elastic Investigation of Residual Stresses in Welds, PROF. JAMES J. RYAN, *University of Minnesota, Minneapolis, Minn.*

II. MANAGEMENT - - - - - - - - 9.30 a.m.

(a) To be announced.

(b) To be announced.

III. RUBBER AND PLASTICS - - - - - 9.30 a.m.

(a) Plastic Mold Release, EARL ZIEGLER, *Dow Chemical Company, Midland, Mich.*

(b) Evaluation of Rubber and Rubber Like Materials, J. D. MORRON, *U.S. Rubber Company, Detroit, Mich.*

IV. STUDENT PAPERS - - - - - - - 9.30 a.m.

Papers to be provided by students.

GENERAL LUNCHEON - - - - - - - - 12.30 p.m.

Subject and speaker to be announced.

I. HEATING AND VENTILATING - - - 2.30 p.m.

(a) District Heating in Detroit, GLEN WINANS, *Detroit Edison Company, Detroit, Mich.*

(b) Terminal Velocity as the Measurement of Dust Particle Characteristics, R. B. FOLEY, *American Blower Company, Detroit, Mich.*

II. PRODUCTION ENGINEERING - - - - 2.30 p.m.

(a) Carbide Tooling at New York Navy Yard, Lt. (jg) C. A. PALMER, *N.Y. Navy Yard, Brooklyn, N.Y.* and J. G. KENNEY *N.Y. Navy Yard, Brooklyn, N.Y.*

(b) Cutting Action of Reamers, T. F. GITHERS, *Mech. Engineer, Cleveland Twist Drill Company, Cleveland, Ohio.*

(c) Further Work on Carbide Milling, O. W. BOSTON, *University of Michigan, Ann Arbor, Mich.*

III. STUDENT PAPERS - - - - - - - 2.30 p.m.

Papers to be provided by Students.

LADIES PROGRAMME

A special Ladies Committee is arranging to welcome all ladies who attend the meeting. Interesting trips and luncheons are being prepared and will include such places as Greenfield Village, Detroit Art Center and Belle Isle. It is hoped that a large number of ladies will attend and see Detroit at the most favourable time of year.

PLANT INSPECTION TRIPS

A number of plant inspection trips are being planned to supplement the Technical Sessions. Arrangements are being made to inspect a modern lake freighter, a type of ship peculiar to the Great Lakes. Automobile, Steel and Power Plants will be included in the trips, with emphasis on those industries for which Detroit is particularly noted.

FELLOWSHIPS IN TRAFFIC ENGINEERING

The Bureau of Highway Traffic in Yale University, New Haven, Conn., offers ten fellowships in Traffic Engineering for the academic year 1946-47. These awards have been made possible through a grant from the Automotive Safety Foundation.

This course of graduate study and research provides a broad foundation in the techniques of traffic operations. It is designed to give the student increased skill and ability in the analysis of traffic problems and to equip him with a thorough knowledge of traffic engineering.

The course of work begins September 23, 1946. Upon successful completion of the course of study, students will be eligible for a "Certificate in Traffic Engineering" subject to the approval of the Committee on Transportation of Yale University.

Qualifications for Fellowship

These fellowship awards are open to men who have been granted a degree by an accredited college in some branch of engineering. Applicants should have had practical experience in city engineering, highway engineering, or in related fields. Preference will be given to those applicants who are now employed in street and highway engineering and who secure a leave of absence in order to return to their present employer.

Fellowship Stipend

The fellowships provide a living stipend of $800.00, disbursed at the rate of $100.00 per month for a period of eight months while the student must be in residence in New Haven. The fellowships also provide a tuition fee of $400.00. In addition, a maximum of $200.00 is available to each Fellow for his individual research project to be approved by the Bureau. The total value of each of these fellowships is, therefore, approximately $1,400.00.

Applications

Request for additional information and application blanks should be addressed to BUREAU OF HIGHWAY TRAFFIC, YALE UNIVERSITY, STRATHCONA HALL, NEW HAVEN 11, CONNECTICUT. The closing date for application is June 1, 1946.

QUEBEC CORPORATION HOLDS ANNUAL MEETING

The Annual Meeting of the Corporation of Professional Engineers of Quebec was held at the Ecole Polytechnique, Montreal, on Saturday, March 30th.

The retiring president, P. E. Poitras, gave an informal report on the presentation by the Corporation of Bill 200 to have its charter amended by the Quebec Legislature. The bill met with considerable opposition when introduced before the Private Bills Committee and was finally withdrawn by the Corporation's representatives at the request of the prime minister. Mr. Poitras explained that it would be left with the new council to make the necessary changes in the bill so as to render it acceptable to the Legislature.

(*Associated Screen News*)
E. A. Ryan, M.E.I.C.

The reports of Council and of the various committees were then presented and discussed at length. An unprecedented increase in membership of nearly 700 during the year was reported, this being due in large part to the fact that a large number of members of the Engineering Institute joined the Corporation under the terms of the co-operative agreement.

Chief among the subjects under discussion was the recently formed Canadian Council of Professional Engineers and Scientists. It was recalled that, at the 1945 Annual Meeting, concern had been expressed by several members about the then proposed formation of this over-all organization and President Lindsay had explained that the Corporation's representatives had refrained from endorsing the establishment of such a body.

After an interesting discussion on the relations between the new Council and the Dominion Council the following resolution was introduced, put to the vote and carried by a large majority

WHEREAS the recently organized body known as The Canadian Council of Professional Engineers and Scientists is being financed in part by contributions from the Dominion Council which comes out of moneys furnished it by the Corporation and the other provincial professional associations, and in part by contributions made direct to it by certain other bodies, including the Corporation; and

WHEREAS the Corporation does not consider this new organization is serving a useful purpose for the engineering profession; and

WHEREAS the Corporation does not desire to contribute to the expenses of the new organization, either directly or indirectly;

THEREFORE be it resolved:

1. That as long as the Corporation remains a member of the Dominion Council its representative thereon should make certain that no contributions of the Corporation are used to support the Canadian Council of Professional Engineers and Scientists.
2. That as soon as practicable, the Secretary of this Corporation forthwith furnish a copy of this resolution to the President and Secretary of the Dominion Council and of each of the provincial professional associations.
3. That no further contributions be made by the Corporation to The Canadian Council of Professional Engineers and Scientists.

The scrutineers reported on the election of members of Council for the year 1946 and at the first Council meeting which took place immediately after the Annual Meeting, the following officers were appointed:

President—E. A. Ryan, M.E.I.C.

Vice-President—Ernest Lavigne, M.E.I.C.

Secretary-Treasurer—W. G. Hunt, M.E.I.C. (Deceased April 6th, 1946).

Councillors—Louis Beaudry, M.E.I.C; J. A. Lalonde, M.E.I.C.; E. Larochelle; J. W. McCammon, M.E.I.C.; G. H. Midgley, M.E.I.C.

Marc Boyer, M.E.I.C., was re-appointed as registrar.

UNIFICATION OF ENGINEERING STANDARDS

In the October number of *The Engineering Journal* considerable information was given about the International Conference held in Ottawa on September 24th to October 6th, 1945 to consider means of arriving at the unification of many engineering standards, particularly screw threads.

It was known at that time that the delegates from the three countries had agreed on many details, but that it was necessary to take these agreements back to the standardizing bodies of each country for further discussion and for approval. Just recently the Institute has received a report from the American Standards Association, which brings this subject pretty well up to date. The following is quoted from their report:—

The release of an official report by the Combined Production and Resources Board now makes it possible for the American Standards Association to give the results of the conference on Unification of Screw Thread Standards held last October at Ottawa.

This conference was the culmination of months of hard technical effort on the part of national engineering committees working through the British Standards Institute, the Canadian Standards Association, and the American Standards Association. Agreement was reached that there should be unification of the basic screw threads of the three countries. A technical basis was laid for such unification. The report that came out of the conference consists essentially of recommendations to the industries of the three countries as to how they may carry out the work of unification through their respective national standardizing bodies.

The immediate spur to completion of this job was the experience of the past war. Urgently needed equipment was sometimes kept out of action for months waiting for replacement parts because British and American screws were not interchangeable. Had there been a common system of screw thread forms in 1939, production could have been multiplied in volume and millions of dollars would have been saved for the Allies.

For some thirty years, engineers in the countries concerned have been working to this end with increasing conviction of its importance. The present agreement is the culmination of the work of three conferences which the Combined Production and Resources Board made possible by providing authorization under wartime restrictions and by supplying travel funds.

All recommendations of the conference have been referred to committees of the national standardizing bodies of the three countries with a view to their use in development of the national standards. The Committee on Screw Threads of the American Standards Association, working under the technical leadership of the American Society of Mechanical Engineers and the Society of Automotive Engineers will reduce these recommendations to the usual terminology of American Standards. The technical detail is to be identical in the standards of the three countries.

thus providing for complete interchangeability of threaded parts.

The American thread system, originally developed by Wm. Sellers for whom it is named, has a thread form with a 60 degree angle; while the British, called the Whitworth system, has an angle of 55 degrees. There are also other important differences. The pitches of the British fine thread are coarser than the pitches of the American fine thread. Fortunately the pitches of the coarse thread are the same except in the half-inch bolt for which the British have twelve threads per inch and the American thirteen. Furthermore, the Whitworth screw has a rounded top and bottom and the Sellers screw a flat top and bottom.

Whitworth Thread

Sellers Thread

The new basic form of thread which was endorsed by the conference has an angle of 60 degrees and rounded crest and root, with truncation of the crest of the screw permissible. Threaded products made to this new form will be practically interchangeable with those having the same nominal diameter and pitch made to the present American Standard. On the part of the British, however, a change in the thread angle from 55 to 60 degrees for threads of all sizes will be necessary.

In addition to the agreement on a unified basic form of thread, agreements were reached on special purpose threads, including acme threads, buttress threads and threads for fastening screws for precision instruments. It is expected that certain parts of the American War Standard for Acme Threads (the piano stool thread) published by the American Standards Association will be clarified when it is converted to a regular American Standard; that the final draft will be submitted to the British and Canadians before being approved; and that it will be adopted by all three countries as a national standard.

A standard form of buttress thread was agreed upon, particularly designed for use in applications involving exceptionally high stresses in one direction only. The agreements also included preferred series of diameters and pitches, formulas for calculating suitable tolerances and allowances, and a recommended system of gaging. The thread form has an over-all depth of engagement of 0.4 pitch, a pressure face angle of 7 degrees and the pressure face and back face connected by symmetrical radii of suitable proportions. The formula for calculating the effective diameter was the same as that used in British Standard 84-1940 (Screw Threads of Whitworth Form) but modified to suit the buttress thread and so arranged as to compromise the pitch-diameter factors to meet the wide range of pitch-diameter relationships.

An alternative form with a vertical pressure flank thread was in demand, the British found, particularly for larger gun work and on high pressure steam valves. An appendix added to the draft standard, therefore provides an alternative optional thread form having a vertical pressure flank.

It was also agreed at the conference that the method of calculating tolerances and allowances on Buttress threads as given in the British proposal should be accepted with the reservation that it is open to revision in accordance with any general change in basic formulas for tolerances and allowances in a unified standard for screw threads.

The conference reached agreement for unification on threads for optical tubes and cells; and on microscope objective threads (interchangeable with the Royal Microscopical Society thread).

These agreements on instrument screw-threads were based on the Swiss Horological Society standards and it was decided that gaging practices for small screws should be discussed with the Swiss.

For fine motion screws the new basic form of thread was proposed, possibly with the adoption of decimal inch diameters, particularly for sizes below ¼ inch.

In order to facilitate the supply of taps and dies, three series of nominal diameters were recommended.

On bearing adjusting screws, it was agreed that the diameters and pitches should be chosen from the series recommended for fastening screws of fine motion screws.

Screw threads for optical instruments were considered under three separate headings: major, minor and optical constructional screw threads.

The major optical component screw threads included microscope objective screw threads and screw threads for photographic or camera lens mountings.

It was recommended that the existing British and American Standards on screw threads for photographic or camera lens mountings be studied with a view to establishing uniform standards, giving particular attention to diameters, pitches, the proposed new basic thread form and length of threads to shoulder.

For minor optical components such as lens accessories, shutter cable release gear, between-the-lens shutters, and the like, it was recommended that the new basic thread form be adopted and the dimensions for such threads be based on the inch unit.

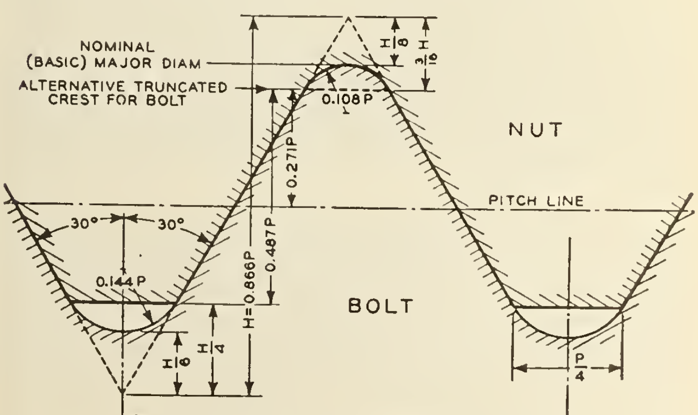
Agreement was reached on a common series of pitches for optical constructional threads on tubes and cells, to be used with the proposed new basic thread form.

On tripod mounting threads for surveying and similar equipment it was recommended that the Service departments of the three countries be asked to reconsider their diverse standards with a view to unification.

The use of the proposed basic thread form in the development of standard screw threads for mounting cameras and similar equipment on stands or tripods was referred to the standardizing organizations in each of the three countries.

The possibility of reaching agreements on pipe threads, methods of gaging and inspection, a universal system of nomenclature and definitions relating to drawing practice, high duty studs in light alloys and on rolled sheet metal threads and associated moulded plastic and die-cast threads was discussed but no agreements were reached. Arrangements were made for continuing the discussion.

The proposal on a basic thread form was by far the most outstanding accomplishment of the conferences and exemplifies the spirit of collaboration that prevails among the engineering professions of the three countries. Throughout the New York, London, and Ottawa conferences there was a spirit of accord which promises well for future cooperation between the three countries in the development of improved industrial methods and equipment.



Proposed basic screw thread form.

Headquarters was much surprised and not too displeased to receive a press release from the Technical Advertisers Association of Montreal, which indicated that *The Engineering Journal* was the most read publication in Canada, within the field surveyed.

It is interesting to note that the *Journal*, in this one particular office, has more readers than any similar Canadian or American publication, including the very popular "*Engineering News Record*". It is worthy of note also that the *Journal's* figure not only is higher, but is substantially higher than the others.

Occasionally a member has suggested that advertising in the *Journal* is not professional or ethical. It has been the opinion of the Publication Committee that members are interested in this advertising and that the *Journal* is more valuable with it than it would be without. One cannot help but notice that in this release it is the opinion of at least one engineer who has studied it that "engineers look at advertisements 90 to 95 per cent more than editorial content". He states also "the engineer reads technical advertisements regularly and spends an average of 2½ hours each week looking at technical publications".

Believing that members will be interested in getting these reactions to advertising, as well as knowing that their publication is well read, the release is being printed herewith.

Purchasing Agent and Engineer Tell What They Think of Technical Advertising

That "a man running can read it," that "it can be read by a tired man in a poor light" are the tests of a good advertisement in the technical press. So said John S. M. Hayes, Secretary and Purchasing Agent, Shipping Containers Limited, speaking before a large meeting of the Technical Advertisers Association of Montreal recently. In this he related the advertisement to instructions given in the army for clear message writing. He said that the average purchasing agent at his desk these days was just as busy as a message runner in the army,—he had little time for uninterrupted reading by reason of the press of work over his desk, "his day made hectic by delayed shipments, the need for tracing orders six months old, arranging emergency repairs when parts are unobtainable".

Bringing with him "close to 300 years of engineering experience" gained from discussions with twelve senior engineers on the subject of technical advertising, R. N. Ferguson, Engineering Department, Canadian Industries Limited, added greatly to the already stimulating ideas of Mr. Hayes, for the benefit and sometimes slight embarrassment of the advertisers.

That the opinions of the engineers are worth listening to is proven by the fact that "most of the money which is spent on construction and on new equipment is controlled by them. An example of this is the 53,959 orders written by the Defence Industries Limited, Engineering Department during the war. These resulted in the construction of plants valued at $125,000,000. During the same period, Canadian Industries Limited's Engineering Department wrote 17,056 orders which would also be valued in the millions of dollars."

It was most reassuring to all, the extent to which both Mr. Hayes and Mr. Ferguson felt the technical press, both editorial and advertising content, was read by purchasing agents and engineers. Both groups leaned heavily on such publications for information about the trade. "The engineer depends largely on technical advertisements to keep him informed of new types of equipment and material which becomes available. In general he feels that the advertisements fulfill this function."

In general Mr. Ferguson felt that engineers looked at advertisements 90 to 95% more than the editorial content; the purchasing agent thought his group looked at advertisements and editorial content equally.

"The engineer reads technical advertisements regularly and spends an average of two and one-half hours each week looking at technical publications. He would like to spend six hours but simply cannot find the time. He does not confine his reading only to his own field. He has no publication on which he is most dependent for information. . . ."

The technical library of Mr. Ferguson's own company regularly receive over one hundred periodicals. The most widely read by his group of engineers are:

Canadian Publications	*Number of Readers*
Engineering Journal	26
Manufacturing and Industrial Engineering	14
Industrial Canada	7
Business Management	5
Electrical News and Engineering	4
Hardware in Canada	4
Canadian Refrigeration Journal	3
United States Publications	
Chemical and Metallurgical Engineering	21
Engineering News Record	17
Construction Methods	16
Power	16
Product Engineering	15
Factory Management and Maintenance	14
New Pencil Points	12
Architectural Forum	12
Heating and Ventilating	11
Heating, Piping and Air Conditioning	10
Business Conditions and Forecasts	7
Modern Plastics	6

From the engineers, criticism and suggestions to technical advertisers might be listed as follows:

1) the technical advertisement should be informative, though not to sacrifice the attractiveness of the ad from the human viewpoint.
2) very often general price information would save useless correspondence.
3) engineers don't like extravagant statements.
4) many advertisers take themselves too seriously,—the humorous advertisement is not out of place in the technical press.
5) poor illustrations are inexcusable. One good picture per page, with complete information about it, is desirable.
6) many American and sometimes even Canadian advertisers omit mentioning their local agents. These should be noted.

Mr. Ferguson felt that advertisers could do engineers a real service and could influence them even more than at present by concentrating on helping them make the best use of their limited reading time.

In general the purchasing agents have the following suggestions:

1) many technical ads are too stuffed with words . . . "that tired purchasing agent just won't be bothered reading it all . . . he is looking for some manufacturer of welding equipment . . . he naturally passes the picture of the legs and eventually sees a large colour plate of a welder at work . . . he stops and reads".
2) picture your product prominently. Make it evident exactly what you sell . . . it is old stuff that a picture is worth a thousand words. . . .
3) do not labour the technical detail. "After all you are trying to impress trained men, who already know a lot of engineering principles"; they will write for the details or call in your representative if they are interested.
4) a miniature catalogue is wasted effort.

5) do not print " hurrah for you " letters. Most purchasing agents have the usual comment of " I wonder how much he got for that ".
6) " free trial or use of heavy equipment " offers do not get much of a response from purchasing agents.
7) be sure illustrations are clear and do not pose the question, " I wonder what it is? " Any technical man can be trapped by a neat model of the " here's how it's done " variety.
8) repetition gets attention,—but do not go to the point of monotony.
9) " the smiling face of the company President or any member of the firm " is not appreciated.
10) pictures showing the application of a unit actually at work in someone else's plant are interesting and informative.
11) do not be too technical. A large number of senior executives are not technical men and " a description full of highly technical terms actually can lose a large potential market ".
12) simple, clean illustrations are a MUST, an ad is better in colour.

VISIT OF BRAZILIAN ENGINEERING STUDENTS TO CANADA

A group of 13 engineering students (graduating class 1946) of the National School of Engineers of the University of Brazil, recently paid a visit to engineering plants in Quebec and Ontario. They were accompanied by two of their Professors in Civil Engineering, the whole visit being under the official patronage of the Brazilian Government and arranged by the Canadian Inter-American Association.

The series of industrial visits commenced with a day in Lachine, Que., at the Works of Dominion Bridge Company and Dominion Engineering Works Limited. Here the students were able to see a very great variety of heavy engineering work in actual progress in the shops, including export orders to South America. The accompanying picture was taken during the visit to the Dominion Bridge Company's plant and in it may be seen the only woman member of the graduating class Senhora Régina de Castro Barbosa.

Group of Brazilian students having a technical point described by one of their Professors during their recent visit to the Dominion Bridge Company's Lachine Plant. In the party may be seen the only woman student Senhora Régina de Castro Barbosa.

CORRESPONDENCE

An Invitation to Criticize

350 Willowdale Ave., Apt. 23,
Outremont, Montreal 26, Que.
March 12th, 1946.

The Editor,

The Engineering Journal.

Following upon recent activities of the Institute towards establishing a rational scale of earnings for engineers, and in the light of recent comments in the daily press on the serious exodus of Canadian engineers to the U.S., one cannot but feel dismayed upon glancing through the " Situations Vacant " columns in the February issue of *The Engineering Journal.*

Particularly striking, although not the worst, is the request for a physicist or an electrical engineer who, in addition to being preferably a veteran, must also possess the remarkable qualities of a knowledge of nuclear physics, the ability to express himself clearly, and an analytical mind. For this remarkable display of mental gymnastics the fortunate possessor is offered $275.00 per month. It can of course be assumed that such an adroit character should be in a position to substantially augment his salary at either the poker or barbotte table. For inexpensive amusement he also has the standard set of five years of unread *Journals.*

It would seem that, having reached some conclusions on the question of engineering earnings, the Engineering Institute should have the courage to implement them. The first and most obvious step towards this would probably be a refusal of advertisements for positions in *The Engineering Journal,* the salaries for which do not provide a recognized minimum.

I find it difficult to imagine that the critical comments of engineers on your " Situations Vacant " column have not already reached your ears. While I have noted your editorial criticism of salaries offered engineers for Government Service I fail to see why this criticism should not be extended to positions offered engineers generally. It can hardly be denied that the present situation is a most serious one affecting not only the individual engineer but also the profession and particularly the future of Canada itself and therefore of Canadians. I am sure that few of us will deny the lack of enthusiasm within the profession displayed in the meager attendance at meetings of the Institute, at least in Montreal. There is a growing cynicism, particularly in the ranks of the younger engineers, born of the feeling that the penalty to be paid for a serious attitude towards the practice of his profession is more than he can afford.

One can only conclude that the assessment of the value of its services on the part of the profession antiquates the timeworn quip, "dime-a-dozen". It is now a "dozen-a-dime".

The Engineering Institute, in view of its universal membership should provide, through its executive and *Journal*, dynamic leadership for the profession in matters of importance to all engineers. This it fails to do and I believe the fault lies both with executive and membership. It would be hypocrisy to deny the existence of a general attitude of scorn on the part of younger engineers towards the Institute, which it damned well deserves. It would seem to me that the very best place for the display of such criticism would be in the *Journal* itself.

Recommended—a Full Page Invitation to all engineers to criticize through the pages of the *Journal*.

Yours truly,

(Signed) WALTER K. DOW, JR.E.I.C.

April 8th, 1946.

Walter K. Dow, Esq., Jr. E.I.C.,
350 Willowdale Ave., No. 23.
Outremont, Montreal 26, Que.

Dear Mr. Dow:

Unfortunately, several absences from the city have prevented me acknowledging your letter of March 12th which reached us on the 15th. I think the points you raise require an answer, and while I regret that I do not have the opportunity to discuss this with you in person, I am glad to go into several matters by letter.

Everyone will share with you in your criticism of low salaries for engineers, and in particular those positions which occasionally are advertised in *The Engineering Journal*. However, there is one angle of this question which you may not appreciate.

You suggest that we should refuse to print advertisements where the remuneration is considered too low. Consideration has been given to such action, but it was agreed that the pages of the *Journal* could not be closed to a member who desires to secure engineering assistance. Supposing, for example, you were an employer and wanted to engage an engineer. Could we refuse you the right to state your case in our publication? The Publication Committee has agreed that we could not.

Our policy is to suggest to such advertisers that they are not likely to get any replies when the advertised rates are below the going price. Quite frequently, advertisers have changed their rates when we have so advised them, but in other instances they have asked us to insert the advertisement as prepared by them. We feel we have no alternative.

To illustrate our position further, let me call to your mind a letter which was printed in the December number of the *Journal*, addressed to the Civil Service Commission, in which we told them that we could not continue to advertise their positions at their scales of pay. We felt in this instance that we could do it, because the advertiser was not a member of the Institute. These are factors which you and probably others have overlooked.

In one part of your letter you say "Few of us will deny the lack of enthusiasm within the profession displayed in the meager attendance at meetings of the Institute." While appreciating that the word "meager" may have different meanings to different people, I find it difficult to agree with your use of it. In fact, the auditorium of the Institute has been so overcrowded on so many occasions that consideration has been given by the House Committee and Council to enlarging the premises. I am confident that if you attended all meetings of the Montreal Branch, you would find the average attendance was not adequately described by "meager."

Of course, the outstanding statement in your letter is: "It would be hypocrisy to deny the existence of a general attitude of scorn on the part of younger engineers towards the Institute". Again, I suggest that the record does not bear out your observation. The Institute's membership today is almost 8,000, of which about 3,000 are young men. At the meeting of Council held last Saturday, over 300 applications for membership were approved, and of this group, 250 were young men. Apparently they do not share with you the "scorn" you confess for the Institute.

It is a matter of concern to the officers of the Institute that a member should feel towards it as your letter indicates you do. It is their belief and hope that your opinion is not shared by any great block of the membership. Certainly there has been no evidence of it discernible to the officers. However, I personally am grateful to you for having had the courage to express your convictions, and I am glad to have the opportunity to discuss them with you. After consultation with the chairman of the Publication Committee, we are proposing to print your letter in the *Journal*, as you have requested, along with this reply.

Yours sincerely,

L. AUSTIN WRIGHT,

General Secretary.

Member Visits New Zealand

Hotel St. George,
Wellington, New Zealand,
February 23rd, 1946.

Dr. L. Austin Wright,
The Engineering Institute of Canada,
Montreal, Que.

Dear Dr. Wright:

I was sorry to have to miss the Annual Meeting this year but I may be allowed some credit as I have attended the Annual Conference of the New Zealand Institution of Engineers, which just yesterday concluded after being in session from Tuesday morning. I have been much impressed by their kindness and hospitality. The Engineers Club in Wellington hold a luncheon monthly and I have been asked to address the meeting on March 12th. I found the technical papers and discussions to be of a very high standard and I would say that the engineers generally are very competent. I also attended the annual meeting of the Professional Engineers Association which was formed only a year ago and is chiefly concerned with improving the economic status of the profession. They have nothing to do with registration as there is a Registration Board for that purpose. They have quite a distance to go before they arrive at the point we have attained in Ontario but they are working together with remarkable unanimity.

As far as I have observed, the country as a whole is not in a particularly happy position. There is a great scarcity of almost everything. The pegging of the New Zealand pound at 75 per cent of the pound sterling together with the practically universal practice of the 40-hour 5-day week and other advanced social legislation have been mixed blessings, to say the least.

Although it is now summer, the weather in Wellington is relatively cool, generally in the top 60's. There has been little rain in the past few weeks (which, I am told, is most unusual) and Wellington, which is known as the "Windy City" has certainly not lived up to its name. We had an earth tremor the other night which I thought quite severe but the people here took little notice. It was given about four lines in the next day's newspaper.

With kindest regards,

(Signed) A. H. MacQuarrie, M.E.I.C.

Stop Suggesting—Demand Higher Salaries

Department of Public Works, Canada,
District Office,
March 8th, 1946.

L. Austin Wright, Esq.,
The Engineering Institute of Canada,
Montreal, Que.

Dear Mr. Wright:

I have just read your article "A Break in the Clouds" in the February issue of *The Engineering Journal*.

It is gratifying to know that "signs are developing" regarding engineer salary revisions but the signs are by no means hopeful of a proper treatment of the case if the information in the article is anywhere nearly correct.

I maintain it is still difficult to discern what the Civil Service Commission itself hopes to accomplish. The treatment of the Civil Service staff during the war has made "Confusion worse confounded" showing that no intelligent effort is being made for proper adjustment of the salaries of the technical services. All stagnation and muddling cannot be blamed on the Treasury Board.

If the reclassification survey is to be pushed by the beginning of April there is still much work to do as this district for one has not yet been surveyed. What is feared is likely to take place. Salary revisions will be prepared and authorized by Order in Council before any opportunity is given to lodge a protest. If the proposed revision is such as is listed in the article it is far short of requirements.

Regarding the continued salary increases, this is an excellent objective but can be worked with any grading system, simply by fixing a point where promotions will cease, until vacancies above occur. This must be done somewhere and I would say that Grade 4 would be that place.

Now comes the important and vital part. I maintain that The Engineering Institute of Canada must make it its business to know definitely what is to emerge from the "cover of secrecy" and to raise what objections and recommendations it may have before those salaries become law.

That The Engineering Institute of Canada must interfere is inevitable. Why sit around outside waiting to see what will emerge? Such an aggregation of intelligent, sensible, practical men should be within, with a definite proposal as to what the Government must pay the classes of the Civil Service which the Engineering Institute represents as their official body.

No Royal Commission is required. Your Institute can definitely determine what are proper salaries for engineers in the service and should be strong enough to see that these are the salaries authorized by the Government.

I do not know on whom can be laid the blame for the failure of the adoption of the Beatty report or the Coon committee. If engineers had been granted the salaries proposed in the Beatty report the increases now proposed, as above, would have been forthcoming as they would not have appeared so radical as they do now, comparing them with 1921 salary scale on which we are now.

"The need is for someone or something that will make the Treasury Board do something about it." There is no need to go far to see that "someone or something"—it is The Engineering Institute of Canada, not by suggestion but by demand.

I would implore the Institute to take hold of this object firmly, to make up its mind definitely what salaries its Civil Service members should receive and to drive on unflinchingly until this object is attained, accepting no compromise. Thirty-three years of "existence" does make one rather bitter and radical ! !

Yours sincerely,

(Signed) ...., M.E.I.C.

Echoes of the Annual Meeting

The Institution of Electrical Engineers,
Savoy Place, W.C.2, London, England,
February 26th, 1946.

Dr. E. P. Fetherstonhaugh,
c/o Engineering Institute of Canada,
2050 Mansfield St.,
Montreal.

Dear Dr. Fetherstonhaugh,

Our recent visit to the Sixtieth Annual General Meeting of The Engineering Institute of Canada will always remain a very lively and happy memory. It gave us a long overdue closer knowledge of the organization of a very energetic and enthusiastic sister Engineering Society within the Commonwealth, and we have come away with high hopes of much greater collaboration in the future, towards which we expect to lay more definite foundations at the forthcoming Conference. But from a personal point of view the Convention gave us the opportunity of making many new friendships and of gaining a better understanding of the problems facing engineers in Canada, which would have been impossible in any other way.

Throughout our stay we enjoyed a hospitality warmer than I have ever experienced in any part of the world. I had known that Canada was renowned in this way but until I had experienced it I had not really believed that such sincere warmth of welcome could be possible. As the President in office during the greater part of the Convention, our personal thanks for the reception accorded to the President and to me are due to you, but I would like you to accept our appreciation in a personal capacity as much as in your capacity as President.

With my very kind regards to you and Mrs. Fetherstonhaugh.

Yours very sincerely,

(Signed) W. K. Brasher,
Secretary.

A meeting of the Council of the Institute was held at Headquarters on Saturday, March 23rd, 1946, convening at nine thirty a.m.

Present: Vice-President J. E. Armstrong (Montreal) in the chair; Past-President de Gaspé Beaubien (Montreal); Vice-Presidents G. F. Layne (Quebec), and C. E. Sisson (Toronto); Councillors S. R. Frost (Toronto), W. L. Saunders (Ottawa), Paul Vincent (Quebec), R. S. Eadie, R. C. Flitton, C. C. Lindsay, C. A. Peachey, P. E. Poitras and J. B Stirling of Montreal; Treasurer J. A. Lalonde (Montreal); E. P. Muntz, past-vice-president and member of the Committee on Professional Interests; General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

Harry Bennett Memorial Fund—Speaking for the committee on the Harry Bennett Memorial Fund, Mr. Wright reported that it had been found necessary in order to have contributions to the fund deductible from income for tax purposes to have a Deed of Trust prepared by the Institute's solicitors. This was now ready to be signed by the president and the general secretary and by the trustees of the fund, and was submitted for the approval of Council.

At the request of Vice-President Armstrong, the general secretary read the Deed, following which, on the motion of Mr. Beaubien, seconded by Mr. Flitton, it was unanimously resolved that the deed, as submitted, be approved.

The Engineer in the Civil Service—The general secretary reported that the Institute had received an invitation from the Royal Commission on Administrative Classifications in the Public Service to present a brief at a sitting in Ottawa on Tuesday, April 9th. He reported that he had been to Ottawa to discuss the matter with Mr. MacRostie, the chairman of the Institute's Committee on the Engineer in the Civil Service, and the lines which the brief was to follow had been agreed upon.

Co-operation in Ontario—Mr. Stirling referred to the discussion on co-operation in Ontario which had taken place at the first meeting of the new Council on February 8th, and inquired as to what progress had been made.

The chairman pointed out that as far as co-operation in any province is concerned the initial steps were not taken by the Council or by Council's committee but came from members of the Institute and the association within the province. He pointed out that it would be quite within the purview of Vice-President Sisson and the Toronto councillors or other Ontario councillors to initiate such action.

Mr. Sisson asked for further information as to the establishment of a provincial division and also asked whether or not the action by Mr. Buss referred to in Minute 4347 had yet taken place.

The general secretary replied that so far there had been no further word from Mr. Buss and the presumption was that there had been insufficient action to report.

Mr. Sisson suggested that an endeavour should be made to get the Ontario councillors together at a meeting in Toronto in order to discuss the Ontario situation. It was pointed out that a regional meeting of Council was planned for Toronto on April 27th and that the previous day should be a good date for the meeting of the Ontario councillors.

It was agreed eventually that the general secretary should communicate with Mr. Buss before any further action was initiated and that he should then inform Vice-President Sisson so that he could proceed with the Ontario conference.

Resolution from the Toronto Branch: Mr. Sisson presented a resolution from the Toronto Branch as follows:

"That Headquarters be advised that the Branch Executive believes the interests of the members of The Engineering Institute of Canada, and especially those of the Junior members, would be best served if The Engineering Institute of Canada were associated with, and had a representative on the Canadian Council of Professional Engineers and Scientists ".

He explained that this resolution had come from the Junior Section of the Branch to the senior executive for endorsation and transmittal to Council. The resolution, he explained, was very similar to one passed at a meeting of the Junior Section at which the subject of the Canadian Council and the Engineering Institute was discussed by Mr. Dobson, speaking for the Canadian Council, and Mr. Stirling and Mr. Wright for the Institute.

He pointed out that the Juniors at the meeting were very anxious that something should be done in order to bring the Ontario Association and the Institute, as well as the Canadian Council and the Institute, closer together. Their resolution had been supported by 50 votes in favour and 2 against.

Mr. Stirling expressed surprise that the resolution had come forward inasmuch as a member at the meeting had asked that a record be taken of the number who had not voted on the resolution. This showed 120 as not voting which, in his opinion, far outweighed the 50 that had voted for it.

Mr. Sisson was careful to point out that the action of the Junior Section was based primarily on a desire to improve the Institute's position in the Toronto area and he was very anxious to assure the Toronto executive and the Junior Section that the resolution would be given immediate consideration.

This reopened the whole question of the Institute's relationship with the new Council. The chairman suggested that Council was hardly in a position to change its decision at this meeting, in view of the fact that no evidence had been submitted to indicate that its decision had been incorrect or unwise. He pointed out that Council had not made the decision quickly and suggested that if there were sound reasons for Council changing its decision they should be submitted to the Committee on Professional Interests for preliminary consideration.

Mr. Stirling pointed out the position in which the committee would find itself. It had spent many weeks analysing the various elements and had prepared a statement of principles which had been approved by Council and widely circulated. There had been no further information submitted that would indicate that the decision should be reversed. In the light of these facts he asked as to what his committee could possibly do with this resolution.

It was pointed out that the Junior Section and the Toronto executive may not have a complete understanding of the reasons back of Council's decision and it was suggested that Mr. Stirling might ask the Junior Section for a statement of the reasons upon which they based the resolution and the decision to send it to Council. With such information in hand the committee would have something specific to answer.

Mr. Vincent stated that in the Quebec Branch there had also been some discussions as to Council's decision with regard to the new organization.

Mr. Muntz explained that at the meeting of the Junior Section in Toronto he had tried to give his views as to why the Canadian Council was not a proper body. At the same time he explained that he thought the members at large did not understand that the Institute was ready to co-operate with other organizations through an agency such as a Committee of Presidents which it had advocated from the beginning. Such a committee would have a much better chance of accomplishing something for the profession because of its ability to work informally and unofficially. Such a committee would not act as a mouthpiece for the entire group nor would it take any action of itself. It would merely co-ordinate the policies of the various bodies. He thought it would be helpful if this statement were reaffirmed so that the Institute's position would be more clearly understood.

Mr. Lindsay referred to the meetings of the Committee of Fourteen which he had attended as president of the Corporation of Professional Engineers of Quebec. He stated that he, too, had tried to direct the Committee of Fourteen's efforts into a Presidents Conference Committee, rather than into a new organization. He had hoped that at that time the Institute would be active in pushing the counter proposition and was disappointed that no such action had followed. He was still of the opinion that the committee type of organization had many advantages and should be given further consideration.

Mr. Lalonde pointed out that this matter had been before Council many times and that Council's position had been clearly indicated over and over again. It had been printed in the minutes and circulated to every councillor, to the chairman of every branch and to the chairman of every committee. He was surprised to hear that so many members do not know about it. He recommended that the Committee on Professional Interests should reiterate its policy, particularly with reference to the Presidents Conference Committee. He thought the proposed co-operative group should be restricted to those organizations made up of professional people. If this were not done there might be some confusion of interests.

The general secretary pointed out that at the last meeting of the Dominion Council a suggestion had been made that the Dominion Council should investigate further the proposal for a conference committee. At the same meeting only three of the provincial associations had voted in favour of the Dominion Council's support of the new Council.

Mr. Peachey emphasized the importance of the subject. He thought the Institute was being criticized for its stand by persons who did not understand the situation. He thought Council should take some action to inform the engineers in order to counteract the criticism. Mr. Muntz supported Mr. Peachey and re-emphasized the desirability of Council reiterating its decision with regard to participation in a Presidents Conference Committee.

Finally it was agreed that Mr. Stirling would communicate immediately with the Toronto Branch, informing them that the matter was being given immediate attention, at the same time making some inquiries along the lines which had been suggested by the discussion.

Proposed Amendment to New Brunswick Agreement—Mr. Stirling reported that he had been in communication with the Association of Professional Engineers of New Brunswick regarding the proposed amendment to the agreement between the Institute and the association, but had not yet had time to receive a reply. He hoped to be able to report on this matter at the next meeting of Council.

Memorandum from the Toronto Branch—Mr. Stirling reported that a copy of the Toronto memorandum presented at the February meeting had been sent to each member of his committee and he hoped to have a report ready for presentation to the next meeting of Council which he understood would be held in Toronto. He suggested that Vice-President Sisson should endeavour to have all Toronto councillors present at that meeting, which Mr. Sisson undertook to do.

Wartime Bureau of Technical Personnel—The general secretary reported that a memorandum had been issued by the Deputy Minister of Labour, dated March 6th, 1946, to the effect that it proposed to discontinue the Wartime Bureau of Technical Personnel on August 1st, 1946. It is understood that the records and work of the Bureau will be transferred to the executive and professional offices of the National Employment Service.

Proposal from Toronto Branch re Salaries—At the last meeting of Council, a resolution from the Toronto Branch regarding the publication in the *Journal* of a scale of salaries had been referred to the Institute's Committee on Employment Conditions. The general secretary reported that the committee is now making a study of all scales to see what can be approved by Council for publication. It is hoped that a report will be available for the next meeting of Council. This was accepted as a progress report and Mr. Sisson undertook to report progress to the Toronto Branch.

Society of Civil Engineers of France—The general secretary presented a translation of a letter from the president of the Society of Civil Engineers of France to the president of the Institute, inviting him to attend a meeting of representatives of engineering societies with whom the French Society was maintaining relations before the war. The meeting will be held in Paris, June 21-22, and will be attended also by chairmen of sections of the Society in France and abroad.

It was pointed out that although President Hayes expected to be in London in September to attend the conference of representatives of Commonwealth engineering societies, it was not likely that he would be there in June. It was noted, however, that Past-President C. J. Mackenzie would be in Europe this summer, and it was unanimously agreed that he be asked to represent the Institute at the meeting in Paris.

Engineers' Council for Professional Development—It was unanimously resolved that Dr. K. M. Cameron be appointed as one of the Institute's three representatives on the Engineers' Council for Professional Development (E.C.P.D.), replacing Dr. C. J. Mackenzie who had found it necessary to resign.

The general secretary reported that he had just returned from the semi-annual meeting of the executive of E.C.P.D. in New York. Dr. C. R. Young, the Institute's representative on the executive, had been unable to attend and had asked Mr. Wright to take his place.

Mr. Wright reported there were several items of importance and briefly touched on those which he thought were of most interest to Council, at the same time explaining that a more detailed account of the business of the meeting would appear in an early number of the *Journal*.

He reported that the executive had approved a proposal from the Ways and Means Committee for the publication of a booklet to commemorate the fifteenth anniversary of E.C.P.D. This booklet, a dummy of which was submitted to the meeting, would trace the beginning of engineering and bring it up to its present status. Graphs would be used in great numbers and the information was being presented in an extremely attractive way so as to have a broad general interest. The book would be basically a piece of propaganda for the profession.

It would also serve as a basis for soliciting subscriptions from individuals and organizations that felt they would like to assist E.C.P.D. in expanding its work.

The Committee on Engineering Schools reported that they proposed to make a resurvey of all curricula just as soon as conditions permitted. It was thought the work would begin this coming fall. $5,500.00 was appropriated from the reserve for this purpose.

The report from Dr. Vaughn's Committee on the Measurement and Guidance project indicated that the committee was continuing to enjoy success in its work and that it was now preparing to expand the tests into sophomore years and into the high schools. An abridgment of the full report has been printed in pamphlet form for wide distribution. A copy will be mailed to each councillor of the Institute.

Considerable time was spent discussing the possibilities of a new co-operative organization made up of the members of all existing engineering societies or of the engineers themselves. Recognition was made of the fact that the Presidents' Joint Conference Committee made up of the presidents, immediate past-presidents and secretaries of the American societies of Civil, Mechanical, Electrical, Mining and Chemical Engineers, has already done quite a bit of work of a preliminary nature on this subject. The Council of E.C.P.D., however, felt that they could make some contribution to the study and set up a committee for the purpose under the name of the Committee on Relations of E.C.P.D. to other Societies.

The general secretary reminded Council that it had been agreed some time ago that the Engineering Institute should invite E.C.P.D. to hold its 1946 annual meeting in Canada. An invitation had been presented to E.C.P.D. and this item was also discussed at the recent executive meeting. It developed that certain other meetings which members of E.C.P.D. committees would wish to attend had already been settled on dates so close to the desired dates for the E.C.P.D. meeting that it would be difficult for them to get from Toronto or Montreal in time for the other meetings. Certain other factors also affected the issue and eventually it was agreed that the meeting would be held in New York on October 18th and 19th, and with the motion was included a statement to the effect that they would ask the Institute to re-issue an invitation for 1947.

"The Profession of Engineering in Canada"—The recommendation of the Finance Committee that 10,000 copies of the present booklet "The Profession of Engineering in Canada" be printed at a cost of $300.00, to be paid for entirely by the Institute if the universities are not able to finance it, was unanimously approved. This quantity is adequate only to meet the immediate demand.

Bank Account in London, England—It was noted that the Institute had opened a bank account with the Canadian Bank of Commerce in London, England, for the purpose of facilitating the payment of fees of members in the United Kingdom.

Joint Committee on Legislation—The general secretary reminded Council that at the March 1945 meeting approval had been given to appointing three representatives of the Institute to sit on a joint committee with a corresponding number of members of the Corporation of Professional Engineers of Quebec to "work with the Corporation throughout the deliberations in determining the future action" with regard to amending the Professional Engineers Act and the appeal of the Brian Perry case. The Institute's representatives selected at that meeting were Messrs. deGaspé Beaubien, R. E. Chadwick and R. L. Weldon.

The general secretary presented a report to Council from the Institute's panel of the joint committee dated March 16th, 1946. The earlier portion of this report consisted largely of quotations from the minutes of the five meetings of the joint committee and concluded with the following paragraph:

"The Institute's panel has had no part in drafting the proposed amendments to the Act, nor has it been consulted or kept adequately informed in regard to them. In consequence of this, it must decline all responsibility and report to Council that it has been unable to fulfil its assignment. It asks that it be dismissed."

Considerable discussion followed in which important parts were taken by Messrs. Beaubien, Poitras, Lalonde and Armstrong. Mr. Beaubien explained that the committee was not criticizing the Corporation for having undertaken to handle the amendments to the Act under their own sole responsibility. He pointed out that the Institute panel had made proposals with regard to the amendments which had not been followed in the draft finally prepared for submission to the legislature, but he recognized that the final responsibility for the amendments rested legally with the Corporation.

Mr. Poitras was of the opinion that the joint committee had been set up primarily to assist in the appeal of the Brian Perry case. He did not agree with that portion of the report which stated that the committee was set up to discuss "ways and means of having legislation prepared for submission to the legislature and of conducting the appeal of the decision of the Architects vs. Brian Perry case." He was of the opinion that it would be unfortunate if the Institute panel withdrew from the committee. He thought the present situation was due to a misunderstanding and he explained the position in which the Corporation found itself in recent negotiations with regard to the proposed amendments, to illustrate the difficulties of keeping the joint committee properly informed. At the same time he reported progress with regard to the appeal and expressed his wish that the Institute panel continue to act. Mr. Beaubien expressed his pleasure at knowing that the committee could be of further assistance and he believed that under those circumstances the Institute's panel would be prepared to continue.

Finally, on the motion of Mr. Eadie, seconded by Mr. Flitton, it was agreed to accept the report of the panel with the omission of the last sentence referring to its dismissal. The panel was to be asked if it would continue in the matter of the appeal in the Brian Perry case.

Students' Conference—The general secretary briefly outlined the Students' Conference which had been held during the recent annual meeting of the Institute. To this conference had been invited the president of each undergraduate engineering society from every engineering degree-granting university in Canada. Certain others as observers were also included. The Institute had borne the entire cost of bringing the delegates from the universities.

The general secretary presented nine resolutions which had been approved by the conference for submission to Council. He reported that these had also been submitted to the Conference of Deans which was held also during the annual meeting. The deans had taken no action on the resolutions as they were directed to the Institute but they had discussed them and the various matters were recorded in the minutes of their meeting. Comments on the resolutions had also been received from Dean Spencer of Saskatoon, and Colonel Grant of Kingston. These were considered by Council as each resolution was discussed.

The resolutions and Council's decisions are recorded as follows:

Resolution No. 1—"That the minutes be edited and that the E.I.C. be requested to take the steps it deems necessary to act upon the suggestions as offered." Noted.

Resolution No. 2—"That a section be reserved in *The Engineering Journal* for the publication of news and technical papers as supplied by the students' societies. And further resolved that all the delegates to this meeting see that within each undergraduate society a committee be set up whose duty it will be to submit news for publication in the section. Be it further resolved that publication of student papers be encouraged."

There was considerable discussion with regard to this proposal and it was observed that it was very much in line with proposals already made by the Publication Committee. The general secretary was of the opinion that the section referred to could be included just as soon as additional finances were available to employ the necessary editorial help. Council agreed with the resolution in principle and referred it to the Publication Committee for consideration and report at an early date.

Resolution No. 3— "That this meeting go on record as favouring the establishment and expansion of the Bennett Memorial Fund to provide financial assistance to deserving student members."

As the committee for the Memorial has already been advised of this resolution Council found no further action necessary.

Resolution No. 4—"That this conference go on record as recommending to the E.I.C. Council that it establish an employment bureau in each of its local branches whose purpose it shall be to prepare lists of positions available for student engineers.

Moreover, that these bureaus assume the responsibility of launching a strong publicity programme to impress on employers the importance of maintaining student engineers in employment during the summer vacations and that these students be not necessarily employed in production work only but that they be given all possible cooperation and opportunities to broaden their knowledge of the industry or plant in which they happen to be employed.

Moreover, that it would be in the best interest of students and their future employers if such employment would take the form of progressive training from summer to summer."

This resolution promoted considerable discussion. It was pointed out that the Institute's usefulness in the field of employment for students might be broadened considerably, particularly if the services of the Wartime Bureau of Technical Personnel are to be discontinued. The Bureau has been furnishing to the students a very complete list of employment opportunities for vacations. It was recognized that this service would be very helpful if the Institute could continue it.

Council was sympathetic to the proposal and asked that the resolution be referred to the Committee on Employment Conditions with the suggestion that it discuss the proposal with the director of the Wartime Bureau of Technical Personnel.

Resolution No. 5—"As all students are assailed by doubts as to their wisdom in their selection of

i a university
ii a course
iii study options

and are also curious to know if their course of instruction compared favourably with that given in other universities:

Be it resolved that a critical survey of all engineering colleges in Canada, conducted by a reputable body, perhaps the group performing this service at the present time in the U.S. under the auspices of the E.C.P.D., would be of real value to students at large and educational authorities in particular.

It might be practical for the E.I.C. to sponsor this survey.

Furthermore, we believe it would be of value to industry and the profession if identical degrees were conferred upon all graduates of similar courses.

Discussion of this resolution revealed that there were wide differences of opinion. Outside authorities were quoted as being opposed to standardization of university courses across Canada. It was thought by some that it was desirable that each university should develop its own character as long as reasonably uniform standards were maintained.

With regard to the accrediting of curricula as carried out by E.C.P.D. in the States it was thought there was nothing the Institute could do about this unless the universities themselves expressed a desire that such accrediting should be conducted. It was pointed out also that one reason why the accrediting was much more necessary in the States than in Canada was that entrance to engineering courses in that country was attained on a basis similar to that described as junior matriculation in Canada, whereas senior matriculation was required for admission to engineering at Canadian universities. This additional year had permitted the universities to raise their standards considerably and to secure a more uniform level of training by entering students.

The general secretary pointed out that accrediting as carried out in the United States was a very expensive operation and that the principal costs were met by the universities themselves. This was further proof of the necessity of the universities desiring such accrediting before any action could be taken by the Institute or any other organization.

Council recognized that in some instances and for particular courses certain universities enjoyed what seemed a more favourable reputation, but a study of conditions indicated that standards were reasonably uniform at all universities and that no student would suffer any handicap in any given course no matter which university he attended.

As far as identical degrees were concerned, Council saw some advantages, inasmuch as the present variations lead to some confusion, but the engineers themselves understand what each degree means and the advantages of having uniform degrees would be largely from the public point of view. Council thought this should be given further discussion by the Conference of Deans.

The resolution has already been placed before the deans of engineering and Council felt that no further action could be taken unless that body supported it.

Resolution No. 6—"That as the engineer is occupying ever increasing responsibilities in industry and in community leadership, his training could better fit him for these responsibilities if university courses included studies in subjects known as the "humanities".

The proportion of the division of study time between technical and non-technical subjects must be left to the discretion of educational authorities, but a balanced training is a commendable goal".

Council agreed that the inclusion of the humanities in an engineering course was desirable but recognized the difficulties of adding any additional work to an already overcrowded course. It recognized, too, that most universities have already included some such subjects in the curriculum. From the Conference of Deans it was learned that each university is studying this subject closely and is prepared to make changes if a place can be found on the curriculum without replacing other subjects of equal importance and without making the course so heavy that its requirements cannot be met.

In view of the close study being given to this subject by the educationalists and the general support which has been given to it by individuals and bodies outside of those circles, Council felt that there was no further action which could be taken except to call the resolution again to the attention of the Conference of Deans.

Resolution No. 7—"That this conference go on record as being in favour of the establishment of technical institutes to train craftsmen and technicians for industry and for small private businesses. Moreover, that these institutes shall require a partial or full high school course as a prerequisite. Such action would not only insure high quality workmanship, but would greatly increase the appreciation by such persons of the engineering profession".

Council was pleased to get the support of the Students' Conference for the establishment of technical institutes, a proposal which had been supported by the Institute ever since the report made to Council by Dean C. R. Young in February 1944. Although very wide support had been secured previously to the proposal, it was interesting for Council to know that the students themselves favoured the establishment of such institutes.

Resolution No. 8—" That the Dominion government should establish a first-rate graduate school of engineering ".

Council regarded this as a proposal requiring more study. There was a difference of opinion as to the possibility of establishing a graduate school under the auspices of the Dominion government in view of the fact that education is a provincial matter. Some suggestions were made as to existing national organizations such as the National Research Council which might sponsor such a post-graduate school.

The general secretary was instructed to examine into the situation further and to discuss the proposal further with the Conference of Deans.

Resolution No. 9—" That encouragement be given to all universities to make their teaching appointments as attractive as possible to outstanding engineers, through facilities for research, consultation, practical work, and increased remuneration, particularly the latter ".

Council agreed wholly with the sentiment of this resolution although at the moment it was unable to inaugurate any activities that would assist in bringing it to pass. It was agreed that the subject should be kept alive and that the Institue should, as opportunities are presented, do everything possible to bring about these ideals.

The general secretary was instructed to report to the delegates to the Students' Conference, Council's pleasure at receiving these resolutions and to assure them of its continuing interest in all the matters proposed. Council also expressed its satisfaction at the outstanding success of the conference and hoped that much good would come out of it, both for the students and for the universities. It would be glad at all times to have these matters brought forward again by the students whenever they had more ideas or proposals to submit.

Conference of Deans: Council was reminded by the general secretary of the Conference of Deans which was held during the course of the annual meeting, at which fifteen were in attendance. Due to the sudden indisposition of Dean Fetherstonhaugh, Dean Young had presided. The conference met in the morning and the afternoon and it had been reported that both sessions had been very profitable. A verbatim had been taken and sent to Dean Young for the preparation of minutes, but up to the present time he had been unable to complete them. When these have been received a more complete report will be made to Council.

The general secretary presented the following resolution which had been passed at the conference and which was now submitted by Dean McKiel under instructions from the conference:

> " THAT this meeting of deans and teachers of engineering expresses the willingness of its members to participate in a study of engineering curricula and engineering education in general.
>
> It further suggests that any such study should be cooperated in by all interested bodies, as, for example, the universities and schools of engineering, The Engineering Institute of Canada, the Canadian Institute of Mining ad Metallurgy, the Canadian Institute of Chemistry, the Dominion Council of Professional Engineers and the various provincial professional organizations ".

A copy of a letter from Dean Young to Dean McKiel, in reply to his receipt of this resolution, was also presented. In this Dean Young expressed the opinion that the best plan for conducting a study of engineering education would be through the National Conference of Canadian Universities. That conference, he suggested, might set up a committee composed of persons who are experienced in engineering education, with a general instruction to study and report on broad policies. He suggested that in due course professional organizations should be brought into the picture with any comments or suggestions which they might wish to make. He emphasized the need of professionals in the field of education giving this subject prime consideration.

A copy of a letter which Dean Fetherstonhaugh had written to Dean McKiel was also presented and it was noted that he gave very firm support to the alternative proposals as submitted by Dean Young.

A copy of a letter from Dean Spencer to Dean McKiel was also submitted and it was noted that he, too, had alternative suggestions to make.

A telegram was presented from the president in which he agreed that if other organizations were to participate in this study of education, the Institute, too, should give thorough support.

In the discussion, general support was given to the policy as outlined by Dean Young. Mr. Poitras explained that in his opinion the Canadian Institute of Mining and Metallurgy, the Chemical Institute of Canada, the Dominion Council and the Engineering Institute should be invited to participate with the universities.

Finally, it was moved by Mr. Stirling and seconded by Mr. Vincent, that the Institute express its ready willingness to support the deans in whatever way they thought the most help could be rendered. Any time such a Conference of Deans desires assistance from the Engineering Institute, Council would be very glad to see that it is given wholeheartedly, but at the moment it supported the suggestion that the educationalists themselves should investigate the situation before consulting engineers in other fields.

Quebec Agreement: On the motion of Mr. Eadie, seconded by Mr. Poitras, it was unanimously resolved that the privileges available under the terms of the co-operative agreement between the Institute and the Corporation of Professional Engineers of Quebec should be granted to members of either body now returning from overseas and being reinstated on the active membership list, provided that application for membership in the other body is made within ninety days of such reinstatement.

Joint Finance Committee in Nova Scotia: On the motion of Mr. Beaubien, seconded by Mr. Flitton, it was unanimously resolved that Messrs. P. A. Lovett and S. G. Naish be appointed as the Institute's representatives on the joint finance committee in Nova Scotia.

Association Representatives on Council; The appointment of the following association representatives on the Institute Council for the year 1946 was noted and approved unanimously: Nova Scotia—S. W. Gray. New Brunswick—E. O. Turner.

James Watt International Medal: On the motion of Mr. Eadie, seconded by Mr. Stirling, it was unanimously resolved that Major-General A. E. Macrae, O.B.E., M.I. Mech. E., Assoc. Inst. C.E., be nominated by the Institute for the 1946 award of the James Watt International Medal.

Councillor for Kootenay Branch: On the recommendation of the Kootenay Branch it was unanimously resolved that S. C. Montgomery be appointed as councillor for the branch for the year 1946.

ELECTIONS AND TRANSFERS

A number of applications were considered, and the following elections and transfers were effected:

Members

Baker, Lorne Pearce, B.A.Sc. (Mech.), (Univ. of Toronto), Asst. Trade and Industrial Commissioner, Ontario House, 13 Charles II St., London, S.W.1, England.

Bird, David Ardah Godfrey, Graduate (Royal Military Coll.), 7 Powell Ave., Toronto, Ont.

Griffiths, Garth, Major, R.C.E.M.E., B.A.Sc. (Elect.), (Univ. of British Columbia), 1976 W. 15th Ave., Vancouver, B.C.

Jankowski, Jerzy W., Mech. Engr. (Politechnika, Warsaw, Poland), mech. designing engr., Hamilton Bridge Co., Hamilton, Ont.

Martin, Gerald Albert Bray, B.Sc. (Elect.), (Univ. of Manitoba), service and instrument engr., i c service dept., Victor X-Ray Corp. Canada Ltd., Winnipeg, Man.

Mason, Ernest (Manchester Coll. Technology), chief designing engr., Consolidated Mining & Smelting Co., Trail, B.C.
Plow, Gordon Locklin Patrick, B.Sc. (Civil), (McGill Univ.), divn. engr., Canadian National Railways, Ottawa, Ont.
Smith, Paul Dorrian, B.A.Sc. (Univ. of British Columbia), engr., Canadian Westinghouse Co., Ltd., Hamilton, Ont.
Suttie, Earle Ritchie, Brigadier, D.S.O., Graduate (Royal Military Coll.), Canadian Army Overseas.
Walkinshaw, William Maxwell, B.A.Sc. (Civil), (Univ. of Toronto), engr. on staff, Sir Alex. Gibb & Partners, London, Eng.
Walton, Ernest Norman, B.Sc. (Elect.), (Univ. of British Columbia), foreman, Phillips Electrical Works, Ltd., Montreal, Que.
Wintermark, Charles Roar, Mech. Engr. (Univ. of Mittweida, Saxony, Germany), mech. engr. and dftsman., Robert Mitchell Co., Montreal, Que.

Juniors

Dalrymple, James Ross, B.A.Sc. (Mech.), (Univ. of Toronto), staff engr., engrg. dept., Dominion Foundries & Steel Co., Hamilton, Ont.
Hawkins, Currie, Elect. Artificer, R.C.N.V.R., 4285 Dorchester St. W., Montreal, Que.
Holmes, Thomas Frederick, B.A.Sc. (Mech.), (Univ. of Toronto), 235 Charlotte St., Ottawa, Ont.
Leigh, Ernest Douglas, sales engr., Amalgamated Electric Corp., Montreal, Que.
Montgomery, Edward Wilford, B.Eng. (Metall.), (McGill Univ.), engr., development and engrg. dept., Canadian Liquid Air Co., Ltd., Montreal, Que.
Schuett, George Herbert, B.Sc. (Civil), (Queen's Univ.), engr., Anglin-Norcross Quebec Ltd., Montreal.

Transferred from the class of Student to that of Member

Balcom, Alfred Burpee, B.Eng. (McGill Univ.), 59 Maple Ave. Shawinigan Falls, Que.
Henselwood, Edward Wilton, Lt.-Col., R.C.E., B.Sc. (Elect.), (Univ. of Manitoba), Q.M.G. Branch, N.D.H.Q., Ottawa, Ont.
Phomin, Barney Louis, Lt., R.C.E., B.Sc. (Civil), (Univ. of Manitoba), 426 Burrows Ave., Winnipeg, Man.
Topham, William Richard, B.Eng. (Civil), (Univ. of Saskatchewan), asst. works engr. i/c plant construction, Canadian Industries Ltd., McMasterville, Que.
Woolsey, Edgar Garnet, B.Sc. (Civil), (Queen's Univ.), 160 Bay St., Ottawa, Ont.

Transferred from the class of Student to that of Junior

Ball, William Henry Warren, B.Eng. (Elect.), (Nova Scotia Technical Coll.), post-graduate course, Univ. of Toronto, Toronto 5, Ont.
MacCoy, Gerald Bates, B.Sc. (Mech.), (Univ. of Saskatchewan), designing dftsman., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.
Rigsby, David Lorren, B.Sc. (Mech.), (Queen's Univ.), engrg. expeditor and co-ordinator, Aluminum Co. of Canada, Kingston, Ont.
Tulk, Egbert Gordon, B.Eng. (Elect.), (Nova Scotia Tech. Coll.), 261 Gerrard St. East, Toronto 2, Ont.

Admitted as Students

Chizen, Martin, B.Sc. (Elect.), (Univ. of Alberta), Inspection Board of U.K. and Canada, Peterborough, Ont.
Clark, Chester Graham, B.Sc. (Elect.), (Univ. of Alberta), test course, Canadian General Electric, Peterborough, Ont.
Creelman, Elliott Arthur, B.A.Sc. (Univ. of British Columbia), test course, Canadian General Electric, Peterborough, Ont.
Ellis, Harry M., B.A.Sc. (Elect.), (Univ. of British Columbia), test course, Canadian General Electric, Peterborough, Ont.
Mosher, Allison Frederick, B.A.Sc. (Elect.), (Univ. of British Columbia), student, University of Western Ontario, London, Ont.
O'Brien, Michael Joseph, B.A.Sc. (Mech.), (Univ. of Toronto), test course, Canadian General Electric, Peterborough, Ont.
Roos, Albert Edward, B.A.Sc. (Univ. of British Columbia), test course, Canadian General Electric, Peterborough, Ont.
Stevinson, Arthur Lawrence, B.Sc. (Elect.), (Univ. of Alberta), test course, Canadian General Electric, Peterborough, Ont.

Students at University of British Columbia

Baker, F. B.	Harbell, J. L.	Nicholson, W. V.
Bartlet, A. W.	Horton, J. W., Jr.	Parnum, E.
Bateman, W. A.	Howlett, S. B.	Phare, G. R.
Bird, J. McI.	Hudak, N.	Pillman, R. A.
Broe, K. L.	Josephson, G. M.	Quirk, E. T.
Chutter, P. W.	Kenny, W. E.	Slaney, F. F.
Edwards, O. C.	Kerr, R. G.	Tinney, E. R.
Fisher, R. E.	Latimer, N. H.	Wales, D.
Fletcher, A. G.	Lyle, W. E.	Warrender, A. C.
Gallon, A. V.	Moore, W. J. M.	Wong, J. K.

Students at University of Alberta

Allman, R. J.	Ferguson, R. McC.	Mather, G. R.
Berry, A. L.	Hauptman, S. J.	McClary, R. E.
Black, F.	Hochhausen, E.	Nyberg, C.
Clow, J. A.	Herzog, G. W.	Proudfoot, R. G.
Cowley, W. H.	Jones, W. S.	Sissons, T. A.
De Launay, L. H. W.	Kittlitz, R. S.	Smith, E. M.
Downie, G. W.	Linney, J. A.	Spencer, J. G.
		Yachimec, P.

Students at University of Manitoba

Bergman, P. R.	Grahame, F. B.	Rankine, D. F.
Blackman, L. W.	McCaw, A.	Schmidt, C. O. J.
Ellis, W. E.	McClelland, J. I.	Spector, M. N.
Howard, L. H.	McRae, D.	Sullivan, T. E.
Hughes, F.	Morris, A. G.	Wightman, B. A.
Goor, J. H.		

Students at University of Toronto

Allan, M. B.	Hansen, R. J.	Palframan, J. W.
Bald, K.	Higgins, T. G.	Phelan, T. M.
Bitondo, D.	Horner, G. I.	Price, D. A.
Blair, D.	Hurley, R. P. J.	Renouf, E. R.
Boivin, P. P. J.	Jackson, H. A.	Ridler, A. A., Jr.
Bowyer, J. E.	Jackson, J. H.	Rose, L. B.
Buchanan, N. R.	Kahn, F. L.	Rosenthal, G.
Campbell, W. A.	Kozak, S.	Saba, R. N.
Cleverdon, R. K.	Lindsey, A. S.	Sabiston, M. R.
Colotelo, J.	Litchfield, R. D.	Shamess, A. C.
Connell, J. R.	Little, J. F.	Smith, E. I.
Davidson, M. R.	Lye, G. R. K.	Spicer, B. W.
Drohan, J. F.	Markow, G. R.	Stein, M. A.
Eckersley, R. A.	Marion, J. A. D.	Stevens, P. D.
Evans, G.	Massie, J. H. C.	Stock, L. W.
Finley, W. C.	McAulay, D. R.	Sutton, E. E.
Fowler, C. A.	McCracken, T. A.	Thompson, E. J.
Fredenburg, W.	Miller, E. P.	Traill, W. A.
Glenn, D. J.	Milne, H. C.	Urquhart, R. R.
Grant, W. J.	Moore, J. R.	Young, W. B.
Hanham, D. E.	Mosher, R. D.	

Students at McGill University

Arnold, W. B.	Gourdeau, G.	Raymond, J. D.
Beer, W. G.	Griffin, G. J.	Rogers, P. F.
Bilodeau, L. J.	Howard, D. W.	Row, R. V.
Bishop, J. M., Jr.	Hurd, W. H.	Salzman, O.
Bornett, K.	Lawrence, K. A.	Scarabelli, R. J.
Bourke, G. M.	Mann, I. D.	Selchen, Z.
Dargis, R.	McLimont, D. W.	Stephen, R. G.
Dow, G. E.	McVicar, D. A.	Stubbs, J. C.
Drake, E. A.	Mooney, D. R.	Tansey, P. J.
Finch, J. C.	Mustill, L. G.	Tilden, S. F.
Godin, H. F.	Normand, J. J.	Towuson, A.
Goode, J. D.	Nunes, F.	Wright, J. H.
	Picard, M. A.	

Students at Queen's University

Aksim, V. E.	Fuller, R. W.	Mitchell, K. M.
Anderson, W. R.	Greenlees, A. A.	Miura, J. H.
Angus, L. M.	Greenlees, T. C.	Nobes, W. D.
Atkinson, D. M.	Gosh, E.	Paavila, H. D.
Balkwill, J. K.	Haughton, R. N. E.	Patterson, R. A.
Bialik, G. J. M.	Haycraft, A. F.	Purser, R. B.
Bigham, R. H.	Hayhurst, W. L.	Ramsay, D. A.
Bingeman, J. B.	Hebert, J. C.	Searle, C.
Burgoon, W. O.	Hector, G. I.	Shapiro, S. L.
Burks, W. G.	Herisch, P. A.	Smith, J. C.
Bradley, B. R.	Hopkins, A. B.	Smith, W. C.
Cahn, A.	Kane, J. J.	Throop, R. S.
Campbell, W. M.	Kean, E. F.	Turner, M.
Catchpole, G. M.	Keyser, G. M.	Twiss, J. E.
Chalmers, H. M.	Lachance, K. E.	Wagener, L. R.
Chwedchuk, L.	Lund, C. N.	Whyte, G. N.
Cottee, J. F.	Lyall, D. M.	Whyte, J. S.
Dumoulin, J. R.	McCaffrey, B. I.	Wilson, R. G.
Fee, A. E.	McKelvie, J. L.	Wright, J. R.
Finch, W. H.	Miller, I. B.	

Students at Nova Scotia Technical College

Beck, R. V.	Dooley, W. K.	MacKay, F. R.
Blanchard, M. E.	Noel, A. C.	Skinner, C. M.
Crowdis, L. G.		

Students at University of New Brunswick

Carter, C. D.	Fytche, E. L.	Mersereau, M. E.
Dalton, J. R.	Jennings, R. E.	Stevens, A. M.
Day, H. N.	Mackin, G. F.	

Students at Mount Allison University

Gilmore, J.	Parks, D. S.	Snook, W. A. G.
Mullins, R. L.		

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

Alberta

Members

Barchard, Francis Maurice, B.A.Sc. (Univ. of British Columbia), chief engr., Northwest Industries Ltd., Edmonton, Alberta.
Kelly, Oliver G., B.Sc. (Oregon State Coll.), airway engr., Civil Aviation, Dept. of Transport, Edmonton, Alta.

Junior

Bath, Duncan Thomas, B.Sc. (Elect.), (Univ. of Alberta), sessional instructor, Dept. of Electrical Engrg., Univ. of Alberta, Edmonton, Alta.

Cormick, Harold Leslie, B.Sc. (Elect.), (Univ. of Alberta), sessional instructor, Dept. of Electrical Engrg., Univ. of Alberta, Edmonton, Alta.

Stothert, Winston Dunderdale, B.Sc. (Elect.), (Univ. of Alberta), elect. inspector, c/o Old Court House Bldg., Calgary, Alta.

Weeks, John Gordon, B.Sc. (Elect.) (Univ. of Alberta), sessional instructor in physics, Univ. of Alberta, Edmonton, Alta.

Junior to Member

McPherson, Frederick, B.S. (Civil), (Univ. of Alberta), instructor in civil engrg., Univ. of Alberta, Edmonton, Alta.

SASKATCHEWAN

Members

Downing, Charles Glenn Eldrick, B.Eng. (Agricultural—, (Univ. of Saskatchewan), Captain in R.C.E.M.E., Swift Current, Sask.

Hawley, Karl Tomkins, B.Sc. (Elect.), (Univ. of Manitoba), engr., engrg. dept., Saskatchewan Government Telephones, Regina, Sask.

Michalenko, Andrew, B.Sc. (Elect.), (Univ. of Manitoba), asst. professor, elect. engrg., Univ. of Saskatchewan, Saskatoon, Sask.

Milne, George Gordon, B.A.Sc. (Elect.), (Univ. of Toronto), specialist and educational engr., Saskatchewan Government Telephones, Regina, Sask.

Randlesome, Hugh Goffen, chief engr., Dept. of Reconstruction and Rehabilitation, Regina, Sask.

Students at University of Saskatchewan

Anderson, William James, 816 Avenue C North, Saskatoon, Sask.

Brehler, Robert John, 1718, 22nd St. W., Saskatoon, Sask.

Carpenter, Edwin Robert, St. Andrew's College, Saskatoon, Sask.

Harvey, Roger James, 508 Main St., Saskatoon, Sask.

Petuk, George, Qu'Appelle Hall, Univ. of Saskatchewan, Saskatoon, Sask.

Pierce, Mervin Booth, 1012 Melrose Ave., Saskatoon, Sask.

Smith, Elvie Lawrence, 605 Temperance St., Saskatoon, Sask.

Walker, Lyle James, 100-31st Street, Saskatoon, Sask.

Ward, Lyle Chester, 412-5th Street, Saskatoon, Sask.

Student to Junior

Chan, Lloyd George, B.Sc. (Civil), (Univ. of Saskatchewan), jr. engr., soil mechanics, Univ. of Saskatchewan, Saskatoon.

Humphrey, Kenneth Floyd, B.Sc. (Ceramic Engrg.), c/o Ceramic Dept., Univ. of Saskatchewan, Saskatoon, Sask.

Iverson, Norman Leif, B.Sc. (Civil), (Univ. of Saskatchewan), jr. engr., P.F.R.A., Soil Mechanics Lab., Univ. of Saskatchewan, Saskatoon, Sask.

Jacoby, Max George (Univ. of Saskatchewan), resident engr., Dept. of Highways, Regina, Sask.

Kaltio, Willard, B.Sc. (Mech.), (Univ. of Saskatchewan), Lieut., R.C.E.M.E., Esquimalt, B.C.

McLeod, George Carrol, B.Sc. (Civil), (Univ. of Saskatchewan), design and field engr., C. D. Howe Co., Ltd., Port Arthur, Ont.

Olafson, Ellaf Arni, B.Sc. (Agricultural), (Univ. of Saskatchewan), Agricultural Engrg. Dept., Univ. of Saskatchewan, Saskatoon, Sask.

NOVA SCOTIA

Members

Ahern, Phillip Charles, B.Sc. (Elect.), (McGill Univ.), District Engr. Officer, Canadian Army, Halifax, N.S.

Bedwin, Tegler West, B.Eng. (Nova Scotia Tech. Coll.), sales engr., Building Products Ltd., Montreal; Truro, N.S.

Cooper, Douglas LeBaron Peters, M.Sc., Ph.D. (Dalhousie & McGill Univ.), Director of Fisheries, Province of Nova Scotia.

Frost, Louis (Herriot-Watt Coll.), asst. mining engr., Dominion Coal Co., Ltd., Sydney, N.S.

Grisdale, Simpson Vipond, B.Eng. (Elect.), (McGill Univ.), ind. and central stn. engr., Canadian General Electric, Halifax, N.S.

Kline, Donald Robert, B.Eng. (Mining), (Nova Scotia Tech. Coll.), explosion damage appraiser, Halifax Explosion Claims Office. Halifax, N.S.

Smedley, Hubert, B.Sc. (Queen's Univ.), mill supt., Malagash Salt Co., Ltd., Malagash, N.S.

Somers, John Stephen, B.Sc. (Mech.), (Nova Scotia Tech. Coll.), engr. supt., Foundation Maritime Ltd., Halifax, N.S.

Stuewe, William L. (Montana School of Mines), asst. engr., constrn., Dosco; mech. supt. of coal mines, Dominion Steel & Coal Corp., Ltd., Sydney, N.S.

Junior to Member

Stanfield, Gordon Dawson, B.Eng. (Mech.), (McGill Univ.), Starr Mfg. Co. (owner), Dartmouth, N.S.

QUEBEC

Members

Portugais, J. Maurice, B.A.Sc., C.E. (Ecole Polytechnique), managing-director, Delorimier Construction Ltd., Montreal, Que.

Thibodeau, Henri Roger, B.A.Sc., C.E. (Ecole Polytechnique), Captain, R.C.E. (awaiting discharge), Montreal, Que.

Personals

Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.

News of the Personal Activities of members of the Institute

Major-General H. F. G. Letson, M.E.I.C., was recently appointed secretary and comptroller of the household of the Governor-General of Canada. Born at Vancouver, B.C., he served in France in World War I with the 54th Battalion, C.E.F. He was severely wounded and was awarded the Military Cross.

General Letson graduated from the University of British Columbia with a B.Sc. in mechanical engineering in 1919. Four years later he was granted the degree of Ph.D. in engineering by the University of London, England, and was appointed assistant professor of mechanical engineering at the University of British Columbia. In 1931 he became associate professor in the department, a position which he retained until 1934. At that time he became chief engineer and managing director of Letson and Burpee, Vancouver.

In 1941 General Letson was appointed Canadian Military Attaché in Washington, the first military attaché to be appointed by Canada to the United States. In the following year he returned to Canada to become Adjutant General in the Department of National Defence Headquarters at Ottawa, Ont. In 1944 he was appointed commander of the Canadian Army Staff at Washington and chairman of the Canadian Joint Staff, Washington. In the same year he was awarded the United States Legion of Merit Medal and was designated as Commander of the Legion of Merit.

Einar Arnason, M.E.I.C., has been retired from the army with the rank of lieutenant-colonel. He enlisted in September 1939, and served five years overseas, finishing as commanding officer of Number 4 Wing, Canadian School of Infantry. He is now employed by Power and Mine Supply Company Limited in Winnipeg.

R. C. Pybus, M.E.I.C., has been elected chairman of the Vancouver Branch. Born at Winnipeg, Man., he graduated from the University of Manitoba with a B.Sc. in civil engineering in 1922. Two years later he obtained the degree of Bachelor of Architecture. After graduation he worked for a year with the Foundation Company of Canada in Montreal. In 1925 he joined the staff of Carter-Halls-Aldinger Company, general contractors and engineers, as assistant engineer in the Winnipeg office. Three years later he was transferred by the company to the Vancouver office with the appointment of engineer for British Columbia. In March 1945 he became associated with the Commonwealth Construction Company Limited, Vancouver.

Mr. Pybus joined the Institute as a Student in 1920, transferring to Junior in 1923, and to Associate Member in 1930. He became a Member in 1940.

E. A. Goodwin, M.E.I.C., has returned to his former position with the Montreal Engineering Company in Montreal. He was serving as lieutenant (E) stationed in Ottawa at the Department of National Defence, Naval Service.

Colonel C. B. R. Macdonald, M.E.I.C., has resigned his position as comptroller for development and welfare for the British West Indies. He has accepted the position of resident director in Venezuela for the English firm of engineers and contractors, Messrs. A. Monk & Co. Limited.

Elizabeth MacGill Soulsby, M.E.I.C., who attended recent PICAO meetings in Montreal as a technical adviser is the first woman to do so, thus adding another triumph to the long string of distinguished "firsts" which characterize her career. Mrs. Soulsby was the first woman in the world to receive a master's degree in aeronautical engineering, the first woman on the continent to become chief aeronautical engineer with any company, and the first to design, build and test her own aeroplane.

W. D. Adams, M.E.I.C.

W. D. Adams, M.E.I.C., is the newly elected chairman of the Sault Ste. Marie Branch of the Institute. Born at Saint John, N.B., he graduated from the Royal Military College, Kingston, Ont., in 1908. He was employed first with the Grand Trunk Railway as assistant engineer and later was in charge of the engineering department of the Canadian Buffalo Forge Company, Montreal. Before going overseas to serve in World War I, he worked in the railway and bridge section of the Department of Works of the City of Toronto. On demobilization he became a partner with Adams Brothers of Toronto, later joining the staff of the Toronto Transportation Commission in 1921. He subsequently was associated with Walter J. Francis and Company of Montreal and with A. Bentley & Sons, contractors, at Toledo, Ohio, returning to Toronto in 1925 as resident engineer with Toronto Waterfront Viaduct. He was later employed by Electric Tamper and Equipment Co. of Canada, Montreal and as Toronto manager of the Montreal firm of H. E. McKeen and Co. Limited. He is at present with the Algoma Steel Company of Canada.

Mr. Adams joined the Institute as a Student in 1908, transferring to Junior in 1912, to Associate Member in 1922 and to Member in 1936.

Lieutenant-Colonel C. R. McCort, M.E.I.C., former assistant quartermaster-general and assistant director of works and construction at National Defence Headquarters, is retiring from the Canadian Army. For the past seven months he has been special assistant to the Deputy Minister of Veterans' Affairs, on loan from the army. He served overseas for three years with the Canadian Forestry Corps, and is returning to his pre-war position as manager of development and construction with the Ontario Paper Company, Limited, at Thorold, Ont.

F. J. Ryder, M.E.I.C., has been elected chairman of the Border Cities Branch. Born at Holyoke, Mass., he graduated from McGill University in civil engineering in 1929. After graduation he was employed with Motor Products Corporation, Walkerville, and later with Taylor and Gaskin, Detroit. In 1938 he accepted the position of sales engineer with the Canadian Bridge Company in Toronto and in 1943 was transferred to Walkerville in the same capacity. In 1945 he was transferred from sales engineer in the estimating department to the position of assistant superintendent of Plant One.

Mr. Ryder joined the Institute as a Student in 1928, transferring to Junior in 1935, and to Member in 1942. He served as secretary-treasurer of the Border Cities Branch in 1945.

John Gilchrist, M.E.I.C., has now retired from the R.C.A.F. with which he served overseas in the capacity of chief technical officer at a Bomber Command station, with the rank of squadron leader. He is at present establishing his own business as a manufacturer's representative in Montreal.

Dr. G. R. Lord, M.E.I.C.

Dr. G. Ross Lord, M.E.I.C., associate professor of mechanical engineering at the University of Toronto, has been elected by acclamation as president of the Association of Professional Engineers of the Province of Ontario. He has been actively connected with the affairs of the Association for several years, serving as a member of the council, representing the mechanical branch, in 1942, 1943 and 1944 and as vice-president in 1945. He has also served on several committees, including the executive, finance, membership and publicity committees.

Born in Peterborough, Ont., he graduated from the Faculty of Applied Science and Engineering of the University of Toronto in 1929 with the degree of B.A.Sc. In 1932 he was granted the M.Sc. degree from the Massachusetts Institute of Technology. In 1932-33 he was named as Freeman Scholar, sent to Germany by the American Society of Mechanical Engineers, where he studied at engineering colleges in Berlin, Munich and Karlsruhe. In 1934 he returned to his *alma mater* as lecturer in hydraulics and later received successive promotions. He was awarded the Ph.D. degree from the University of Toronto in 1939 for his original research on cavitation in hydraulic turbines.

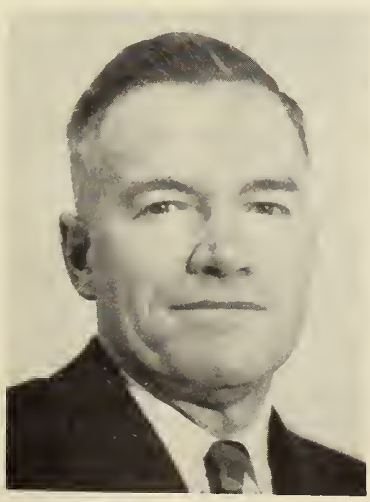
J. H. Irvine, M.E.I.C., office and designing engineer of the City of Ottawa, Ont., is the newly elected chairman of the Ottawa Branch. Born at Nile, Ont., he graduated in civil engineering from the University of Manitoba in 1912. After extensive experience in general construction work he was appointed representative of the Dominion Reinforcing Company Limited at Toronto in 1928. In 1932 he entered the city engineer's department at Ottawa, Ont.

Mr. Irvine joined the Institute as a Student in 1911, transferring to Associate Member in 1917. He became a Member in 1940.

J. H. Johnson, M.E.I.C., has been elected chairman of the London Branch. Born at Waverly, N.Y., he graduated in mechanical engineering from Syracuse University in 1915. For two years after graduation he was employed in the engineering department of The Merell Soule Company, manufacturers of milk products. During World War I he held the rank of captain and adjutant of the 37 Art., Coast Artillery. In 1920 he came to Canada as chief engineer of The Canadian Milk Products Company Limited and assisted in starting Klim powdered milk production in five of the company's plants. In 1928 the Canadian Milk Products Company was taken over by The Borden Company Limited and he became chief engineer of the manufactured milk products division of The Borden Company Limited. Since that time he has been in charge of the installation, operation and maintenance of plants from Phoenix, Arizona, to Richmond, Vermont. In 1934 he returned to Canada to assume added responsibility in the Canadian division of The Borden Company.

Mr. Johnson joined the Institute as a Member in 1937.

F. J. Ryder, M.E.I.C.



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

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

Photo Le Nouvelliste

F. X. T. Berlinguet, M.E.I.C., is shown in the above photograph, working as usual on his 91st birthday, March 15th last. Born in Quebec City, he studied civil engineering and land surveying at Laval University and was connected for a number of years with the development of the harbours at Quebec and Trois-Rivières. He retired from the Department of Public Works of Canada after 46 years of service with the government. Since then, he has been actively engaged in private practice at Trois-Rivières.

Mr. Berlinguet joined the Institute as an Associate Member upon its foundation as the Canadian Society of Civil Engineers, on February 24, 1887, and was transferred to Member in 1890. He became a Life Member in 1931. He enters upon his seventieth year of professional practice with the best wishes of all members of the Institute.

A. L. Tregillus, M.E.I.C., is at present employed by the Ministry of Health, British Government, on the National Housing Scheme. He will remain in England for some time.

A. L. Denton, M.E.I.C., has been released from the R.C.A.F. in which he served as flying officer. He is now with the Department of Lands and Mines of New Brunswick as a land surveyor in Fredericton, N.B.

H. J. Racey, M.E.I.C., has accepted the position of general manager of Cresswell Roll Forming Company Limited and its subsidiary Cresswell-Pomeroy Limited at Montreal, Que. The former company is engaged in the manufacture of cold rolled form shapes for building and other industries and the latter in the installation of window accessories and other building specialties.

A graduate of Queen's University in civil engineering, Mr. Racey spent eight years with Shawinigan Engineering Co. Ltd., on estimating, design and construction of hydro-electric power development work. Following two years in the export and manufacturing business on his own account he joined the staff of Crane Limited in industrial engineering work. Three years later he became employed by the Brown Corporation at La Tuque, Que., in the manufacture of bleached sulphate pulp, first as assistant chief engineer in charge of plant maintenance and construction work. In 1943 he was appointed assistant to the works manager taking charge of industrial and public relations work. At the end of 1944 he was appointed acting superintendent from which position he resigned to accept his present appointment.

Eric Grant, M.E.I.C., has been discharged from the R.C.A.F. with which he served with the rank of flight sergeant attached to Northwest Air Command at Edmonton, Alta. He is now with the gas distribution department of the Quebec Hydro-Electric Commission in Montreal as senior draughtsman. Prior to his enlistment Mr. Grant was on the engineering staff of the Canadian National Railway Company in Montreal.

A. R. Hannaford, M.E.I.C., building commissioner of the City of Hamilton, Ont., has been elected chairman of the Hamilton Branch. Born at Derby, England, he came to Canada in 1910 when he joined the engineering staff of the Grand Trunk Railway. He continued on various works with the railway until 1921 when he accepted the position of office and designing engineer with the city engineer's department at Hamilton, Ont. In 1944 he was appointed to the position he now holds.

Mr. Hannaford joined the Institute as an Associate Member in 1920, becoming a Member in 1940. He was secretary of the Hamilton Branch and served on the executive for several years.

Victor Michie, M.E.I.C., of War Assets Corporation, has been transferred from Montreal to Ottawa, Ont.

Murray A. Stewart, M.E.I.C., formerly principal assistant engineer in the Toronto Department of Works, has been promoted to the position of deputy city engineer. Born in Hamilton, Ont., he graduated from the University of Toronto in civil engineering in 1905. Since that time he has been continuously in the service of the city. From 1905 until 1910 he was draughtsman and assistant engineer in the Roadway Section of the Department of Works, in the latter year being appointed engineer in charge of the Roadway Section.

He was promoted in 1929 to the position of principal assistant engineer in the Department of Works, which position he held until his recent promotion.

Jacques Tétreault, M.E.I.C., formerly with the firm of German & Milne, naval architects, Montreal, is now associated with Marine Industries Limited, at Sorel, Que.

Brian R. Perry, M.E.I.C., Montreal consulting engineer, has been named a member of the board of trustees of the Woman's General Hospital, Montreal. Mr. Perry was elected councillor for the Montreal Branch of the Institute in 1939, after serving as chairman of the branch the previous year. Since 1925 he has been engaged in private practice as consulting engineer.

G. A. Campbell, M.E.I.C., is now with Quebec North Shore Paper Company Limited at Baie Comeau, Que. He served as a lieutenant in the Royal Canadian Engineers. He graduated in engineering at the University of New Brunswick in 1938, receiving his master's degree in civil engineering from that university in 1944.

F. E. Estlin, M.E.I.C. is the newly elected chairman of the Saskatchewan Branch. Born in Melita, Man., he graduated from the University of Manitoba with a B.Sc. (E.E.) in 1925. On graduation he joined the Canadian General Electric Company at Peterborough, Ont., being transferred the following year to Winnipeg as industrial control specialist. In 1932 he moved to Regina, Sask., as sales engineer with the company.

Mr. Estlin joined the Institute as an Associate Member in 1938, becoming a Member in 1940. He is also president of the Association of Professional Engineers of Saskatchewan.

F. E. Estlin, M.E.I.C.

C. D. Martin, M.E.I.C.

C. D. Martin, M.E.I.C., is the new chairman of the Halifax Branch. Born at Amherst, N.S., he graduated in electrical engineering from the Nova Scotia Technical College in 1938. On graduation he entered the services of the Halifax branch of the Northern Electric Company Limited and has remained with the company since that time.

Mr. Martin joined the Institute as a Student in 1938, transferring to Junior in 1941, and to Member in the same year.

T. Linsey Crossley, M.E.I.C., is resuming his work as consultant in paper technology in Toronto, Ont. He was with the deSalaberry Works of Defence Industries Limited at Nitro, Que., for the past five years until the recent closing of the department.

E. H. Davis, M.E.I.C., has entered into partnership with H. A. Ripley, M.E.I.C., to form the firm of Davis, Ripley and Associates, consulting engineers, in Calgary, Alta. Mr. Davis has been released from the R.C.N.V.R. in which he served as lieutenant (E).

D. B. Barry, M.E.I.C., has been released from the Navy, after overseas service as lieutenant with the Fleet Air Arm. He has accepted a position with Trans-Canada Air Lines on the engineering staff at Dorval Airport, Que.

E. Cowan, M.E.I.C., has established his private practice in Montreal, Que., as a consulting engineer to the paper industry.

Fernand Dugal, M.E.I.C., is now associated with the American Locomotive Company at Schenectady, N.Y. He was formerly employed as shop engineer, tank arsenal, Montreal Locomotive Works, Montreal.

Wm. Arsenault, M.E.I.C., is now employed as town engineer at Springhill, N.S. He was formerly assistant maintenance engineer with Imperial Oil Limited at Dartmouth, N.S.

D. H. Evers, Jr.E.I.C., is now registered at McGill University in engineering and is studying at Dawson College, St. Johns, Que. He served as major in the R.C.E. with 1 Canadian Division overseas.

W. E. Ohrner, Jr.E.I.C., has accepted a position on the engineering staff of the Hydro-Electric Power Commission of Ontario. A graduate of the University of Manitoba in electrical engineering in 1943, he served for some time in the R.C.N.V.R.

A. W. Bridgewater, Jr.E.I.C., who served overseas as a captain with 1 Canadian H.Q. Army Group Engineers, has accepted a position with the engineering department of the Canadian Pacific Railway Company in Montreal. Prior to his enlistment, Mr. Bridgewater was employed as structural designer for Canadian Industries Limited in Montreal.

H. M. Coverdale, Jr.E.I.C., has accepted a position in the engineering department of Trans-Canada Air Lines at Dorval airport. He graduated in mechanical engineering from the University of British Columbia in 1943, and enlisted immediately in the Royal Canadian Navy, with which he served overseas in the Air Branch.

Percy Codd, Jr.E.I.C., who served in the R.C.A.F. overseas (aircrew) has been discharged with the rank of flying officer. He has joined the staff of the Canadian Carborundum Company Limited at Shawinigan Falls, Que. He graduated in metallurgy at the University of Saskatchewan in 1939 after which he was employed by the Hudson Bay Mining and Smelting Company at Flin Flon, Man.

E. R. Hammond, Jr. E.I.C., is now with Electric Tamper and Equipment Company of Canada Limited in Montreal. He served as first lieutenant on a number of ships of the Royal Canadian Navy, and recently retired from active service with the rank of lieutenant. He is a graduate of the Royal Military College, Kingston, and of Massachusetts Institute of Technology where he received his master's degree in civil engineering in 1939. After graduation he was with Trinidad Leaseholds Limited in Trinidad, B.W.I.

H. H. Schwartz, Jr.E.I.C., has joined the staff of the engineering department of Dee Electronics Limited, Montreal, in the capacity of communications engineer. After graduation from McGill University in 1938 with the degree of B.Eng. (Elect.) with honours, he worked for the Canadian Marconi Company until 1941 as a radio design engineer, first on radio receivers and later in charge of the design of all iron core components. In 1941 he was awarded a scholarship at the Massachusetts Institute of Technology and he obtained the S.M. degree in communications in 1942. Upon his return from M.I.T., Mr. Schwartz joined the Northern Electric Company, engineering department, electronics division, to work on general radio design including F.M. communicating systems, traffic signal equipment, etc. Later he was with the audio frequency group developing amplifiers and other audio frequency equipment.

For the past two years Mr. Schwartz has lectured at McGill University on the design and construction of communication transformers. In his new position he will be engaged in the development of audio frequency transformers, audio amplifiers and other electronic equipment.

S. A. Dick, Jr.E.I.C., has been discharged from the R.C.N.V.R. in which he served overseas as lieutenant (E). He has accepted the offer of a position with Spruce Power & Paper Co. Ltd. in Kapuskasing, Ont. He graduated from Queen's University in 1940, at which time he joined the Bailey Meter Co. Ltd. for which he was sales engineer in Montreal when he enlisted.

E. A. Dillon, Jr.E.I.C., is now with English Electric Co. of Canada Limited in St. Catharines, Ont. He served in the R.C.N.V.R. as an electrical lieutenant. Prior to his enlistment he was with the Canadian General Electric Company Ltd., Peterborough, Ont.

René Dupuy, Jr.E.I.C., who served as flying officer with No. 1 Aeronautical Inspection Detachment in Longueuil, Que., is now with La Cie de Pouvoir du Bas St. Laurent at Rimouski, Que. Early in the war he was sent to England where he studied aircraft inspection at the A.I.D. school in Bristol and at a number of British factories.

I. M. Foster, Jr.E.I.C., has been released from the army after overseas service as lieutenant with 1 Canadian Base Workshop, R.C.E.M.E. He has accepted a position with Consolidated Paper Corporation Limited at Grand'Mère, Que. He graduated in mechanical engineering at McGill University in 1937 and prior to his enlistment was with Brown Corporation at La Tuque, Que.

G. M. Armstrong, S.E.I.C., has received his discharge from the army in which he served with the R.C.E.M.E. at National Defence Headquarters. He enlisted upon his graduation in electrical engineering from the University of New Brunswick in 1944. He is now employed as electrical engineer at Bepco Canada Limited in Montreal.

C. S. Baburek, S.E.I.C., has accepted a position with Monsanto Canada Limited in Montreal. He served as lieutenant (E) in the R.C.N.V.R. afloat in destroyers and minesweepers. He graduated in mechanical engineering at McGill University in 1941 and spent a year with the R.A.F. Transport Command in civilian capacity prior to his enlistment.

J. J. Archambault, S.E.I.C., is at present employed as student engineer in the switchgear engineering department of Canadian General Electric Co. Limited at Peterborough, Ont. He is a graduate of Ecole Polytechnique in the class of 1944.

A. H. Berry, S.E.I.C., is now employed in the Telephone Division, Northern Electric Company Limited in Montreal. He served as lieutenant (E) in the R.C.N.V.R. in Canada and overseas. He graduated in mechanical engineering from McGill University in 1943 and joined the Navy immediately.

R. C. Eddy, S.E.I.C., is now employed in the capacity of lecturer at Queen's University. He graduated in chemical engineering at this university in 1941 and joined the Royal Canadian Engineers as lieutenant the following winter. He was wounded in action but suffered only temporary disability.

W. D. Kirkland, S.E.I.C., is now employed in the city power plant at Edmonton, Alta.

W. F. Dawson, S.E.I.C., is now demonstrating in the Faculty of Engineering at McGill University. He graduated in mechanical engineering from McGill in 1945 and enlisted as a cadet in the Royal Canadian Engineers.

P. O. Freeman, S.E.I.C., having received his release from the Royal Canadian Engineers in which he served as captain, has returned to McGill University for post-graduate study. He enlisted upon graduation from this university in 1943.

J. P. Genge, S.E.I.C., has received his discharge with the rank of lieutenant from the R.C.N.V.R. which he joined upon graduation from the University of Saskatchewan in mechanical engineering in 1941. He served overseas for nearly four years. He is now employed by Combustion Engineering Corporation Limited, Montreal, Que.

M. R. Hannah, S.E.I.C., is now taking post-graduate training in electrical engineering at the Massachusetts Institute of Technology. He has been released from the Navy which he joined on graduation in electrical engineering at University of Alberta in 1943. He was attached to the Directorate of Electrical Engineering, Naval Service Headquarters, and held the rank of lieutenant (E).

W. M. Hayman, S.E.I.C., has retired from active service with the R.C.N.V.R. after overseas service as lieutenant. He enlisted following his graduation in mechanical engineering from McGill University in 1941. He has accepted a position with Westeel Products Limited in Montreal.

James F. McKay, S.E.I.C., has accepted a position in the production department of Naugaturk Chemicals, Elmira, Ont. He graduated from the University of Saskatchewan with a B.Sc. (chemical) in 1944.

G. A. Cooper, S.E.I.C., is now employed by Globelite Batteries Limited, Winnipeg, Man. He enlisted in the R.C.E.M.E. as a cadet immediately upon his graduation from McGill University in mechanical engineering in 1945.

S. C. Cooper, S.E.I.C., has been discharged from the Royal Canadian Engineers in which he was training as a cadet. He graduated in civil engineering from the University of Toronto in 1945. He is now employed with Finley W. McLachlan Limited, general contractors, in Toronto, Ont.

Obituaries

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

PIONEER ENGINEER DIES

The first graduate of the Faculty of Applied Science and Engineering of the University of Toronto, which, at that time, was known as the School of Practical Science, died at Pembroke, on Thursday, February 21st. He was Dr. James Lewis Morris, M.E.I.C. He died in his eighty-third year. He was the only graduate of the class of 1881. He joined the Institute as an Associate Member in 1887. He was one of the few surviving members of the original group of founders.

Dr. Morris was one of the outstanding engineers of Canada. He exemplified the broad interest of the profession, inasmuch as he participated in the municipal affairs of his home city (being at one time Mayor of Pembroke), was a noted historian and author, and made extensive study of Indian life in Canada.

To the graduates in engineering at Toronto, Dr. Morris was a familiar figure. He attended many of the reunions, and was always the most honoured and distinguished guest present. He will be sadly missed in engineering circles.

Born in Greenlaw, near Renfrew, he received the degree of C.E. in 1885, and in 1927 the honorary degree of D.Eng. was conferred upon him by U. of T. Dr. Morris took a prominent part in many engineering projects. For more than five years he was engaged with the C.P.R. in construction work in the Rocky Mountain foothills.

He was associated actively with drainage operations in the Ottawa valley and in southwestern Ontario. One of his achievements was the laying out of the townsite of Sudbury, and another the designing of the Hydro-Electric plant on Black river.

For 43 years Dr. Morris practised as an engineer in Pembroke. Later he was a member for several years of Morris, Mackie and Co., contractors.

Several years ago Dr. Morris was appointed inspector of surveys and engineer in the Ontario department of lands and forests. While in the department he was the author of "Indians of Ontario", and he wrote the history of cities, towns and villages of Ontario.

Newton James Ker, M.E.I.C., pioneer civil engineer with the Canadian Pacific Railway Company, died at his home in Vancouver, B.C., on March 2nd, 1946. Born at Brantford, Ont., on May 6th, 1866, he was a descendant of United Empire Loyalists who settled in Niagara district in 1785.

Mr. Ker commenced his engineering career with the C.P.R. at Montreal in 1887 on the construction and extension of the rail line from Lachine to Windsor Street station, later working in a similar capacity at London and Windsor, Ont. In 1890 he became assistant city engineer for the City of Toronto, which position he held for nine years. In 1899 he was employed as city engineer at Ottawa, Ont., where he remained until 1913 when he became land agent for the C.P.R. at Vancouver. He was prominently associated with the development of Shaughnessy Heights and was active in other civic improvements.

He retired from the C.P.R. in 1935. During 1943-44 he served as special representative for the real estate adviser, Department of National Defence.

Mr. Ker joined the Institute as an Associate Member in 1893, becoming a Member in 1905. He was made a Life Member in 1936.

Howard Frederick Lambart, M.E.I.C., died at his home in Ottawa, Ont., on January 12th, 1946. Born in Ottawa on December 30th, 1880, he attended Ashbury College there and graduated from McGill University with his B.Sc. degree in 1904.

Mr. Lambart worked on the initial surveys of the Grand Trunk Pacific Railway in 1905 and then joined the Geodetic Surveys Branch of the Department of Interior, transferring later to the Topographical Surveys Branch. As a Dominion Land Surveyor he carried out surveys for the Department in many parts of Canada until his retirement in 1933, including seven years as surveyor in charge of the Yukon-Alaska boundary demarcation. In 1938 and 1939 he organized expeditions to survey the Mackenzie Mountains in the Northwest Territories and on the outbreak of war offered his services to the Inspection Board of the United Kingdom with which he served for some time until ill-health forced his retirement.

Mr. Lambart was one of the first engineers to take a practical interest in the use of aerial photography for mapping purposes and carried out the first experimental aerial surveys in the Ottawa area in 1920. He made early flights for reconnaissance as well as transportation purposes in many parts of Canada, employing air transport for his survey parties wherever possible He was a well known mountaineer and made many notable ascents in the course of his survey work, among them an ascent of Mount Robson, highest peak in the Rockies. The first ascent of Mount Logan in 1925 by the Canadian-American team of which Mr. Lambart was joint leader, on loan from the Canadian government, was a notable achievement in Canadian mountaineering history. The record of the climb was published in the world's leading geographical and alpine journals and widely publicized at the time.

Mr. Lambart was made a Fellow of the Royal Geographic Society in recognition.

Mr. Lambart joined the Institute as a Student in 1902, transferring to Associate Member in 1907. He became a Member in 1940 and was made a Life Member in the same year.

Karl Weatherbe, M.E.I.C., died suddenly in Montreal on March 7th, 1946. Born at Halifax, N.S., on April 1st, 1871, he graduated from King's College, Windsor, N.S., with the degrees of B.A. and B.Sc. in 1891. Two years later he took a special course in civil and mining engineering and mathematics at Massachusetts Institute of Technology.

After some time spent in railway work as a location engineer, he was appointed professor of engineering at King's College. He held this post from 1897 until 1904 when he returned to practising as an engineer. During World War I he served with the Royal Canadian Engineers with the rank of major. He was awarded the Military Cross. After the war he resumed engineering, being employed for some time as field engineer with the Hamilton Bridge Company.

Mr. Weatherbe joined the Institute as an Associate Member in 1904, transferring to Member two years later. He was made a Life Member in 1939.

Reginald Mudge, M.E.I.C., died on February 10th, 1946, in the Ross Memorial Pavilion of the Royal Victoria Hospital, Montreal, Que., after a long illness. Born in Montreal, Que., on May 1, 1885, he graduated from McGill University with a B.Sc. in 1906.

Mr. Mudge joined the Canadian Pacific Railway at Smiths Falls, Ont., in 1907 and four years later became resident engineer at Silver Creek, B.C., returning to Montreal as assistant engineer in 1912. He enlisted in the Army in 1914 and served overseas as a captain in the Canadian Overseas Railway Construction Corps until 1919 when he returned to the C.P.R. in the office of the chief engineer in Montreal. He was assistant engineer of construction until 1939 when he was named assistant engineer of track. He retired in 1943 because of ill health.

Mr. Mudge joined the Institute as a Student in 1906, transferring to Associate Member in 1913. He was made a Life Member in 1939.

Walter Percy Copp, M.E.I.C., head of the engineering department at Dalhousie University, died in Halifax, N.S., on January 31st, 1946. Born at Sackville, N.B., on August 25th, 1885, he took his Arts course at Acadia University. He graduated in applied science at McGill University in 1908, leading his class and winning the British Association Gold Medal.

Immediately after graduation he joined the engineering staff of the Dominion Bridge Company, holding a responsible position with them during the construction of the first Quebec bridge. From 1918 until 1920 he was with the Department of Railways and Canals, Ottawa, as a bridge and structural engineer. In 1920 he became professor of engineering at Dalhousie University and lectured there up to the time of his death. In the fall of 1945 his colleagues on the Faculty honoured him with a presentation on the completion of a quarter century of service there. He was a governor of the Nova Scotia Technical College.

Professor Copp joined the Institute as a Student in 1907, transferring to Associate Member in 1913, and to Member in 1925. He was an active member on the executive of the Halifax Branch of the Institute and on the council of the Association of Professional Engineers of Nova Scotia, serving as chairman of the Association during 1933. He was councillor of the Institute representing the Halifax Branch 1931-32.

Ralph Henry Goodchild, M.E.I.C., died on September 19th, 1945, in Calgary, Alta. Born at Montreal, Que., on April 30th, 1882, he studied civil engineering at McGill University.

In 1910-11 he worked as concrete inspector for the Canadian Pacific Railway irrigation western section. From then until 1932 he was with the Department of the Interior of the Dominion government on irrigation projects. This period was spent in southern Saskatchewan and Alberta doing hydrometric surveys, irrigation surveys, layouts of irrigation projects, preparation of plans, design of works, estimates, classification and reclassification of lands, preparation of contour maps, etc. He served overseas in the Canadian Army from 1916 until 1919.

In 1940 Mr. Goodchild joined the Department of Transport as a resident engineer. He was in charge of the construction of the Calgary airport in that year. In 1941 he was made senior assistant engineer for the Department and was in charge of the southern district of Alberta, supervising all airport construction in that territory. In the following year he was transferred to the northern district of Alberta. In 1944 he resigned from the Department on account of ill health.

Mr. Goodchild joined the Institute as an Associate Member in 1920, becoming a Member in 1940.

Dallas Forrest Grahame, M.E.I.C., died at his home at Montreal, Que., on February 15th, 1946. Born at Lachine, Que., on July 10th, 1885, he attended St. Johns School, now Lower Canada College, and McGill University, from where he graduated in 1910 with a B.Sc. in mechanical engineering.

For two years after graduation he was employed in the locomotive department of the Canadian Pacific Railway Company at Montreal, and from 1912 until 1915 was mechanical inspector of power plants for the company there. In the latter year he was appointed assistant director of heat, light and power of the Ontario government. In 1917 Mr. Grahame accepted the position of chief engineer on the military hospitals commission at Ottawa, where he remained until 1921 when he went to Toronto as chief engineer of Underfeed Stoker Company of Canada. In 1924 he returned to Montreal to become chief engineer of Atwood Limited, with which firm he was associated until the time of his death. During this time he also served as a consultant. From 1924 until 1927 he was supervisor of buildings of the Bell Telephone Company and from 1934 until his death was consulting engineer and member of the Board of the Children's Memorial Hospital.

Mr. Grahame joined the Institute as an Associate Member in 1925, becoming a Member in 1940.

John Cameron, M.E.I.C., died at his home at Peterborough, Ont., on February 8th, 1946, following an attack of coronary thrombosis the previous week. Born at Salt Springs, Antigonish County, N.S., on September 20th, 1902, he attended St. Francis Xavier University from 1922 until 1925 and Nova Scotia Technical College from 1925 until 1927, graduating from the latter with a B.Sc. degree in electrical engineering.

Shortly after graduation he went to Peterborough to enter the electrical test department of the Canadian General Electric Company Limited. One year later he was transferred to the industrial control engineering department as assistant engineer. It was from this department that he was transferred in 1942 to head the wire and cable department as managing engineer, the position he held at the time of his death. He had achieved much success in steel mill drive control and was regarded as an outstanding electrical engineer in that phase of his profession.

Mr. Cameron joined the Institute as a Student in 1927, transferring to Associate Member in 1937. He became a Member in 1940. He was active in the Peterborough Branch having served on the executive from 1939 until 1943 and as chariman of the Branch in 1941-42.

Francis Stanley Adamson, M.E.I.C., deputy city engineer and deputy commissioner of buildings, City of Winnipeg, died on March 6th, 1946, in the Winnipeg General Hospital.

Born at Nassagaweya, Ont., on April 7, 1902, he graduated from the University of Manitoba with the degree of B.Sc., (C.E.) in 1926. Following graduation he was employed by Kelker, Deleuw & Company, consulting engineers, Chicago, as field engineer in charge of construction of pavements, watermains, sewers and sewage treatment plants for Libertyville and Mundelein, Ill.

In 1927 Mr. Adamson was employed as office engineer for the Concrete Steel Company of Akron, Ohio, in charge of the detailing and designing of many important structures in the United States. He remained with this company until 1932 when he returned to Winnipeg to private practice. Two years later he joined the staff of Cowin & Co., structural engineers, Winnipeg, where he was engaged in designing, detailing and estimating reinforced concrete structures.

In 1935 Mr. Adamson was appointed designing engineer with the Greater Winnipeg Sanitary District which position he held for four years. In 1939 he was appointed assistant engineer with the City of Winnipeg engineering department, being in charge of the desinging office. Three years later he was made assistant engineer in charge of building and plumbing inspection and sewer maintenance in the same department. In 1944 he was promoted to the position which he held at the time of his death.

Mr. Adamson joined the Institute as a Member in 1943.

News of the Branches

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

EDMONTON BRANCH

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

The chief pilot testing Gloster Meteor jet planes at the winter testing unit in Edmonton, Squadron Leader E. L. Baudoux, D.F.C., D.S.O., addressed the Edmonton Branch at its monthly dinner meeting in the Macdonald Hotel on February 18th, 1946. His subject was **Jet Propulsion and Future Aircraft.**

Squadron Leader Baudoux, who was introduced by Chairman F. R. Burfield said that the war has advanced aviation a great deal. Speed of travel is greater, higher altitudes are reached, and heavier loads are carried over longer distances than formerly.

He divided aircraft into four categories: (1) high-speed military planes; (2) commercial passenger planes; (3) commercial cargo planes and (4) light private planes. Of these, he claimed, only types 1 and 2 were likely to be jet propelled in the near future.

Attempts to propel by jets were first heard of, the speaker related, in 1680 when Sir Isaac Newton conceived the idea of driving a carriage by a steam jet. Prior to the war the Italians built the predecessor of the jet plane but it was unsuccessful. The development of the modern gas turbine jet propulsion system was begun in 1936 by Air Commodore Whittle.

In comparing the efficiency of propellers and jets, Squadron Leader Baudoux said there was little difference between them at a speed of 400 m.p.h. but that for greater speeds jets were better and for lesser speeds the propeller. He outlined the problem of reaching a flying speed approaching the speed of sound, about 760 m.p.h. which is a critical speed in aerodynamics, and he explained how a shock wave is set up that produces forces so great that they cannot be overcome by ordinary controls.

It is the experience of the speaker that a jet plane is easier to handle than the orthodox plane because there are fewer instruments and controls. He said that one doesn't feel uncomfortable at high speeds except when there is a quick change of direction, a practice which would not be necessary in civilian flying. A crash landing in a jet plane would be less hazardous than in a plane using gasoline.

The remainder of the speaker's paper dealt with future aircraft. Squadron Leader Baudoux expected planes to fly at a height of 30,000 feet or more to obtain greater speed for less power and to operate above "the weather". He said, pressurization of the plane cabin is necessary to permit operation at extreme altitudes. The speaker anticipated much difficulty in exceeding the speed of sound but expected that, as soon as it was passed speeds would soon increase to 1,000 m.p.h. To provide a complete range of speeds he foresaw a plane with propellers on the front of the plane and jets on the back. The appearance of the plane, he stated would depend on the streamlining required past the speed of sound. He thought the wings would decrease in span, be much thinner and have sharp edges. Higher landing speeds, probably 130 m.p.h. would be common. Larger and larger planes would be built, carrying heavier loads longer distances, he concluded.

A long discussion period ended with a vote of thanks to Squadron Leader Baudoux moved by E. D'Appolonia and heartily endorsed by the meeting. The dinner attendance was 73.

HALIFAX BRANCH

J. D. Kline, m.e.i.c. - *Secretary-Treasurer*

S. W. Gray, m.e.i.c. - *Branch News Editor*

On January 29th the annual combined banquet of the Halifax Branch, The Engineering Institute of Canada and the Association of Professional Engineers of Nova Scotia was held at the Nova Scotian Hotel. There were 275 present. This function has become an annual affair and its popularity is proven by our attendance figures. We were very fortunate in securing for the meeting as our guest speaker, Will R. Bird, noted Maritime author. Mr. Bird has had 546 short stories and six full length novels accepted and his most recent book "Here Stays Good Yorkshire" received the Ryerson Literary Award for fiction for the year 1945. Mr. Bird is a student of the history of Nova Scotia and in his talk related many experiences in the historical life of the province.

A very impressive floor show and entertainment was provided along with favours and donations from various industrial concerns, and the success of this informal function was attested by the many complimentary remarks received by the committee responsible.

Guests at the head table included Mr. Alan Butler, mayor of Halifax; Commodore C. R. H. Taylor, representative of the Navy; Air Vice Marshal A. L. Morfee of the Air Force and Brigadier J. C. Stewart of the Army, George Dickson, representative of the Institute, C. A. Fowler, Nova Scotia Architects' Association, G. G. Bowser, Nova Scotia Mining Society and E. G. Young, Canadian Institute of Chemistry.

The meeting was presided over by J. Cavanagh, president of the Association of Professional Engineers of Nova Scotia, and C. D. Martin, chairman of the Halifax Branch.

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On February 14th, 1946 the regular monthly meeting of the Halifax Branch was held in the Nova Scotian Hotel. The attendance was 56 including several engineers of the senior class of the Nova Scotia Technical College, who were guests of the Branch.

The guest speaker of the evening was an ex-mayor of Halifax, John Lloyd, a recent employee of U.N.R.R.A. in the United States and Europe. Mr. Lloyd was introduced by the vice-chairman of the Branch, E. C. O'Leary. Also present at the head table was Mr. J. B. Hayes, recently elected president of The Engineering Institute of Canada.

Mr. Lloyd spoke on the subject **Public Administration** and recited many of his experiences while a member of U.N.R.R.A. in Washington and on the European continent. He stated "If we are to have good public administration and the good things of a real democracy, self interest must be curbed and the old political system of patronage and rewards must be done away with." The chief point was that public administration was a science in which skilled leaders were needed. Mr. Lloyd's talk was very interesting and at the close a hearty vote of thanks was moved by W. C. Risley and seconded by E. C. Thomas.

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On March 21st, 1946 the regular monthly meeting of the Halifax Branch was held at the Nova Scotian Hotel. The attendance was 65, including several members of the senior class of the Nova Scotia Technical College who were guests of the Branch.

Other guests at the head table included Hon. Harold Connolly, Minister of Industry and Publicity in the Nova Scotia Government, Stewart Sime, traffic manager, Trans-Canada Air Lines, Halifax, N.S. The guest speaker of the evening was Mr. J. T. Dyment, engineering superintendent of the Trans-Canada Air Lines, who was introduced by the branch chairman, C. D. Martin.

Mr. Dyment's subject **Present and Future Development of Air Transportation** was especially interesting to our members and was very well received. This phase of transportation was divided into five broad headings: safety, dependability, comfort, speed and reduction of rates.

Mr. Dyment's talk was exceedingly interesting and instructive, and the keen interest of our members was proven by the lengthy period of discussion which followed his talk. L. E. Mitchell, past-chairman of the Branch moved a vote of thanks to the speaker which was seconded by W. C. Risley.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - - *Secretary-Treasurer*
I. M. MacDonald, Jr.E.I.C. - *Branch News Editor*

The regular monthly meeting of the Hamilton Branch, attended by approximately 45 members, was held at McMaster University on February 21st, 1946. Branch Chairman A. R. Hannaford presided.

H. J. A. Chambers introduced the speaker of the evening, Lieut.-Col. V. S. Thompson. Col. Thompson returned last August after spending 22 months in Italy, for most of that time as chief of the public works division of the Allied Commission. The intimate knowledge gained in this project well qualified him to speak on **Reconstruction in Italy,** or "How to make Bricks without Straw".

Up to May, 1945, 70 per cent of all Bailey bridges were replaced with permanent or semi-permanent structures. The speaker explained that the Bailey bridge was the standard army operational structure, and during the campaign these bridges were in constant demand for re-use as the fighting proceeded up the leg of Italy. A total of 1,652 bridges, or about 3½ per day, were repaired or reconstructed by the division under Col. Thompson's command. This figure does not include any culverts or bridges under 12 ft. span.

In addition to bridge structures and 4,200 miles of road repairs, his work included the urgent rehousing of hundreds of thousands of refugees made homeless by enemy bombing. It was estimated that 3,700,000 persons were displaced from approximately 700,000 houses and apartments that were ruined or damaged during the fighting. Consideration was given to shipping prefabricated houses from this side of the Atlantic, but lack of shipping and more particularly the unsuitability of this type of accommodation for Italian conditions compelled this idea to be abandoned. It was found that the only suitable method was to rebuild and repair with local material and labour, following the traditional Italian methods.

Reconstruction work was always difficult because of lack of adequate labour, shortage of material, and almost complete lack of transport. Italian contractors who were called on to help co-operated very well despite lack of equipment. Col. Thompson and his staff worked very closely with local government engineers, whose knowledge of the country made their help inestimable.
It is estimated that 500,000 workers, both male and female, were engaged in this work of reconstruction at an approximate expenditure of $70,000,000.

Many pictures of the work and the country-side were shown during the lecture. These pictures, taken by Col. Thompson, well illustrated the magnitude of the work in which he was engaged.

At the conclusion of this talk, the speaker answered numerous questions, and a vote of thanks was moved by Alex. Love.

The chairman closed the meeting with a plea to the members to support the Harry F. Bennett Memorial fund, which will be used for the financial assistance of student engineers. The members then adjourned to the anteroom for customary refreshments.

KINGSTON BRANCH

J. Douglas Lee, Jr.E.I.C. - *Secretary-Treasurer*
T. L. Brock, M.E.I.C. - - *Branch News Editor*

On Thursday, February 21st, the Kingston Branch held a meeting in Old Arts Building, Queen's University, with J. R. Carter, branch chairman presiding. The speaker was Mr. William Storrie of the Toronto firm of consulting engineers, Gore and Storrie. Mr. Storrie's subject was **The Engineer and Public Health — With Particular Reference to Kingston.** Because of unusual interest in the topic under discussion the meeting was opened to the Kingston Junior Chamber of Commerce and to Queen's students. Mr. Storrie knows existing conditions with regard to Kingston utilities intimately, as his firm have been engineers for the Kingston Public Utilities Commission for many years, during which time they have made a thorough study of the city's need for water purification and sewage disposal facilities.

Mr. Storrie stressed the little appreciated fact that over half the supply of the world's fresh water is located in the Great Lakes. Canada has innumerable sources of fresh water, but communities in Eastern Canada near areas of water have an easy task in securing their supply compared to certain communities in the mid-west. Cities on the Great Lakes have merely a matter of water purification with which to contend without the task of transporting the water great distances. Mr. Storrie told the audience that the International Boundary Treaty detailed the use of boundary waters in the following order: (1) water supply, (2) navigation, (3) water power.

Mr. Storrie said that the question of public health is one of vital importance to a nation. He described it as the art of directing the forces of nature for the protection of the health of all citizens. It must be a public effort, however. The speaker cited typhoid fever as a case where the individual could not be relied upon for protective measures, but where community action was responsible for reducing the scourge to the point where doctors refer to number of cases rather than number of deaths.

Mr. Storrie asserted that the water chlorination process used in Kingston is not infallible and is certainly not the best system. He urged that Kingston should establish a water purification plant for the welfare of its citizens. The speaker described the $15,000,000 water purification system in Toronto which is now operating to the satisfaction and good health of the city. Slides were shown illustrating different systems for laying intake pipes. The newest system employed at Toronto has the pipe below the lake bed, thus preventing damage by ice flow in the spring. Slides of the construction of the Toronto project, the operations of the modern filter plant, the layout of the various piping systems throughout the city were shown and compared with various water purification plants in other Canadian cities.

In addition Mr. Storrie showed slides of the sewage disposal plant in Toronto and described some of the details of the work and process involved in the purification and disposal of the sewage.

LETHBRIDGE BRANCH

T. O. Neumann, M.E.I.C. - *Secretary-Treasurer*
H. T. Miard, M.E.I.C. - - - *Branch News Editor*

Mr. Doug. Brown, District Service Engineer for the Canadian General Electric, entertained members of the Lethbridge Branch of The Engineering Institute of Canada, and interested visitors, when he spoke on **Electronics,** and demonstrated various electronic phenomena, in the Marquis Hotel on Wednesday evening, March 13. He was ably assisted by Mr. "Jimmy" Munro of the Canadian General Electric.

Commencing by lighting an electric light with a match and extinguishing it by a puff of breath, he gave a performance that would be envied by any top-rate magician, while demonstrating the marvels of electronics.

The speaker described the diode, a vacuum tube with a filament and a plate, and the "Edison effect" or the flow of electrons from the filament to the plate, when the latter was charged positively. He demonstrated with a tungar rectifier tube, showing on a large meter the effects of changing the heat of the filament.

The triode tube had a grid interposed between the filament and the plate. By varying the grid voltage, the flow of electrons was controlled. These tubes are used for amplifying currents, and Mr. Brown demonstrated with a record-player, a pocket radio, and a radiosonde transmitter. He showed a home-made "time delay relay" for use in photography. This illuminated a lamp for any required time from one-half second to half-an-hour, then extinguished it.

Exposing a photo-electric cell to a beam of light, he controlled the lighting of a neon gas sign by interrupting the beam. Practical uses of this included opening mine doors as cars approached, opening kitchen doors, and inspections on assembly lines. He demonstrated rejection of defective articles from an endless belt by a photo-electric cell operating a relay.

Talking movies reproduce sounds by means of a photo-electric cell, and Mr. Brown proved sounds could be produced by unusual means. With a beam of light projected through a spinning perforated disc and through two reading glasses to a photo-electric cell, he produced musical tones in a sound reproduction machine about thirty feet away.

He then projected a beam of light through a space between two vertical pieces of cardboard. The lower piece was attached to the diaphragm of a speaker, which was connected to a gramophone pickup. The movements of the diaphragm varied the width of the beam, and these variations were picked up by a photo-electric cell and the sound was reproduced in a machine thirty feet distant.

Demonstrating gaseous lights, Mr. Brown displayed a half-finished fluorescent tube. He set it between contacts, and pointed out that a high voltage formed an arc through the gas, setting up ultra violet rays which caused fluorescence in the salts coating the finisched part. He then lifted the tube away from the contacts but it continued to glow. Finally six tubes of different colours were lying loose on the table and glowing brightly. The speaker explained that a very strong field was created at each terminal by plates beneath the table. The plates were connected to a transmitter.

Mr. Brown demonstrated a stroboscopic effect with a flashing mercury vapour lamp and with a flashing neon lamp. With a power supply at high voltage connected to condensers which discharged through the lamp, he produced some exceptional illusions on whirling discs.

He pointed out that this stroboscopic light was used to take photos at high speeds, and was particularly useful in industry in examining machinery in motion at high speed. Gears could be made to appear to stand still, or revolve slowly either way, and stresses could be studied.

Mr. Brown closed with a description and demonstration of a cathode-ray tube, and showed how the point of light produced by the impinging electrons could be deflected vertically or horizontally by impressed voltages. He demonstrated the use of the tube to show visually the sine curve of an alternating current, or impulses of music and voice.

P. E. Kirkpatrick was chairman of the meeting, Mr. Bradley introduced Mr. Brown and Mr. Munro, and Mr. Ryder thanked the speaker. There was a large audience composed of members of the Institute, technical students and teachers, and electrical men.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
J. C. Keppy, m.e.i.c. - - } *Branch News Editors*
J. W. Kirk, jr.e.i.c. - - - }

A review of the achievements and future plans of the Association of Professional Engineers of the Province of Ontario was made by Dr. G. R. Lord, president of the Association, before a well-attended joint meeting of the members of that body and the London Branch of the Engineering Institute on Friday, March 1st.

Dr. Lord outlined the history of the Association since the time it was formed in 1922. Acknowledgment was made of the ground work by the small group of engineers who pioneered during early years. Under the stimulus of the 1937 Amendment to the Provincial Act, by which the Association was formed, a very considerable growth in membership has been experienced, with the result that there are at present 4500 engineers and 3000 engineers-in-training registered with the Association. The desirability of strengthening the Association, by adding to the membership, was brought to the attention of the meeting.

The speaker made reference to the fact that the prestige of the engineer could be raised by gaining the confidence of the public. In this connection, the Association is carrying out a publicity campaign with a view to encouraging the employment of only registered engineers to carry out engineering work. Constant surveillance by the Association of the action of industries and engineers in general, is showing results.

A discussion period followed the address, with Lieut.-Col. Tom Medland, public relations officer of the Association, taking part.

J. H. Johnston, chairman of the London Branch, conducted the meeting. The speaker was introduced by E. V. Buchanan and thanked by W. R. Smith.

MONCTON BRANCH

V. C. Blackett, m.e.i.c. - *Secretary-Treasurer*

On March 5th a branch meeting was addressed by R. N. Fournier, supply manager, Canadian General Electric Co., Halifax. Mr. Fournier spoke on the subject **Electric Heating in Industry,** which he discussed under three main headings. First, he described the many forms of small electric heating devices which can be obtained as standard articles. In this class is found the strip or bare type heating unit, used in toasters, electric irons, hot plates and melting pots. There is also the calrod insulated element in which the heating wire is surrounded by insulating material, and the whole enclosed in a metallic casing which may be bent into any required form. This type is used for immersion heating and is often cast into place for use in modern electric ranges. The speaker next dealt with electric heat treating furnaces. Three types were discussed, the regulation type using a resistance heating element, the induction type of heat treating equipment, used principally for localized heating applications, such as hardening bearings in crankshafts without affecting the quality of the rest of the shaft, and, lastly, the salt bath type of heat treating equipment. Finally, the much publicized infra-red method of paint drying was described. This method has been used with great success in the drying of synthetic paints since the infra-red ray not only acts on the surface but penetrates the entire layer of the paint. Lead-oil base paints, on the other hand, do not respond to this treatment since they depend on the oxygen of the air and not on heat for drying.

Mr. Fournier's remarks were illustrated by numerous slides and samples of electric heating equipment. A vote of thanks was extended the speaker by the presiding chairman, T. H. Dickson, on motion of B. E. Bayne, seconded by H. J. Crudge.

The Mulberry film, "A Harbour Goes to France" was shown at this meeting.

MONTREAL BRANCH

E. M. Van Koughnet, m.e.i.c. - *Secretary-Treasurer*
Hyman Schwartz, s.e.i.c. - - - } *Branch News Editors*
Eli L. Ilovitch, m.e.i.c. - - - - }

"We must appreciate the resistance caused by fear and resentment that management, supervisors and employees have towards the installation of new methods in industry", Mr. Clifton H. Cox, the author and ex-director of Job Methods Training for the U.S. Manpower Commission, told the members of this branch on Thursday evening, January 10th, when he spoke on **Applying Industrial Engineering Techniques Through Supervisors.** These new methods are primarily aimed to give more goods of better quality at lower cost, and thus give greater job security and a higher standard of living to the people.

Mr. Cox explained that management consisted of three branches, viz. executive management, technical management, and supervisors, each of which must understand the others' problems as well as their own.

In introducing new methods the industrial engineer must see to it that each branch of management thoroughly understands his plan and how it will help production. After he has devised some recording or accounting system to prove the actual gains derived from his work, he is prepared to introduce his methods in the shop by securing the aid and co-operation of the supervisors who will enforce and use the new methods.

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The difficulty with forming an opinion on the economic aspect of **The St. Lawrence Waterway Project,** according to Professor John L. MacDougall, is that there are so many variables to the problem. Professor MacDougall, who has been lecturing at Queen's University for the past 13 years, gave this talk before the Montreal Branch of the E.I.C. on January 17th, 1946.

Today, freighters on the lakes carry iron ore to the east and bring back coal to the west, and transportation of grain is only a small part of the yearly tonnage hauled. What is needed on the lakes is not larger ships to carry bigger cargoes but small and faster freights which will run more often. The biggest competitors to lake transportation are the railways and truck agencies which can offer quicker, better and more regular service.

A commonly seen estimate of $392,000,000 is what the 25-foot seaway would cost. This figure does not mention any alterations to present port facilities which are adequate for only 14 foot navigation. Off the record estimates for deepening ports run between $100,000,000 and $200,000,000.

The seaway project as it is now planned will provide one large power site, said Mr. MacDougall. A more economical provision for hydro-electric power would be to develop small generator units as needed, as close to the final place of consumption as possible. In the opinion of the professor, too much of the cost of this project is being charged to navigation to give an unreasonably low figure as the cost of power generation.

A lively discussion was opened by G. De Beaulieu and R. E. Heartz thanked the speaker.

The annual meeting of the Montreal Branch was held on Thursday, January 31st, 1946, at 8.15 p.m. The minutes of the previous annual meeting were read by L. A. Duchastel, secretary-treasurer of the Branch. These were approved and adopted. The scrutineers' report was read and J. A. Beauchemin was elected branch chairman for 1946.

When the general meeting ended, Major D. C. MacCallum, Rehabilitation Officer of the Institute, gave a talk on **Rehabilitation.** This word means, among other things, "to reinstate, or restore to a former rank or privilege lost or forfeited". The men who have been in the fight have had an opportunity to feel things in the light of this new experience and they have found a new set of absolute values.

Most of these men need no rehabilitation; what they need is assimilation and a job. Their new philosophy will help them to make the best of any position they take.

Statistically, this department has received about 3,000 applications and has contacted about 300 employers. Approximately 800 interviews have been granted and 150 confirmed direct placements have been made. Probably a like number of placements have not yet reported back to the Institute.

"I can assure you that I very much appreciate the privilege of sharing in this undertaking, and as a measure of rehabilitation for myself, it couldn't be better", said Major MacCallum in closing.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, Jr.E.I.C. - - *Secretary-Treasurer*
J. L. McDougall, M.E.I.C. - *Branch News Editor*

A meeting of the Niagara Peninsula Branch was held at St. Catharines on February 28th with J. Ings, branch chairman, presiding.

Branch Councillor P. Buss reported on the annual general meeting held in Montreal at which honours went to two local members, W. R. Manock being appointed a vice-president and A. J. Grant receiving the Julian C. Smith medal.

Dean C. R. Young of Toronto University, the speaker of the evening, was introduced by C. C. Cline. The title of the address chosen by Dean Young was **Engineering Organizations and Professional Development,** a subject of timely interest to all members. The subject was admirably covered and the growth of the profession was traced from early times up to the present. The steps in professional development and recognition were fully reviewed.

The speaker reminded his listeners that there is a perpetual challenge to the engineer "to assist his brother engineer, to give service to his fellow man, to work in the national sphere and to expand into the sphere international". Greater recognition of the engineering profession by the public, Dr. Young stressed, depends on how each individual member conducts himself. "Stature, not status, should be strived for among engineers. Satus will follow as a natural course."

Many questions were put to the speaker at the close of the talk and W. Jackson, on behalf of all present, voiced the vote of appreciation to Dr. Young.

C. G. Moon said a few words, expressing his desire to see closer working agreements for the benefit of the profession as a whole. At the close of the general meeting an executive meeting was held.

OTTAWA BRANCH

C. G. Biesenthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - - *Branch News Editor*

Safety and health, and the engineer's place in the community were discussed in an address before the Ottawa Branch at the noon luncheon on March 7th at the Chateau Laurier. H. J. McGough, Toronto, general manager of the Ontario Highway Construction Safety Association, was the speaker. J. H. Irvine, chairman of the Branch, presided.

Engineers, though qualified by careful and painstaking training to be leaders, are very little interested in public life and politics. This was to be regretted, said the speaker. They were taught the value of order, of meticulous care, and were given every possible educational aid and training to fit them for their occupation. All these would be of value in other spheres besides engineering alone. Why were engineers so backward in coming forward?

The engineer had many types of men under him and it was his task to plan not only for the safety of structures under construction but for the safety of every employee under his control. If the employee knows that this is being done, he will take greater interest in his work and accord greater respect to the engineer. "Until those in charge realize that the men and women on the payroll are human beings, we will not achieve one iota of that better world we are all eager to build", he declared.

PETERBOROUGH BRANCH

E. Whiteley, M.E.I.C. - *Secretary-Treasurer*
J. C. Allan, M.E.I.C. - *Branch News Editor*

A paper on **Compressed Air and Its Uses** was presented jointly by Mr. George M. Dick, manager of engineering, and Mr. Cyril N. Danks, district engineer, both of the Canadian Ingersoll-Rand Co. Ltd., before the February 14th meeting of the branch

Mr. Dick opened the subject with a brief historical account of the development of the use of compressed air down to modern times. One of the earliest uses of compressed air at relatively high pressures of possibly 7 or 8 atmospheres, was made by Egyptian priests who used it to move temple doors.

The development of compressors from about 1850 onwards was outlined by Mr. Dick, with a discussion of the problems involved and the nature of various advances in the art. The relative applications of rotary, centrifugal, and reciprocating compressors were outlined.

Reciprocating compressors were considered in more detail than the other types and the theory of this type was very briefly reviewed.

Compressor speeds have increased a great deal in the last 30 or 40 years. This has been due to several different factors, such as better bearing materials, better forgings and anti-friction bearings. The biggest influence, however, is due to the continual betterment in valving. Mr. Dick outlined the history and development of several types of valves each of which represented a considerable advance over its predecessors and permitted operation at higher speeds.

The function of unloaders were explained and several types were described.

Many of today's compressors are equipped with anti-friction bearings. The larger ones usually use roller self aligning bearings. On the smaller ones ball bearings are frequently used. Regardless of the type, everyone of them have only one crank. It is quite common to find 2 or 3 and some times 4 connecting rods on the one crank pin. This is because the use of 2 cranks would require the use of an intermediate anti-friction bearing and anti-friction bearings can not be split to permit their assembly in such a location.

Mr. Dick illustrated his paper with slides.

Mr. Danks added the second part of the paper.

Recorded data indicates that compressed air was used in the 18th century for elevating water and in connection with diving. However, it was not until the Rock Drill came into prominence that a real attempt was made to develop compressed air as a means of power transmission. Compressed air is now recognized as one of the most useful forms of power transmisison which mankind has ever known. The success of compressed air Rock Drills has lead to the use of many other compressed air devices in under ground workings. Jack hammers, stopers, drill sharpeners and small pneumatic tools have come into common use. Even large mine hoists installed underground have been powered by compressed air. Compressed air is also generally employed for such miscellaneous uses as sand blasting, spray gun painting, cement gun applicators, liquid agitators and forging hammers.

The uses of compressed air are therefore, of a very diversified nature and the application of compressed air as a Power Transmitting Medium is today a very far reaching and highly developed science.

Mr. Danks concluded the paper with 2 motion picture films. One illustrated the use of compressed air in tunneling the 13 mile Alva B. Adams bore and the other illustrated the use of compressed air in the paper box industry.

SARNIA BRANCH

F. F. Dyer, M.E.I.C. - *Secretary-Treasurer*
C. E. Leon, M.E.I.C. - *Branch News Editor*

On Thursday, February 28th, the Sarnia Branch held a dinner meeting at the Sarnia Golf Club. The speaker of the evening, Mr. I. G. Goddard, manager of the plastics division, Canadian General Electric Limited, chose as his subject **Plastics.** Assisting Mr. Goddard in the presentation of his talk was Mr. D. G. McNabb, also of Canadian General Electric.

In opening his talk, Mr. Goddard stated "If Medals were given to industrial products, plastics would win the Victoria Cross." In every theatre of war, plastics played their part—in a battleship alone there are over 1,000 applications of this substance. However, during the war, plastics were poorly represented on the home front, and in many cases incited public distrust by failing in ordinary household appliances. This was due to: article not being properly labeled as to suitable use, scrap material being used, wrong material being used, and poor design of article. At the present moment, there is a progressive movement in progress among manufacturers to overcome this distrust by standardized presentation of plastics to the public, and by accurate informative labelling of the articles. Mr. Goddard regards plastics as one of the three most rapidly advancing sciences. It shares an equal position with electronics, and neuclionics, all three being concerned with the re-arrangement of molecules.

The first plastic was accidentally discovered by John Wesley Hyatt over 75 years ago, when he found that by mixing guncotton with camphor it was possible to make celluloid. Since that time, the plastic industry has developed into over a 500 million dollar business. Following Hyatt's discovery, Leo H. Bakelon developed bakelite with the co-operation of Professor Redman of the University of Toronto. These three men are today considered the fathers of plastics.

In defining plastics, Mr. Goddard stated that a plastic is a material formed by the addition of a resin and a chemical substance that, by the application of heat and pressure, can be forced or moulded into any desired shape. The classification of plastics is based upon physical characteristics rather than their constituents.

Mr. Goddard emphasized that for successful application of plastics we must remember two modifying conditions. The "Whens' and the 'Whys'. Plastics will be successfully applied only if used

1. When they will do some job for less money than any other material.
2. When they will do a better job for the same money than any other material.
3. When no other material can be used.

Why we use them depends upon
1. Their properties of being light and strong
2. Their mouldability—with or without metal inserts.
3. Their excellent electrical and heat insulating properties.

By their versatility, designers of modern equipment are able to meet any exact function and design that may be required. In 1946 the U.S. expects an expansion of this industry to the order of 120 million dollars. Through plastics we can soon anticipate many new and worthwhile profits for the improvement of comfort and the enhancing of our standard of living.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Algoma Steel Sheet Piling:
Algoma Steel Corporation Ltd., Sault Ste. Marie; H. E. McKeen & Co., Ltd., Montreal, 1942, 11½ x 9 in., 106 pp., illus., leather.

Canadian Fisheries Manual; Thirty Years Progress in Canadian Fisheries Industry, 1914-1944:
Frederick William Wallace. Gardenvale, Que., National Business Publications, 1945. 11 x 9 in., 124 pp., illus., paper.

Engineering Interpretation of the Economic and Financial Aspects of American Industry; Vol. 7, Plastics and the Plastics Industry:
N.Y., Montreal, George S. Armstrong, 1946. 83 pp., paper.

Hackh's Chemical Dictionary; American and British Usage, 3d. ed.:
Edited by Julius Grant. Philadelphia, Toronto, Blakiston, 1946. 10 x 7 in., 925 pp., illus., cloth, $8.50.

How to Evaluate Supervisory Jobs; an Executive and Supervisory Appraisal Manual:
Albert N. Gillett. Deep River, Conn., National Foremen's Institute, 1945. 11½ x 10 in., looseleaf, illus., charts, cloth, $7.50.

Human Behaviour and Its Relation to Industry; a Series of Lectures Delivered at McGill University, Montreal, January 12, 1944—March 28, 1944:
Planned and Arranged by D. Ewen Cameron and H. Graham Ross. Montreal, McGill University, 1944. 9 x 6½ in., 204 pp., cloth, (McGill Monograph Series, No. 3.)

Metal Working and Heat-Treatment Manual; Vol. I:
F. Johnson. London, Paul Elek, 1945. 8½ x 6 in., 204 pp., illus., cloth, 17s. 6d.

Plan de Fabrication Aeronautique:
M. P. Guibert. Paris, Dunod, 1945. 10 x 6½ in., 126 pp., illus., paper, 255 fr. (in French).

Ports Maritimes:
A. de Roubille. Paris, Dunod, 1946. 8¼ x 5¼ in., 182 pp., illus., paper, 250 fr. (in French).

Practice of Printing:
Ralph W. Polk. Peoria, Ill., Manual Arts Press; Toronto, Copp Clark, 1945. 8 x 5½ in., 300 pp., illus., cloth, $4.00 in Canada.

Sheet Piling, Cofferdams, and Caissons:
Donovan H. Lee. London, Concrete Publications, 1945. 9½ x 6¾ in., 191 pp., illus., cloth, 10s.

Studies in Supervision; a Series of Lextures Delivered at McGill University, Montreal, January 30, 1945-March 20, 1945:
Planned and arranged by D. Ewen Cameron and H. Graham Ross. Montreal, McGill University, 1945. 9 x 6½ in., 149 pp., illus., cloth. (McGill Monograph Series, No. 6.)

PROCEEDINGS, TRANSACTIONS, ETC.

American Society for Testing Materials:
1945 Supplement to A.S.T.M. Standards, including Tentatives; Part III—Nonmetallic Materials—General.

American Society of Civil Engineers:
Transactions Number 110, 1945.

Nova Scotia Institute of Science, Halifax, N.S.:
Proceedings, Vol. 21, 1942-1944.

Quebec Library Association:
Papers read at the First Annual Convention, Montreal, October 11-13, 1945.

REPORTS, YEARBOOKS, ETC.

American Railway Engineering Association:
Program and Year Book, 1945. (Being Vol. 47, No. 459, March 1946 of the Bulletin.)

American Society of Civil Engineers:
Official Personnel Directory Number 1946.

British Engineers' Association:
Classified Handbook of Members and Their Manufactures, 1945.

Canada. Department of Labour:
Annual Report, 1944-45. (French Edition.)
Salaries and Hours of Work in Canada, 1943. (Report No. 26. French Edition.)

Canada. Department of Transport:
Annual Report, 1944-45.

Canada Permanent Mortgage Corporation:
Annual Report, 1945.

Canadian Radio Technical Planning Board:
Notices and Minutes of Meetings, Interim Reports of Committees and Panels, 1944-1945.

Combined Production and Resources Board:
Report on the Conference on Unification of Engineering Standards, Screw Threads, Pipe Threads, Limits and Fits, Drawing Practice and Metrology; Ottawa, September-October 1945.

Engineers' Council for Professional Development:
Thirteenth Annual Report, 1945.

Metropolitan Water District of Southern California:
Report for the Fiscal Year, July 1944 to June 1945.

TECHNICAL BULLETINS, ETC.

British Standards Association:
British Standard 1264: 1945—Methods of Test for Transport Gas Producer Fuels. P.D. 420: November 1945—Recommendations on Methods of Protection against Corrosion for Light Gauge Steel and Wrought Iron used in Permanent Building Construction.

Electrochemical Society:
Preprints:—*88-31—Effect of Electrolytically Released Halogens on an Absolute Methyl Alcohol Solution of Cinnamic Acid, by Robert Leininger and L. A. Pasiut.—89-3—High Titania Dielectrics, by Eugene Wainer.—89-4—Electrolysis of Manganese into a Metal Cathode from Suspensions of Manganese Oxide and Carbon in Molten Manganous Chloride, by Burke Cartwright and S. F. Ravitz.—89-5—Production of Beryllium Oxide and Beryllium Copper, by Bengt R. F. Kyellgren.—89-6—New Type of Electrochemical Reaction, by J. E. Stareck.—89-7—Protective Value of Lead and Lead-Tin Deposits on Steel, by A. H. Du Rose.—89-8—Electrochemistry of the Rare Earth Group, by B. S. Hopkins.—89-9—Production of Metallic Calcium by Thermal Reduction, C. C. Loomis.*

Illinois University. Engineering Experiment Station:
Bulletin Series *No. 359—Grain Sixes Produced by Recrystallization and Coalescence in Cold-Rolled Cartridge Brass, by Harold L. Walker.*

Circular Series *No. 51—Rating Equations for Hand-Fired Warm-Air Furnaces, by Alonzo P. Kratz and others.*

Reprint Series *No. 32—Progress Reports of Investigation of Railroad Rails and Joint Bars . . . by Herbert F. Moore and Others.—No. 33—Progress Report on the Effect of the Ratio of Wheel Diameter to Wheel Load on Extent of Rail Damage . . . By Norville J. Alleman.*

Institution of Mechanical Engineers:
Advance Papers, 1946—*Change in Mechanical Properties of Mild Steel under Repeated Impact, by F. V. Warnock and J. A. Pope.*
Flow of Gases at Sonic and Supersonic Speeds, by G. A. Hankins and W. F. Cope.
High-Pressure Gear Pumps, by T. E. Beacham.
Recent Developments in Alternating-Current Turbo-Electric Ship Propulsion, by G. O. Watson. (Eighteenth Thomas Lowe Gray Lecture.)
Use of Vibration as a Means of Industrial Drive, C. A. M. Thornton.

Purdue University. Engineering Experiment Station:

Vickers, Rockwell and Brinell Hardness Values for Various Materials and Alloys, Prepared by J. T. Agnew.

PAMPHLETS, ETC.

Aeronautical Facilities at the National Research Laboratories, Ottawa:

Ottawa, King's Printer, n.d.

British Speeches of the Day:

Ottawa, United Kingdom Information Office, 1946.

British Trade & Industry; the Lessons of Wartime Production Applied to World Reconstruction:

London, Country Life, 1945.

Glimpses of Industrial Britain:

Ottawa, United Kingdom Information Office, 1946.

Great Responsibility:

L. K. Sillcox. Columbus, Ohio State University, 1946. (Lincoln Lecture.)

Industrial and Scientific Research in Canada:

Toronto, Canadian Manufacturers' Association, 1946. (Reprinted from Industrial Canada, January 1946.)

Investigation into the Phenomenon of Screw Propeller Action:

Alexander Kari. North-East Coast Institution of Engineers and Shipbuilders, 1946.

National Foremen's Institute; What It Is and What It Does:

N.Y., National Foremen's Institute, n.d.

Orientation de la Jeunesse vers la Carrière de l'Ingénieur:

Henri Gaudefroy. Montreal, Ecole Polytechnique, 1945. (In French.)

Selection of Steel for Welding:

Samuel L. Hoyt. N.Y., American Welding Society, 1945. (Adam Lecture, 1945.)

Solid Phase Welding:

Augustus B. Kinzel. N.Y., American Welding Society, 1946. (Adam Lecture, 1944.)

Supply and Demand in the Professions in Canada:

Ottawa, Dominion Bureau of Statistics, 1945.

Switzerland; Our Best Manufactured Goods:

J. C. Klaus. Trade Advisory Board of the Swiss Abroad.

Where is the Radiator?

Camden, N.J., Warren Webster & Co. (Bulletin B 1600.)

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

BRITISH STANDARD SPECIFICATION FOR METHODS OF TEST FOR TRANSPORT GAS PRODUCER FUELS; B.S. No. 1264, 1945:

London, British Standards Institution, 1945. 26 pp., illus., 2/–.

The standard tests cover methods for sampling; screen analysis; determination of strength and friability, total moisture, potential tar, critical air blast value, ash content, sulphur and chlorine, alkali used for activation, with an Appendix giving a graphical method of recording screen analyses.

While not complete, the tests are of immediate value to users and meet a definite need. The publication is subject to addition and revision as further experience is gained.

CHEMICAL PROCESSES IN THE HARDENING OF PORTLAND CEMENT:

By Rune Hedin. Svenska Forskningisnstitutet for Cement och Betong vid Kungl Tekniska Hogskolan I Stockholm—Handlingar N:R 3 (e), 1945 (Swedish Cement and Concrete Research Institute—Proceedings.) (In English.)

After a description of the constitution of the Portland Cement clinker and a survey of the most important published information on the hydration of Portland cement, the author reports on his own investigations in detail. Adducing extensive experimental evidence, he shows that the chemical reactions which take place when a mixture of Portland cement and water hardens under normal conditions are determined by the rate of solution of the clinker components as well as by the concentration and activity of ions in the solution formed. The reactions of the individual clinker components were studied separately, both in pure water and in various other solutions. This study included the principal components as well as those constituents which occur in comparatively small quantities. Special tests were made in order to investigate those reactions which continue in the solutions. Based on the results of his investigations, the author advances some theories which have been verified by tests on non-alkaline cements manufactured by a special calcining process and on ordinary commercial grades of cement.

HANDBOOK ON STAINLESS STEEL:

Brackenridge, Pa., Allegheny Ludlum Steel Corp., 1946. 100 pp., tables.

This handbook presents practical information on twenty-six types of stainless steel. It brings up to date, supersedes and amplifies the stainless steel chapters of the earlier "Handbook of Special Steels" and includes most of the data and information that is available on file-size "Blue Sheets" for the various types of stainless steel.

It contains a forty-four column finder table, corrosion resistance to 230 materials, discussions of properties, products, available forms and sizes, and fabrication methods.

ON THE MODULUS OF ELASTICITY OF CONCRETE:

By Erik Forslind. Svenska Forskningsinstitutet for Cement och Betong vid Kungl Tekniska Hogskolan in Stockholm—Handlingar N: 4 (e), 1945 (Swedish Cement and Concrete Research Institute—Proceedings.) (In English.)

In this paper an attempt is made to set up a theory of elasticity dispersion in concrete by means of elementary arguments based on the calculus of probabilities. The theory advanced was subjected to an experimental verification by tests made on a concrete beam, 3m in length, which was cut down by steps to an ultimate length of 1.765 m. The modulus of elasticity was determined by a dynamical method as a function of the length of the beam, and the results were compared with the variation in the modulus of elasticity computed from the theory. The paper concludes with a discussion of the assumptions and results of the investigation. A method for studying the variations in mass density of cement mortar is dealt with at some length in this connection.

RECOMMENDATIONS ON METHODS OF PROTECTION AGAINST CORROSION FOR LIGHT GAUGE STEEL AND WROUGHT IRON USED IN PERMANENT BUILDING CONSTRUCTION:

London, British Standards Institution, 1945. P.D. 420, 8 pp., 1/–.

A memorandum describing various methods which can be used for the protection of light gauge steel, the recommendations have been prepared and published, pending the completion of the work necessary before a Standard can be issued. The memorandum is intended essentially for general guidance, and gives recommendations as to the particular points which need to be observed.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

ATOMIC ENERGY IN WAR AND PEACE

By G. G. Hawley and S. W. Leifson. Rainhold Publishing Corp., New York, 1945. 211 pp., illus., diagrs., tables, 7¾ x 5 in., cloth, $2.50.

The first part of this book discusses atoms, neutrons, energy transformations, combustion, explosions, radioactivity, transmutation, nuclear fission and other subjects of fundamental importance. The second part, based on the official report of the atomic bomb project, gives the story of this tremendous job, the obstacles to be surmounted and the means by which it was done. A concluding section discusses future military and industrial applications of atomic energy in the light of present knowledge.

BASIC ELECTRICAL ENGINEERING, Circuits, Machines, Electronics

By A. E. Fitzgerald. 1st ed. McGraw-Hill Book Co., New York and London, 1945. 443 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $3.75.

This new text-book presents an integrated treatment of circuit theory, electrical-machinery fundamentals and applications, and engineering electronics. Discussion of instrumentation and of automatic-control applications in research and industry supplements and correlates the treatment of individual items. The book is intended for students who have had a course in college physics and have some experience in simple d-c theory. No knowledge of alternating currents is assumed.

ELECTRICAL ESSENTIALS IN MARINE SERVICE, Vol. 1

(Marine Electricians' Library.) 419 pp., $3.00.

ELECTRICAL POWER SOURCES IN MARINE SERVICE, Vol. 2

(Marine Electricians' Library.) 458 pp., $4.00. By J. M. Dodds. McGraw-Hill Book Co., New York and London, 1945, illus., diagrs., charts, tables, 8½ x 5¼ in., cloth.

These volumes are the first two of a three-volume set covering all phases of marine electrical work except radio. Vol. 1 explains the essential principles of electricity and magnetism and the characteristics of electrical circuits; alternating and direct currents are discussed together, and their various uses are described and compared. Vol. II covers machines and devices involved in the generation and distribution of electrical power in shipyards and aboard ships. The size and limitations of the electrical machine are discussed, and separate sections are devoted to a.c. and d.c. generators, storage batteries, regulating devices, switchboards, and installation work.

(Continued on page 282)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

March 30th, 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 May meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

A Member shall be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thrity-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, 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 attainment 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

BEECHER—KEITH DAVIDSON, of 270 Arlington Ave., Ottawa, Ont. Born at Montreal, Que., Dec. 6th, 1917. Educ.: B.Eng. (Elect.), McGill Univ., 1941; 1939-40 (summers), Aluminum Co. of Canada, Arvida, Que., Noranda Mines Ltd., Noranda, Que.; 1941-45, Lieut. E., Royal Canadian Navy; 1945-46, elect. engr., Montreal Locomotive works; and at present, patent examiner, Canadian Patent Office, Ottawa, Ont.

References: C. A. Norris, F. Dugal, A. E. MacRae, C. V. Christie, E. Brown, R. O. McGee, L. A. Wright, L. Trudel.

BORROWMAN—MURRAY LEROY, of Winnipeg, Man. Born at Winnipeg, Man., July 17th, 1914. B.Sc., (Civil), Queen's Univ., 1934; 1936-38, engrg. dept., Winnipeg Electric Co. Ltd.; 1938-41, constrn. dept., McColl-Frontenac Oil Co., Ltd., Winnipeg, Man.; 1941-45, Royal Canadian Engineers, with rank of Lieutenant, discharged December, 1945; at present, constrn. foreman, operating dept., McColl-Frontenac Oil Co., Ltd., Calgary, Alta.

References: N. M. Hall, J. N. Finlayson, J. S. Neil, R. W. Borrowman, E. V. Caton, C. P. Haltalin, A. Sandilands.

BROWN—HUGH CAREY, of 642 Lansdowne Ave., Westmount, Que. Born at Montreal, Que., Nov. 14th, 1914. Educ.: B.Eng., (Elect.), McGill Univ., 1936; 1936-41, test course and sales engrg., Canadian Westinghouse Co.; 1941-46, Royal Canadian Signals; 1946 to date, sales engr., Canadian Westinghouse Co., Montreal, Que.

References: C. V. Christie, K. W. Fraser, W. O. Sorby, E. E. Orlando, H. M. Esdaile, S. A. Charters.

BURNS—STUART L., of 3453 Peel St., Montreal, Que. Born at Kingston, Ont., April 13th, 1892. Educ.: B.Sc., (Mech.), Queen's Univ., 1914; R.P.E., Quebec; 1914-17, Canadian Pacific Railway; 1917-40, pulp and paper mill engr., Canadian International Paper Co. and companies taken over by it; 1940-45, inspecting officer, Inspection Bd. of U.K. and Canada, Allied War Supplies Ltd., and Dept. Munitions and Supply; 1945 to date, mgr., Montreal District, Donald Inspection Ltd., Montreal, Que.

References: J. R. Donald, H. Anvik, A. K. Grimmer, B. Grav, R. L. Meek, W. H. Wharton.

BURROW—JOHN ALBERT, of 16 Rosemount Ave., Toronto, Ont. Born at Fredericton, N.B., Aug. 3rd, 1920. Educ.: Univ. of N.B., 1938-39; with Canadian General Electric, as follows: 1940-41, shop practice and production, testing of transformers, 1941-44, test course, 1944 to date, asst. supervisor, transformer testing, Toronto, Ont.

References: C. E. Sisson, D. Norman, B. I. Burgess, J. S. Keenan.

CASSIDY—JAMES FELIX, of Montreal, Que. Born at Folkestone, Kent, Eng., Dec. 25th, 1918. Educ.: Sir George Williams College, 1937-42; with Canadair Limited, (formerly Canadian Vickers Ltd., aircarft divn.), as follows: 1940-43, st. dftsman., 1943-44, sales and cost engr., 1944 to date, schedules supervisor. (Asks for admission as an Affiliate.)

References: M. Turgeon, S. Warnock, W. H. S. Bird, E. A. Harvey, R. C. C. Brown.

CRITCHLEY—JOHN CHURCHILL, of 42 Elizabeth St. E., Welland, Ont. Born Salem, Mass., Oct. 7th, 1911. Educ.: B.Eng., Nova Scotia Tech. Coll., 1935; R.P.E., Ontario; with Ford Motor Co. of Canada, as follows: 1935-37, dftsman., 1937-43, elect. engr., and from 1936-43 elect. instructor (night classes) Windsor Vocational School; 1943 to date, asst. elect. supt., Page-Hersey Tubes Ltd., Welland, Ont.

References: J. B. Candlish, C. G. Walton, G. W. Lusby, W. D. Donnelly, E. G. Little, R. W. Willis, V. W. MacIsaac.

CUKE—NORMAN HAMPDEN, of Montreal, Que. Born at Montreal, Que., June 25th, 1919. Educ.: B.Eng., (Metall.), McGill Univ., 1941; 1941, metallurgical engr., Defence Industries Ltd.; 1941-45, Auronautical Engr., R.C.A.F.; at present, engr., development and engrg. dept., Canadian Liquid Air Co., Ltd., Montreal, Que.

References: F. G. Kerry, J. Morse, W. F. Drysdale, T. J. Kennedy.

CYMA—ZYGMUNT STANISLAW, of 50 Raglan Ave., Toronto, Ont. Born at Lubaczow, Poland, Jan. 1st, 1901. Educ.: Mech. Engr., Politechnika Lwowska, Poland, 1923; (Member, Assn. Polish Engineers in Canada—educational qualifications guaranteed by the Association) with Engrg. Office of The Military Central Aircraft Plant, Warsaw, Poland, as follows: 1923-25, designer, 1925-26, asst. to plant supt., 1926-27, plant supt.; with Podlaska Aircraft Co., Ltd., Biala Podlaska, Poland, as follows: 1928-30, i/c production planning and tool designing dept., 1931-32, chief engr., 1933-39, tech. mgr. and asst. to genl. mgr., i/c production engrg. and mfg. divns.; 1939-40, planning engr. and group leader of Polish Engineers and Workers Group (Societe National Constructions Aeronautiques du Midi), Toulouse, France; 1940-41, research engr., Polish Army H.Q., London, Eng.; with National Steel Car Corp., Ltd., aircraft division, Malton, Ont., as follows: 1941-42, plant development engr., 1942-45, plant development and chief plant engr. in Victory Aircraft Ltd., 1945 to date, plant development and chief plant engr., A. V. Roe Canada Ltd., Malton, Ont.

References: D. Boyd, C. Klawe.

DAVIDSON—PHILIP, of Calgary, Alta. Born at Peterborough, Ont., May 31st, 1902. Educ.: B.A.Sc., Univ. of Toronto, 1925; Member, A.S.M.E.; 1925-26, assay asst., Tacoma Smelter; 1926, assayer, Poillion & Poirrier, Tilt Cove, N'fld.; 1926-29, Combustion Engrg. Co., New York, as field service engr. i/c putting into operation some of the largest boilers and power plants burning all types of fuels, and entailling much design and re-design; 1929, started boiler factory in Seattle, Wash., known as Automatic Steam Corp., responsible for much of the design; 1936, returned to Combustion Engrg., New York, field service engr., at Fulton Bag & Cotton Co., Atlanta, Ga., transferred to Raymond Divn., Combustion Engrg., Chicago, as service engr., and put into operation largest sewage disposal plant, South West Stn., Chicago, besides many other plants; 1943, chief engr., Carter Mfg. Co., Memphis, Tenn.; 1944, formed Robinson Engrg. and Development Co., Ltd., Calgary, president and chief engr., manufacturing heavy farm and road machinery, tractor parts, etc.

References: R. S. Trowsdale, D. G. Tapley, P. F. Peele, R. MacKay, J. M. R. Fairbairn.

EGGERTSON—SIGURDUR HJALTI, of Winnipeg, Man. Born at Winnipeg, Man., Dec. 10th, 1907. Educ.: B.Sc., (Elec. Engrg.), Univ. of Manitoba, 1933; 1933-37, radio engr., N. A. Richardson; with Winnipeg Electric Co., as follows, 1937-40, dftsman., 1940-43, asst. engr., 1943-45, designing engr., 1945 to date: distribution engr., i/c all elect. distribution, Winnipeg, Man.

References: E. V. Caton, E. P. Fetherstonbaugh, L. M. Hovey, C. P. Haltalin, D. A. McCuaig.

ELFORD—GLENN EARL, of Corunna, Ont. Born at Champion, Mich., Oct. 1st, 1904. Educ.: B.A.Sc., Univ. of Toronto, 1934; 1934-35, inspector and instru'mn., Dept. of Highways, Chatham, Ont.; 1935-36, party leader, survey party, Dept. of Mines, Ottawa; with International Nickel, Copper Cliff, as follows: 1936-40, mine survey and layout work, 1940-42, layout engr., mines engrg. dept.; 1942-44, field engr., Canadian Kellogg Co., Sarnia, Ont.; 1944 to date, engr., responsible for layout and supervision of constrn. jobs, St. Clair Processing Corporation, Ltd., Sarnia, Ont.

References: E. W. Dill, R. W. Dunlop, E. K. Lewis, G. L. Macpherson, F. F. Dyer.

GOOCH—PETER WILLIAM, of Montreal, Que. Born at Toronto, Ont., Feb. 18th, 1915. Educ.: B.A.Sc., 1936; M.A.Sc.(Aero.) 1937, Univ. of Toronto; 1936, (part), dftsman. and sales engr., Horton Steel Works, Fort Erie, Ont.; with De Havilland Aircraft Co., as follows: 1937-39, design engr., Toronto, 1939-41, Hatfield, Herts, Eng.; with Canadair Limited (formerly Canadian Vickers Ltd.), as follows: 1941-42, asst. chief technician, 1942-43, chief technician, 1943 to date, chief engr.

References: C. R. Young, T. R. Loudon, C. F. Morrison, R. C. Flitton, J. T. Dyment.

GREGG—JOHN WILLIAM, of Calgary, Alta. Born at Medicine Hat, Alta., May 22nd, 1918. Educ.: B.Sc., (Petroleum Engr.), Univ. of California, Berkeley, Calif., 1944, (accredited E.C.P.D.); will receive M.Sc. from same Univ. upon completion of thesis; 1941-43, (summers), rodman, gravitymeter party, asst. meter operator, mtce. crew, Buena Vista Field, Taft, Calif.; 1944-45, roughnecking and separator man, Princess, Alta.; 1945, jr. petroleum engr., Standard Co., Princess, Alta.; 1945 to date, petroleum engr., Denton & Spencer Co., Ltd., Calgary, Alta.

References: J. F. Langston, L. A. Thorssen, F. K. Beach, R. S. L. Wilson, J. S. Irwin, H. E. Denton.

HISCOCKS—RICHARD DUNCAN, of Ottawa, Ont. Born at Toronto, Ont., June 4th, 1914. Educ. B.A.Sc., Univ. of Toronto, 1938; with National Research Council, as follows: 1939-40, jr. research asst., later res. asst., Dept. Physics engaged in study of vibration in aircraft, 1940-42, jr. research engr., divn. mech. engrg., wind tunnel struct. design, strength calculations, 1942 to date, jr. research engr., later asst. res. engr. i/c work of structures lab., Divn. Mech. Engrg., National Research Council, Ottawa, Ont.

References: C. J. Mackenzie, T. A. McElhanney, J. H. Parkin, W. T. Reid, N. B. Hutcheon.

KATZ—ALLEN ELVIN, of Hamilton, Ont. Born at Ethelbert, Man., Sept. 10th, 1912. Educ.: B.Sc., (Elec. Engrg.), Univ. of Manitoba; R.P.E., Ontario; 1929-36, machinist apprentice, C.P.R., Winnipeg; 1936-37, jr. engr., Westinghouse; 1937-41, development engr., National Steel Car Corp., Hamilton, Ont.; 1941 to date, Major, R.C.E.M.E., C.M. Hdqts., Canadian Army Overseas.

References: E. P. Fetherstonhaugh, N. M. Hall, A. O. Monk, A. C. Davidson.

LYONS—JOSEPH HARVEY KENT, of Toronto, Ont. Born at Winnipeg, Man. June 17th, 1915. Educ.: B.Sc., (Elect. Engrg.), Univ. of Manitoba, 1936; B.Eng. (Mech.), McGill Univ., 1937; R.P.E., Ontario; 1937--38, shop work and design, Manitoba Bridge and Iron Works, Winnipeg; 1938-40, chief planner, i/c prod., planning dept., John Inglis Co., Toronto, Ont.; 1940-42, prod. mgr., ordnance divn. (Bofors Guns), Otis-Fensom Elevator Co., Hamilton, Ont.; with Massey-Harris Co., as follows: 1942-43, prod. supt. and sub-contract mgr., Brantford, 1943-44, asst. to vice-pres., organization and method investigation and analysis, Toronto; 1944-45, R.C.E.M.E., with rank of Lieutenant; and at present scheduling dept., Canadian General Electric Co., Ltd., Peterboro, Ont.

References: R. Fleming, C. H. McL. Burns, W. J. W. Reid, E. C. Williams, E. P. Fetherstonhaugh, A. R. Roberts.

McCABE—GEORGE P., 60 Prince St., Sydney, N.S. Born at Toronto, Ont., Oct. 6th, 1906. Educ.: Univ. of Toronto, 1924-26; Member, American Inst. Mining & Met. Engrs.; 1928-35, Lake Shore Mines Ltd.; 1935-36, Hollinger Gold Mines Ltd.; with Ingersoll-Rand Co., as follows: 1936, Pittsburg, rock drill design, working between engrg. dept. and field, training course on hydraulics, pump engrg. and compressed air equipt., etc., (6 mos.), Sherbrooke, Que., engrg. design, mtce. and erection equipt., 1937-41, Winnipeg, field service, plant erections, mtce., etc., 1941-45, St. John's, N'fld., responsible charge of N'fld. district in advisory capacity with U.S.N., R.C.N., R.C.A.F., U.S. Army and military base contractors, work incl. torpedo topping, ships repairs, aricraft mtce., working with engrg. dept. on special wartime applications, 1945 to date, Sydney, N.S., mgr. i/c Nova Scotia and Nfld.

References: S. C. Mifflen, J. A. Russell, W. S. Wilson, E. L. Ganter, J. A. MacDonald, S. G. Naish, J. B. Petrie, G. M. Dick.

McCAFFREY—KEITH ALLAN, 20 Aylmer St., Peterborough, Ont. Born at Swindon, Wilts., Eng., April 2nd, 1919. Educ.: B.Sc., (Mech.), Queen's Univ., 1943; 1940, (summer), miner, Aldermac Copper Corp., Arntfield, Que.; 1941, (summer), student helper, mech. mtce., Queenston Generating Stn., H.E.P.C. Ontario; 1942, (summer), dftsman., Frost & Wood Co., Smith's Falls, Ont.; 1943-45, Lieut. (E), R.C.N.V.R., i/c machinery, Engr. Officer, H.M.C. Ships; 1945 to date, student, test course, Canadian General Electric, Toronto and Peterborough, Ont.

References: G. R. Langley, W. M. Cruthers, W. P. Dobson, D. S. Ellis, C. E. Sisson.

McLEOD—WILLIAM RUPERT YERXA, of 6 Park Place, Westmount, Que. Born at Saint John, N.B., Dec. 10th, 1893. Educ.: Univ. of New Brunswick, 1910-13 (overseas 1914-19, unable to return to coll. for final year); with Canadian Pacific Rly., as follows: 1919-21, instru'man., 1921-24, Dept. Natural Resources, Brooks, Alta.; 1925, instru'man., G. G. Murdock, Saint John, N.B.; 1926-28, designing, detailing, reinforced concrete structures and structl. steel, Truscon Steel Co., Toronto; 1928-29, constrn. engr., E. G. M. Cape & Co., Montreal; 1929-30, engr. on constrn., Pigott Construction Co., Hamilton, Ont.; 1930-32, asst. engr. in field, Morrow & Beatty Ltd., Peterboro, Ont.; 1933-34, private work in Toronto, estimating, designing and detailing reinforced concrete structures; 1935, instru'man. on geological survey in Northern Quebec; 1936, instru'man., H.E.P.C. Ontario; 1937-41, town engr., Grand Falls, N'fld.; 1940-42, R.C.E., Officer i/c constrn. at St. John's, N'fld.; 1942-43, res. engr., constrn. aluminum plant at Beauharnois, Que.; 1944-45, res. engr. on grain elevator constrn., R. A. Rankin & Co., Montreal, Que.; and at present, engr. municipal staff, Town of Mt. Royal, Que.

References: W. L. Pugh, F. P. Flett, D. G. Anglin, S. M. Sproule, D. G. Elliot, J. F. C. Wightman.

MOLINE—GUSTAV ADOLPH ALEXANDER, of Hamilton, Ont. Born at Buffalo, N.Y., June 21st, 1900. Educ.: B.Sc., (Mech.), Univ. of Colorado, Boulder, Colo., 1925, (accredited E.C.P.D.), Member, A.S.M.E.; R.P.E., Ontario; with Westinghouse Electric Corp., as follows: 1926-28, member special mech. problems section, A.C. divn., generator divn., East Pittsburgh, Pa., 1928-36, mech. engr., A.C. divn., generator divn., East Pittsburg, Pa., 1936-37, mfg. engr., generator divn., East Pittsburgh, Pa., 1937-45, mech. engr., Canadian Westinghouse Co., Ltd., Hamilton, and at present, chief engr.

References: H. A. Cooch, N. Hand, C. J. Porter, L. C. Sentance, A. F. White.

MURPHY—BERNARD ROSS, of 36 Cheltenham Ave., Toronto 12, Ont. Born at Toronto, Ont., Oct. 1st, 1919. Educ.: B.A.Sc., (Mech.), Univ. of Toronto, 1941; R.P.E., Ontario; 1941 to date, design engr., Hydro Electric Power Commission of Ontario, Toronto, Ont.

References: I. S. Widdifield, R. H. Self, T. Dembie, G. R. Lord, E. R. Graydon, C. R. Young.

NICHOLAS—GORDON ALFRED, of 28 Brussels Apts., Winnipeg, Man. Born at Winnipeg, Man., June 23rd, 1917. Educ.: B.Sc., (Civil), Univ. of Manitoba, 1939; 1939-41, design and detail wide variety reinforced concrete structures, Cowin & Co., Ltd.; 1941-46, R.C.E., 2nd Lieut. and then Major, C.A.O.; demobilized, and at present with Cowin & Co., Ltd., Winnipeg, Man.

References: H. B. Henderson, C. V. Antenbring, E. S. Kent, W. A. Capelle, E. J. Weselake.

RABINOVITCH—ROY SIDNEY, of 260-21st St., Brandon, Man. Born at Winnipeg, Man., Sept. 12th, 1920. Educ.: B.Sc., (Elect. Engrg..), Univ. of Manitoba, 1943; 1942-46, R.C. Signals, with the rank of Lieutenant.

References: E. R. Love, E. P. Fetherstonhaugh, G. H. Herriot, A. E. Macdonald, D. N. Smith, W. F. Riddell.

RANSOM—GEORGE EDGAR McKEE, of Beauharnois, Que. Born at Montreal, Que., May 13th, 1921. Educ.: B.Eng., McGill Univ., 1943; 1943-45, Canadian Army, Wireless E.M.E.; 1945 to date, asst. to master mtce. mechanic, Beauharnois Light, Heat & Power Co., Beauharnois, Que.

References: H. Remine, C. G. Kingsmill, C. Miller, F. Willows, C. V. Christie.

SAVAGE—VICTOR LAWLOR, 37 Church Hill, Westmount, Que. Born at Montreal, Que., Nov. 2nd, 1918. Educ.: B.Eng., (Mech), McGill Univ., 1941; 1940, (summer), dftsman., Shawinigan Engrg. Co.; 1941-45, Engr. Officer, Royal Canadian Navy with the rank of Lt. Cmdr. (E); and at present, estimating engr., G. M. Gest Ltd., conduit contractors, Montreal, Que.

References: F. M. Corneil, A. R. Roberts, D. C. MacCallum.

SLATER—ARTHUR EVAN CROSS, of 534 Davis St., Sarnia, Ont. Born at Iron Bridge, Shropshire, Eng., July 22nd, 1900. Educ.: B.Sc., (Elect. Engr.), Victoria Univ. of Manchester, Eng., 1921; R.P.E., Ontario; 1924-29, owner and mgr., Slater & Co., Engrs., Stowmarket, Eng., machine shop and foundry, elect. and mech. repairs; 1929-34, with Canadian Comstock Co., Ltd., as engr., asst. to elect. supt., asst. elect. constr. supt., design engr. and office engr. and estimator on numerous projects; 1934-42, elect. engr., Noranda Mines Ltd., Noranda, Que.; 1942-44, elect. supvr., and after Dec. 20th, 1943, asst. supervising engr. for Stone & Webster during entire constrn. of butyl rubber and isobutylene plant for Polymer Corp., Sarnia; 1944 to date, elect. engr., design and supervision elect. instln. Polymer research pilot, (rubber) plant, layout and instln. Dow chemical Co.'s new styron plant, Polymer Corp. Ltd., Sarnia, Ont.

References: A. D. Ross, C. W. Justice, G. R. Henderson, B. B. Hillary, A. H. Munro, F. F. Walsh, R. Neave.

SMITH—GERALD EDWARD, of Windsor, Ont. Born at Toronto, Ont., Aug. 4th, 1913. Educ.: B.A.Sc., Univ. of Toronto, 1936; 1936, student engr., American Blower Corp., Detroit, Mich.; 1936-39, sales engr., Canadian Sirocco Co., Ltd., Windsor, Ont.; 1939-45, R.C.E., C.A.O., with rank of Lieut., then Captain, and finally Major, Commanding 1 Field Sgn.; and at present field engr., Canadian Sirocco Co., Ltd., Windsor, Ont.

References: G. W. Lusby, J. B. Dowler, J. M. Wyllie.

SMUCK—FREDERICK HAROLD, of Toronto, Ont. Born at Mount Hope, Ont., May 18th, 1914. Educ.: B.Sc., (Mining), Queen's Univ., 1941; 1941-42, mining engrg., Canadian Gypsum Co., Ltd.; 1942, (3 mos.), H.E.P.C., Ontario; 1942-46, Canadian Army as Section Officer with the rank of Lieut.; and at present jr. engr., hydraulic dept., Hydro Electric Power Commission of Ontario, Toronto, Ont.

References: E. G. Tallman, J. Mackintosh, S. W. Black, D. S. Ellis.

SOICHER—PERCY ARTHUR, of 4629 Hutchison St., Montreal, Que. Born at Proskurov, Ukraine, Oct. 16th, 1918. Educ.: B.Eng., (Mech.), McGill Univ., 1940; M.Sc., Univ. of Michigan, 1941 (accredited E.C.P.D.); 1940-41, lab. instructor, Univ. of Michigan, 1941-42, chassis designer, General Motors of Canada; 1942 to date, Lieut., R.C.E.M.E.

References: E. A. Armstrong, A. D. Fish, A. R. Roberts, C. M. McKergow, R. H. Patten.

SPIGELMAN—MAX, of 141 Polson Ave., Winnipeg, Man. Born at Winnipeg, Man., Sept. 19th, 1912. Educ.: B.Sc., (Elect.), Univ. of Manitoba, 1933; R.P.E., Manitoba; 1935-38, co-owner Apex Electric Co., genl. electrical contracting; 1938-41, elect. mtce. staff, City of Winnipeg Hydro Electric System, power plant, Pointe du Bois, Man.; 1942-45, Aero. Engr., R.C.A.F., as mtce. engr. on design and development at Ottawa and Chief Engrg. Officer at Canadian Joint Staff, Washington, D.C.; and at present street lighting engr., City of Winnipeg Hydro Electric System, Winnipeg, Man.

References: E. P. Fetherstonhaugh, H. L. Briggs, T. E. Storey, R. T. Harland.

STEVENSON—HENRY FREDERICK, of Toronto, Ont. Born at Winnipeg, Man., Sept. 5th, 1911. Educ.: B. Architecture, Univ. of Man., 1932; 1926-38, asst. in supt.'s office, Univ. of Toronto, i/c preparation of drawings for all constrn. and mtce. work; with Imperial Oil Limited, as follows: 1938-41, architect, contrn. and mtce. dept., 1941-42, asst. to operations mgr., 1942-43, engr. for special divn. to construct aircraft refuelling plants for U.S.A.A.F. over Northwest Staging Route from Edmonton, from Dec., 1942, to April, 1943, acted as chief engr. and supervised work at six large airports on staging route, 1943, engrg. constrn., N'fld., 1943-45, asst. to operations mgr., 1945 to date, asst. to chief engr., and arch., constrn. and mtce. dept., Sarnia, Ont.

References: I. G. Wheaton, W. S. Wilson, C. E. Carson, F. C. Mechin, W. E. Sheets, L. Grime.

TESSIER—JOACHIM desRIVIERES, 71 St. Peter St., Quebec, Que. Born at Quebec, Que., Sept. 15th, 1884. Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1909; eight years as partner in firm of Hamel & Tessier, consulting engineers, Quebec City; and at present, real estate and insurance broker, Quebec City, Que.

References: E. Gohier, R. Desjardins, H. M. H. Cimon, A. W. Ahern, D. Gray-Donald, deG. Beaubien.

THORNBER—WILLIAM, 958 Carlaw Ave., Toronto, Ont. Born at Summerland, B.C., July 23rd, 1909. Educ.: B.A.Sc., (Mech.), Univ. of Brotish Columbia, 1932; R.P.E., Ontario; 1933-34, sales engr., U.S.L. Battery Corp., Niagara Falls, N.Y.; 1934-35, mgr., Hollup Corp. Ltd., Canada; 1937-39, inspector, elect. machinery, ceramics, etc.; 1939-45, R.C.A.F., H.Q.,, as Officer Pilot; and at present student School of Graduate Studies, Univ. of Toronto, Canadian Lumberman's Assn. Timber Research Fellowship.

References: T. R. Loudon, C. F. Morrison, M. W. Huggins, C. A. Davidson, J. E. Goodman.

TOMLINSON—JOHN WINDOWS, of 415 Rosedale Ave., Winnipeg, Man. Born at Winnipeg, Man. July 6th, 1907. Educ.: B.Sc., (Elect. Engrg.), Univ. of Manitoba, 1930; with Winnipeg Electric, as follows: 1930-31, inspector, 1932-33, sub-stn. operator, 1934-36, asst. distribution engr.; with Manitoba Power Commission, as follows: 1936-42, asst. genl. supt., 1943-44, elect. i/c constrn., 1944 to date, chief engr. and engrg. representative on executive.

References: E. V. Caton, J. P. Fraser, L. Mackay, J. W. Sanger, H. L. Briggs.

WALKER—HARLEY HAVELOCK, of Milton, N.S. Born at Milton, N.S., Dec. 16th, 1918. Educ.: B.Eng. ,(Mech.), Nova Scotia Tech. Coll., 1943; 1940-42, (summers) Mersey Paper Co., Ltd., steam dept.; 1943-46, with Canadian Army as Lieut. E.M.E.

References: F. H. Sexton, G. H. Burchill, D. S. Nicoll, A. E. Flynn, S. W. Gray.

WAUGH— STANLEY LAWRENCE, of Summerside, P.E.I. Born at Wallace, Cumb. Co., N.S., Aug. 29th, 1914. Educ.: Nova Scotia Tech. Coll., 1934-35; 1936-41, Eastern Light & Power Co., Sydney, and Dominion Utilities (subsidiary of E.L. & P. Co.) as asst. engr.; 1941-42, town engr., Pictou, N.S.; 1942-45, with Foundation Maritime Ltd., engrg. dept., outfitting foreman, asst. supt. and supt.; 1945 to date, town engr., Summerside, P.E.I., prov. land surveyor for P.E.I.

References: R. F. Shaw, I. P. MacNab, L. J. Barron.

WILKINS—CHARLES FRANCES, of Ottawa, Ont. Born at Nottingham, Eng., July 24th, 1891. Educ. Sr. Local Univ. of London Matric. (Coll. of Preceptors, Univs. Oxford and Cambridge); (Junior, 1920-1924); 1912-14, rodman, topo., Hudson Bay Rly. location survey; 1915-19, Engr. Officer, 1st Can. Pnr. Batt. and 12th C.R.T., France; 1920-21, levelman, transitman and a/chief, C.N.R., location; 1922-23, municipal and highway engr. i/c dist., Parsons Engrg. Co., Regina, Sask.; 1923-24, res. engr. (bridge) C.P.R., three bridges replacing trestle by steel; 1925-27, chief asst. resurvey, Moose Jaw, Sask.; 1927-32, sr. engr. clerk, Dept. Int., N.W.T. & Y. Branch; 1937-39, hydrographer, Dept. Mines and Resources; 1939-44, Lt. Cmdr., R.C.N., (Staff Hydrographic Office); and at present, office engr., Lands Branch, Dept. of Transport, Ottawa, Ont.

References: P. Sherrin, S. Hairsine, F. C. Jewett, K. R. Chestnut, O. S. Finnie, F. L. Davis.

WILLIAMS—SIDNEY ELTON, of Three Rivers, Que. Born at Toronto, Ont., Nov. 24th, 1894. Educ.: Univ. of Toronto, 1911-14, (B.Sc., Forestry, course interrupted due to enlistment in 1914); 1911-14, (summers), C.N.R., location survey, T.C.R., railway survey, Hamilton Bridge Works, bridge constrn.; 1920-23, groundwood asst., Belgo Paper Co., Ltd.; 1923-28, mill mgr., Nipigon Corp. Ltd.; 1928-38, with International Paper Co., as groundwood tech. supt., sulphite supt., groundwood and sulph. supt., genl. supt. and asst. mgr.; 1938-45, res. mgr., Lake St. John Power & Paper Co.; and at present, res. mgr., St. Lawrence Paper Mills Co., Ltd., Three Rivers, Que.

References: J. Stadler, R. L. Weldon, J. H. Fregeau, J. F. Wickenden, K. O. Elderkin, L. A. Wright.

WILSON—ROBERT GALBRAITH, of Hamilton, Ont. Born at Copper Cliff, Ont., Feb. 4th, 1915. Educ.: 1945 graduate of special electrical course at the Nova Scotia Tech. Coll., given to selected personnel in the Navy qualifying them for commissioned officer. (Course approved by Council as meeting requirements for Junior); with Canadian Westinghouse Co. Ltd., Hamilton, Ont., as follows: 1936-40, elect. machinist, trades apprenticeship, six mos. in service dept. erecting divn., then service engr.; 1940-45, with R.C.N.V.R.; 1945 to date, service engr., service dept., supervision of seven repair shops with respect to engrg. data, methods of production, machine tools and equipt., process specifications and materials, Canadian Westinghouse, Hamilton, Ont.

References: F. H. Sexton, G. H. Burchill, W. H. G. Roger, J. Deane, D. W. Callander, J. T. Thwaites, L. C. Sentance, J. R. Dunbar.

WURTELE—DOUGLAS BARNETT, of 116 Howick St., Rockliffe, Ottawa, Ont. Born at Croydon, Surrey, Eng., Sept. 10th, 1919. Educ.: Graduate, Royal Military College, 1939; 1939, R.C.A.F. as Pilot Officer, instructed in flying schools until Oct., 1942, went overseas to fighter command returned to Queen's Univ., Oct. 1945, recalled by R.C.A.F. and sent to Test and Development Unit, R.C.A.F., Ottawa, Ont.

References: W. F. M. Bryce, J. H. Irvine, C. W. Crossland, J. H. Parkin, A. C. Ross.

YOUNG—HAROLD RANDOLPH, of Winnipeg, Man. Born at Bonavista, N'fld., Oct. 2nd, 1921. Educ.: B.Eng., (Civil), McGill Univ., 1943; 1943-44, dfting., field engrg., Aluminum Co. of Canada, Montreal, Que.; 1944-46, field engr., C. D. Howe Co., Port Arthur, Ont., c/o Commonwealth Constrn. Co., Winnipeg, Man.

References: J. M. Fleming, W. C. Byers, C. Miller, A. W. Fosness, B. R. Collard, G. J. Dodds, R. DeL. French.

FOR TRANSFER FROM JUNIOR

HAMMOND—ROWLAND ERNEST, of Kitchener, Ont. Born at Toronto, Ont., Aug. 16th, 1911. Educ.: M.A.Sc., Univ. of Toronto, 1933; R.P.E., Ontario; 1934-35, lab. asst., Stromberg Carlson; with Northern Electric Co., as follows: 1935-38, jr. radio engr., 1938-39, buyer, 1939-40, planning engr., 1940-42, scheduling supvr., 1942-43, aircraft radio instalns. engr.; engr., British Government; 1944 to date, co-ordinator, radio and communications divn., Dominion Electrohome Industries Ltd., Kitchener, Ont. (Jr. 1941.)

References: C. B. Fisher, S. T. Fisher, J. J. H. Miller, C. F. Morrison, L. A. Wright.

LEE—JOHN DOUGLAS, Kingston, Ont. Born at Brantford, Ont., April 15th, 1917. Educ.: B.Sc., (Civil Engrg.), Queen's Univ., 1940; M.Sc., Hydraulic and Sanitary Engrg., Iowa State Univ., 1942; R.P.E., Ontario, 1942, (summer), designing engr., H.E.P.C., Ontario; 1943-44, (summers), asst. dist. engr., dist. engr., Dept. National Health, Ottawa; 1945, (summer), designing engr., James Proctor & Redfern, Toronto, Ont.; at Queen's Univ., as follows: 1941-45, lecturer, Dept. Civil Engrg., 1945 to date, Asst. Professor, Civil Engineering. (Jr. 1943.)

References: D. S. Ellis, S. D. Lash, W. B. Redfern, W. F. Noonan, H. G. Ferguson, D. J. Emrey, R. A. Low, J. R. Carter.

NOONAN—RICHARD, of Winnipeg, Man. Born at Brandon, Man., Nov. 1st, 1911. Educ.: B.Sc., (Elect. Engrg.), Univ. of Manitoba, 1934; R.P.E., Ontario; 1935-39, graduate ap'tice., then asst. to works mgr., transformer dept., Ferranti Ltd., Hollinwood, Lancs., Eng.; 1939, (3 mos.), time study, industrial dept., Canadian Vickers, Montreal; 1939-41, elect. dftsman. and designer, architect's office, C.N.R., Montreal; 1942-45, factory engr., English Electric Co., Ltd., St. Catharines, Ont.; 1945 to date, pres. and genl. mgr., Pioneer Electric Ltd., Winnipeg, Man. (Jr. 1939.)

References: E. V. Caton, E. P. Fetherstonhaugh, E. R. Love, R. K. Thoman, A. L. Malby, N. S. B. Watson, R. H. Hobner.

SCHOFIELD—ROBERT JOHN GRAHAM, of Hamilton, Ont. Born at Winnipeg, Man., May 25th, 1912. Educ.: B.Eng., (Chem.), McGill Univ., 1935; 1935-36, calcium chloride operator, Brunner Mond Canada; with Canadian Cottons Ltd., as follows: 1936-38, chemist, Milltown, N.B., 1938-42, asst. dyer and chemist, Hamilton, Ont., 1942 to date, dyer and chemist, Hamilton, Ont. (Jr. 1940.)

References: E. T. W. Bailey, W. E. Brown, H. A. Cooch, N. A. Eager, A. R. Hannaford.

FOR TRANSFER FROM STUDENT

EDDY—ROBERT CHEYNE, of Kingston, Ont. Born at Bathurst, N.B., Jan. 24th, 1920. Educ.: B.Sc., (Chem.), Queen's Univ., 1941; 1936-40, (summer), control dept., Bathurst Power & Paper Co.; 1942-45, Engr. Lieut., R.C.E.; 1945 to date, lecturer in chemical engineering, Queen's University. (St. 1941.)

References: D. S. Ellis, A. Jackson, L. T. Rutledge, R. A. Low.

FERGUSON—ROBERT NORMAN, of Drummondville, Que. Born at Winnipeg, Man., Feb. 21st, 1916. Educ.: B.Eng., (Mech.), McGill Univ., 1939; 1939-42, asst. engr. and asst. supt., International Foils Ltd.; with Defence Industries Ltd., as follows: 1942-44, foreman, sr. foreman, area supvr. and sr. supvr., Verdun and Mtl. works, 1944-46, jr. engr., engrg. dept., C.I.L., assisting project engr.; and as of March 25, 1946, asst. to chief engr., Canadian Celanese Ltd., Drummondville, Que. (St. 1937.)

References: I. R. Tait, H. C. Karn, D. A. Killam, M. S. MacGillivray, J. R. Auld.

GEAKE—LLOYD WOODROW, of 389 Douglas Ave., Toronto 12, Ont. Born at Regina, Sask., Sept. 1st, 1918. Educ.: B.Sc., Univ. of Saskatchewan, 1941; 1941-42, govt. aircraft inspector., R.C.A.F. Depot, Toronto; 1942, (3 mos.), dftsman, Hamilton Bridge Co., Hamilton, Ont.; 1942-45, R.C.E.M.E., with rank of Lieutenant. (St. 1940.)

References: I. M. Fraser, N. B. Hutcheon.

McGEE—LEONARD DAVIDSON, of Montreal, Que. Born at Montreal, Que., May 2nd, 1910. Educ.: B.Eng., (Elec.), McGill Univ., 1933; with Dominion Rubber Co., Dominion Tire Factory, Kitchener, Ont., as follows: 1935-36, time study and cost development engr., 1936-38, mgr., standards dept., industrial engrg., 1938-40, mgr., motor products divn., 1940, (6 mos.), asst. sales mgr., automotive; 1940-45, R.C.E.M.E., Overseas, with the rank of Lieut. Colonel; and at present mgr. of sales and field instlns., Cresswell-Pomeroy Ltd., Montreal, Que. (St. 1933.)

References: H. G. Conn, L. S. McGregor, H. W. B. Swabey, H. J. Racey, D. C. MacCallum, J. R. Donald, J. E. Hurtubise.

McPHERSON—JOHN DONALD PERRIN, of Montreal, Que. Born at Sioux Lookout, Ont., Aug. 15th, 1920. Educ.: B.Sc., (Civil Engrg.), Univ. of Alberta, 1943; 1940-41, (summers), Canadian National Railways, engrg. dept., United States Public Roads Adminis., Alaska Highway; with Royal Canadian Naval Building Construction Corps, 1943, (6 mos.), 1944-45, Engr. Officer i/c of Machinery; and at present, estimating design work, Foundation Co. of Canada, Montreal, Que. (St. 1942.)

References: R. M. Hardy, I. F. Morrison, R. W. Rose, W. Griesbach, L. H. Burpee.

PECKOVER—FREDERICK LIONEL, of 290 First Ave., Ottawa, Ont. Born at Toronto, Ont., March 15th, 1921. Educ.: B.A.S.e, (Civil Engrg.), Univ. of Toronto, 1944; 1944 to date, jr. research engr., hydro-dynamics lab., divn. of mech. engrg., design, constrn. and operation of hydraulic models, since formation in April, 1945, have served as secretary of Associate Committee on soil and snow mechanics, National Research Council, Ottawa, Ont. (St. 1943.)

References: J. H. Parkin, R. F. Legget, C. J. Mackenzie, C. R. Young, R. E. Jamieson.

TAYLOR—HARRY, of 267 Munroe Ave., Winnipeg, Man. Born at Winnipeg, Man., Aug. 22nd, 1913. Educ.: B.Sc., (Mech. Engrg.), Univ. of Saskatchewan, 1939; 1940-42, designing jigs, tools and fixtures, C.N.R. Munitions, Winnipeg; 1942-45, Lieut., R.C.E.M.E.; and at present service engr., Aluminate Chemicals, Ltd., Winnipeg, Man. (St. 1939.)

References: N. B. Hutcheon, I. M. Fraser.

WARD—JOHN, of 538 Roselawn Ave., Toronto, Ont. Born at Toronto, Ont., Nov. 7th, 1920. Educ.: B.A.Sc., Univ. of Toronto, 1944; 1944-45, Engineer Officer, R.C.N.V.R.; 1946, jr. engr., operating dept., Hydro-Electric Power Commission of Ontario, Toronto, Ont. (St. 1944.)

References: C. R. Young, W. J. T. Wright, W. S. Wilson, E. A. Allcut.

WRONG—JAMES STUART, of 60 Parklea Drive, Leaside, Ont. Born at Ottawa, Ont., Aug. 4th, 1921. Educ.: B.Sc., (Civil Engrg.), Queen's Univ., 1944; 1941-43, (summers), field checker and acct., Hadley-McHaffie, Hamilton, instru'man., Bell Telephone Co., field engr., Anglin-Norcross Ontario Ltd.; 1944-45, R.C.E., Training Officer, with rank of Lieut.; 1945 to date, asst. engr., James Proctor & Redfern, consultg. engrs., Toronto, Ont. (St. 1943.)

References: E. M. Proctor, W. B. Redfern, D. S. Ellis, R. A. Low, S. D. Lash, H. E. Bushlen.

LIBRARY NOTES

(Continued from page 279)

ELECTRONICS DICTIONARY

By N. M. Cooke and J. Markus. McGraw-Hill Book Co., New York and London, 1945. 433 pp., illus., diagrs., charts, tables, 9 x 5½ in., fabrikoid, $5.00.

Authoritative and readily understood definitions are given for nearly 6,500 terms used in radio, television, industrial electronics, communications, facsimile, sound recording, etc. More than 600 diagrams and sketches illustrate the principles and equipment described. A consistent policy on abbreviations and compound terms has been followed, based on groundwork laid by the American Standards Association but extended to cover many not yet listed by that association.

RIGHTS OF TRAINS, a Complete Analysis of Single Track Standard Code Rules

By the late H. W. Forman, revised by P. Josserand, 3 ed. Simmons-Boardman Publishing Corp., New York and London, 1945. 561 pp., diagrs., charts, tables, 7½ x 4¾ in., cloth, $3.50.

This manual analyses the Standard Code of Operating Rules of the Association of American Railroads as applied to single and double track. It completely explains and illustrates train rules, train orders and transportation problems of the operating department of any American railroad. Reasons for the rules are given, and questions and answers likely to be met in rules examinations are included to test the reader's understanding of the applications of the rules.

FAMOUS NEW ENGLAND LIGHTHOUSES

By E. R. Snow. Yankee Publishing Co., Boston, Mass., 457 pp., illus., 9 x 5¾ in., cloth, $3.75.

First of a series on American lighthouses, this volume gives briefly the history of every primary and secondary lighthouse in the Boston or New England district. The light itself is described, the stories of famous disasters and remarkable rescues associated with each are told with full credit to the man or woman whose participation was in the line of duty, the lighthouse-keeper.

PRODUCTION ILLUSTRATION, the Techniques and Applications of Perspective Engineering Drawings

By J. Treacy. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 202 pp., illus., diagrs., charts, tables, 9 x 11½ in., cloth, $4.00.

Perspective drawing found wide adoption during the war as a medium for presenting engineering facts, especially to inexperienced workers unfamiliar with blueprints. This book presents the forms and processes of production illustration in simple form. Part one deals with the actual preparation of production illustrations, including drafting and shading techniques, short-cuts, perspective methods and aids to reproduction. Part two shows why, when and where production illustration is of use in industrial production. The book is profusely illustrated with examples of actual production drawings.

(Continued on page 288)

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET,
MONTREAL 2, QUE.

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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.

NOTICE

SERVICE PERSONNEL: The completed rehabilitation questionnaires have indicated a need for the employment service to be made available to all members of the E.I.C. in the Armed Forces. It is suggested that all those who are interested—

1. **Consider these positions as indicative of present conditions.**
2. **Reply to interesting advertisements to establish contact for the future.**
3. **Apply for any of these positions when discharge is imminent.**

Situations Vacant

CIVIL

CIVIL OR MECHANICAL ENGINEER is required for design works by a paper company in the St. Maurice Valley. Some mining experience helpful. Salary $275. a month. Apply to Box No. 3381-V.

CIVIL ENGINEER, graduate age 30 to 40 years, is required for supervision of construction on 2½ million dollar project near Montreal. Salary $300 plus expenses. Apply to Box No. 3383-V.

CIVIL ENGINEER is required to act as assistant to city engineer, some knowledge of town services such as, water works, sewage, building inspection, parks, lighting an asset. Location Montreal. Salary open. Apply to Box No. 3385-V.

CIVIL ENGINEER with five to ten years experience in reinforced concrete design is required by a firm of consulting engineers in Montreal. Salary open. Apply to Box No. 3387-V.

TWO CIVIL ENGINEERS are required to act as senior and junior structural designer respectively with a steel company in southern Ontario. Salary open. Apply to Box No. 3389-V.

CIVIL OR MECHANICAL ENGINEER recent graduate is required by a company in Montreal for work in field on construction; taking measurements with instruments and some surveying. Preferably bilingual. Salary $200 a month. Apply to Box No. 3390-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to Box No. 3394-V.

RESIDENT ENGINEER graduate, preferably but not necessarily bilingual with several years' experience in building construction is required for a housing project in Montreal. Several civil engineers from recent graduates up are also required. Salary open. Apply to Box No. 3402-V.

CIVIL ENGINEER recent graduate is required by a pulp and paper company in the province of Quebec to understudy logging engineer on road-building, dam construction, etc. Candidates should be bilingual. Salary $200 a month. Apply to Box No. 3405-V.

SEVERAL CIVIL ENGINEERS with experience in the design of structural steel and reinforced concrete, or who are interested in testing and research work in connection with concrete and soils are required in the engineering department of a large organization in Toronto. Salary open. Apply to Box No. 3409-V.

CIVIL ENGINEER experienced in making surveys, laying out water lines, etc., is required by a firm of consulting engineers in Montreal to conduct a complete survey of a mill site. Partly field work and partly office work for at least 18 months. Salary $400-$450 a month. Apply to Box No. 3418-V.

CIVIL ENGINEER graduate with several years experience in construction work, preferably bilingual is required by a construction company in Montreal to take charge of a project as resident engineer in Quebec. Salary open. Apply to Box No. 3421-V.

CIVIL ENGINEER, young graduate, is required for work in connection with the design of pumping stations, substations, buildings, vaults, conduit lines, retaining walls, etc., and field survey, layout of railway works, and water supply system for a city in southern Ontario. Salary open. Apply to Box No. 3423-V.

CIVIL OR MECHANICAL ENGINEER graduate, with experience in construction and truck equipment, age 35 to 40, is required by an oil company to take charge of operations in Montreal area. Apply to Box No. 3427-V.

ELECTRICAL

ELECTRICAL ENGINEER graduate, experience in acoustics is required by a firm in the Montreal area. Some experience in radio acoustics might be helpful. Salary $250 to $300 or more. Apply to Box No. 3382-V.

TWO ELECTRICAL ENGINEERS with a minimum of four years' experience with commercial radio equipment are required by a firm in Montreal. Applicants must have good personality and ability to meet public. Please do not apply unless qualified. Salary open. Apply to Box No. 3395-V.

ELECTRICAL ENGINEER with experience in marine electrification is required by a consulting firm in the Montreal area. Salary open. Apply in writing to Box No. 3398-V.

TWO ELECTRICAL ENGINEERS graduates with construction experience preferably in utility substation and power plant work are required by a consulting firm in Montreal. Salary open. Apply to Box No. 3398-V.

ELECTRICAL ENGINEER graduate with several years experience is required for plant maintenance work. Preference to ex-service man with enough experience. Salary open. Apply to Box No. 3403-V.

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 Box No. 3415-V.

ELECTRICAL ENGINEER 5 to 10 years experience on general electrical design wiring of buildings, industrial plants and sub-stations, preferably a graduate, is wanted by a firm of consulting engineers in Montreal. Salary $250-$400 a month. Apply to Box No. 3420-V.

ELECTRICAL ENGINEERS from recent graduates up, if possible with experience in maintenance and repair of A.C. and D.C. motors, or in power plant work, are required by a mining corporation in South America. Salary $275 up. Apply to Box No. 3425-V

MECHANICAL

MECHANICAL ENGINEER is required to act as assistant mechanical superintendent of a paper mill in the St. Maurice Valley. Salary $350 a month. Apply to Box No. 3381-V

MECHANICAL ENGINEER under 30 years of age, with some experience in steam and refrigeration is required by a company in Montreal to act as assistant to plant engineer. Preference to veterans of R.C.N.V.R. Salary $200 a month. Apply to Box No. 3386-V.

MECHANICAL ENGINEER, not necessarily a graduate, but with 5 to 10 years' experience in industrial design concerning conveying equipment as used in rock or fertilizer plants, is required for work with a large company in Montreal. Salary $200 a month. Apply to Box No. 3390-V.

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

MECHANICAL DRAUGHTSMAN is required for the preparation of plans and design work, for a textile company near Montreal. One or two years' experience necessary. Salary open. Apply to Box No. 3396-V.

THREE MECHANICAL ENGINEERS with one or two years experience in draughting and design are required for a paper company on the east coast. Work will involve draughting, design of new equipment and alterations to existing plant and equipment. Salary open. Apply to Box No. 3397-V.

MECHANICAL DRAUGHTSMAN is required by a paper company in Ontario. Must have industrial plant experience including conveyors, piping and machinery layouts. Salary $200-$225 a month. Apply to Box No. 3399-V.

MECHANICAL ENGINEER with paper mill experience is required to act as assistant mechanical superintendent of a large paper mill located in a city in western Quebec. Salary open. Apply to Box No. 3400-V.

JUNIOR MECHANICAL ENGINEER AND SENIOR MECHANICAL DRAUGHTSMAN, not necessarily graduates, but must have some experience of mechanical design problems. Preference will be given to ex-servicemen. Salary $1,800 to $2,700 depending on experience. Possibility of permanent employment located in Quebec City. Apply to Box No. 3401-V.

MECHANICAL ENGINEER with five to ten years experience in general industrial plant work, such as supervision of drafting office, building construction and maintenance machinery layouts, furnaces, boilers, etc., is required in a factory in Montreal. Salary open. Apply to Box No. 3403-V.

MECHANICAL ENGINEER, recent graduate, is required by a pulp and paper company in the province of Quebec, to learn woods operations with a view to mechanization. Candidates should be bilingual. Salary $200 a month. Apply to Box No. 3405-V.

CHIEF ENGINEER, age 35 to 40, preferably graduate mechanical, with experience in shop and production planning, running drafting office, etc., and ability to get along with people, is required by a factory in Sherbrooke ,Quebec. Salary $5,000 to $6,000 a year. Apply to Box No. 3410-V.

MECHANICAL ENGINEER, young graduate, veteran, preferably but not necessarily bilingual, is wanted by a company in Montreal engaged in light manufacturing to be trained for plant maintenance, trouble shooting, etc. Salary $200 to $250 a month. Apply to Box No. 3411-V.

MECHANICAL ENGINEER is required for junior position with an organization in the Montreal area. Successful candidate will be trained in tool designing with excellent opportunity to eventually work into supervisory capacity. Salary $185 to 240 a month. Apply to Box No. 3414-V.

MECHANICAL ENGINEER with considerable practical experience is required for general plant maintenance of production equipment for large out of town metal processing plant. Salary open. Apply in writing to Box No. 3417-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-V.

METALLURGICAL

RECENT GRADUATES in metallurgical or chemical engineering are wanted for quantitative non-ferrous chemical analysis by a mining corporation in South America. Salary open. Apply to Box No. 3425-V.

MINING

MINING ENGINEERS, necessarily with some experience in mining work, capable of becoming shift bosses, are wanted for work with a corporation in South America engaged in the production of coal and copper. Salary $275 to $400 a month. Apply to Box No. 3425-V.

MINING ENGINEER graduate experienced and capable of doing underground survey work, estimating tonnage extraction, etc., is wanted by a company in South America. Salary open. Apply to Box No. 3425-V.

MISCELLANEOUS

DRAUGHTSMAN familiar with reinforced concrete and structural steel is required by a consulting firm in Montreal. Salary open. Apply to Box No. 3387-V.

DESIGN ENGINEER not necessarily a graduate but with mechanical or structural experience in the paper industry is required by a firm in the St. Maurice Valley of Quebec. Salary $250 to $300 a month. Apply to Box No. 3388-V.

CHIEF INSTRUCTOR completely bilingual, veteran, not necessarily an engineer, is required by a pulp and paper company in the province of Quebec to instruct in labour relations, etc., and to understudy personnel manager. Salary $150 a month. Apply to Box No. 3405-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Salary open. Apply to Box No. 3406-V.

GRADUATE ENGINEER with experience in structural design and detailing is required for work in bridge department of large transport company. Apply to Box No. 3407-V giving all particulars including salary expected.

ENGINEER with good knowledge of industrial practice, and ability to analyze financial statements, age 35 to 40, is wanted by a manufacturing concern in Toronto to act as assistant to the president. Salary will be commensurate with ability and experience. Apply to Box No. 3413-V.

YOUNG GRADUATE ENGINEER, recent graduate up, to learn operation of cement business, is required by a company with numerous plants in Canada. Not necessarily a specialist, to be trained for manager. Salary $175-$200 a month. Apply to Box No. 3419-V.

ENGINEERING SALESMAN with pleasing personality, bilingual, 25 to 35 years old, not necessarily a graduate, but with some engineering background and if possible some knowledge of lubrication is required by a large company in Montreal. Salary open. Apply to Box No. 3422-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

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

CHEMICAL

SEVERAL CHEMICAL ENGINEERS for technical service and plant operations, (not laboratory work) with good personality and background are required by a manufacturer in Montreal. Preference will be given to ex-service men and successful candidates will be completely trained at a starting salary of $170. per month. Apply to Box No. 3260-V.

CHEMICAL ENGINEER, preferably with graduate training in chemical engineering and some industrial experience will shortly be required in the chemical engineering department of a university in Ontario. Apply to Box No. 3280-V.

CIVIL

STEEL BRIDGE INSPECTOR, not necessarily a graduate but with good experience, is wanted by a railway company with headquarters in Montreal, to supervise the erection and repair of steel bridges. Salary about $250. a month. Apply to Box No. 3246-V.

SALES ENGINEER with knowledge of building materials, preferably discharged service man with sales ability and inclinations, is required by a manufacturer in Montreal. Successful candidate will have opportunity to become head of this department. Salary is open according to qualifications. Apply to Box No. 3263-V.

CIVIL ENGINEER, graduate with road construction experience, preferably bilingual, age 30-45 years, is required to act as sales engineer for a manufacturer of building materials in Montreal. Candidates should have good personality and appearance to be able to contact government officials, sit in at council meetings, etc. Apply to Box No. 3264-V.

CIVIL ENGINEER, graduate, is required by a firm in Montreal to supervise construction, according to specifications, of new buildings all across Canada. Preferably young man with enough experience . Salary will be $300. to $400. a month. Apply to Box No. 3292-V.

TWO CIVIL ENGINEERS, age 25-40 are required as (1) road construction engineer and (2) general building construction engineer, for estimating, organizing and supervising construction work for a firm in Newfoundland. Some designing and draughting. Salary open according to qualifications. Apply to Box No. 3318-V.

CIVIL OR MECHANICAL ENGINEER, not necessarily a graduate, age 24-30, some experience in concrete and steel draughting, some sales ability, required to work with a consulting engineer and contractor in Montreal. Salary open. Apply to Box No. 3339-V.

CIVIL ENGINEER, young graduate with 2 or 3 years experience, is required to be trained for survey work on municipal, sewer, drainage, etc. problems with a consulting engineer in southern Ontario. (Might eventually be partner). Salary $200. to $225. a month. Apply to Box No. 3340-V.

TWO CIVIL ENGINEERS, graduates with one or more years experience, are required for hydro electric construction and development in South America. Salary $300. to $350, a month. Apply to Box No. 3350-V.

SEVERAL CIVIL ENGINEERS, two with two or three years' experience in road construction and two recent graduates, are required for road building work in northern Quebec. Salary $2400. to $3000 a year. Apply to Box. No. 3351-V.

GRADUATE CIVIL ENGINEER, three or four years out of college, is required for surveying in bush in the Ottawa district, able to take charge of survey and do some plotting, make studies, etc. at office. Salary about $250. a month. Preference to veterans. Apply to Box. No. 3357-V.

CIVIL ENGINEER graduate with a good background of experience is required to act as superintendent or project manager for a large company in the Montreal area. Experience in heavy building construction essential. Age 40-50. Salary open. Apply to Box No. 3358-V.

CIVIL ENGINEER with some experience in highway or railway construction is required by a paper company in Ontario to act as instrumentman. Able to do some layout work on railway lines, take cross sections, calculate earth quantities and be familiar with surveying instruments. Salary about $200-225. a month plus room and board. Apply to Box No. 3362-V.

TWO CIVIL ENGINEERS, preferably but not necessarily graduates, are required to act as structural steel draughtsmen or checkers for a company engaged in this sort of work in Alberta. All applications should indicate education, experience and salary expected. Apply to Box No. 3365-V.

CIVIL OR MECHANICAL ENGINEER with four or five years experience in a pulp and paper company is required by a company engaged in this work in eastern Ontario. Apply to Box No. 3367-V.

ELECTRICAL

ELECTRICAL OR MECHANICAL ENGINEER is required by a firm in Ontario, for work in connection with research and development in electrical farm equipment. Some experience in design and manufacturing methods desirable. Apply to Box No. 3309-V.

SIX ELECTRICAL ENGINEERS, preferably graduates, but not necessarily experienced, are required for specification work by a company in Montreal engaged in the production of telephone systems, automatic dialing equipment, etc. Preference will be given to young veterans, who will be completely trained. Salary $170. to $250. a month. Apply to Box No. 3324-V.

ELECTRICAL ENGINEER, graduate, young man with at least one year of construction experience since graduation, bilingual, is required for work in connection with the erection of wood pole, steel tower transmission lines and sub-stations in various parts of the province of Quebec. Salary open. Apply to Box No. 3332-V.

ELECTRICAL ENGINEER, graduate with a minimum of two years' experience, including a background in power generation. Preference to veterans. Location: southern Ontario. Salary $225. to $275. a month. Apply to Box No. 3344-V.

ELECTRICAL ENGINEER with some experience with machinery and/or electrical installation work, with ability to get along with people, and interested in investing some capital, is required for executive work with a small company on the west coast for work in connection with the electrical machinery requirements and installation of lighting and power plants in the province. Salary open. Apply to Box No. 3352-V.

SEVERAL ELECTRICAL ENGINEERS, two experienced ,if possible, in transmission and distribution line work; two recent graduates are required for rural electrification work in the province of Quebec. Salary $2400.-3000. yr. Apply to Box No. 3368-V.

MECHANICAL

MECHANICAL ENGINEER, graduate, with at least four years' experience, some of it supervisory is required by a firm in Montreal, to be responsible for the maintenance of textile machinery and equipment. Age 26-32. Location: Ontario. Salary about $250. to $300. a month. Apply to Box No. 3294-V.

MECHANICAL ENGINEER, recent graduate, preferably ex-service man is required by a company in the Toronto area for work in salt processing, steam heating evaporators, power plant etc. Age 25-27. Salary $200. to $300. a month depending on qualifications. Apply to Box No. 3308-V.

MECHANICAL ENGINEER, age about 35-40 with experience in thermo-dynamics, mechanical and chemical work is required to be chief engineer of a company in the Toronto area. Preference to ex-service man. Salary about $400-$600. a month. Apply to Box No. 3308-V.

FIVE MECHANICAL ENGINEERS, preferably graduates but not necessarily experienced, are required for manufacturing methods engineering by a company in Montreal engaged in the production of telephone systems, automatic dialing equipment, etc. Preference will be given to young veterans who will be completely trained. Salary $170 to 250. a month. Apply to Box No. 3323-V.

MECHANICAL ENGINEER, with 4 or 5 years industrial experience since graduation, with knowledge of and interest in steam as applied to industrial equipment, and preferably some experience in ventilation work and in pulp and paper mills, is required by a company in southern Ontario. Salary $3600. per year. Apply to Box No. 3333-V.

MECHANICAL OR CIVIL ENGINEER, with at least five years' experience in pulp and paper industry, and capable of assuming responsibility, is required to plan, direct, and technically supervise new development work in the mills of a company with headquarters in southern Ontario. Salary $4800 to $6000 per year. Apply to Box No. 3334-V.

THREE MECHANICAL ENGINEERS, recent graduates, (1946) for draughting and engineering work in the office and field. Location: southern Ontario. Preference to veterans. Salary $200. to $225. a month. Apply to Box No. 3344-V.

MECHANICAL ENGINEER, preferably graduate, with some experience in general lines of contractors' equipment including tractors, shovels, diesel engines, concrete machinery, etc., is required to act as manager of machinery department head office of a large machinery house in the maritimes. Salary excellent. Apply to Box. No. 3353-V

MECHANICAL ENGINEER, graduate, with some experience in the sale of marine engines, is required to head up the marine department of a large machinery house in the maritimes. Remuneration would depend entirely on the ability and efforts of successful candidate. Apply to Box No. 3355-V.

EIGHT MECHANICAL ENGINEERS or senior draughtsmen are required for design on a large plant extension project near Montreal. Salary $200. a month and good room and board available. Apply to Box No. 3360-V.

MECHANICAL ENGINEER, senior man is required for responsible position in a pulp and paper mill in the province of Quebec. Salary open according to qualifications. Apply to Box No. 3361-V.

MECHANICAL OR ELECTRICAL ENGINEER, preferably but not necessarily with some experience on design of tools and small parts is required by a company in the Montreal area. Salary: open. Apply to Box No. 3374-V.

MECHANICAL ENGINEER with some experience, and ability to handle men is required to act as rock quarry superintendent for a company in southern Ontario. Company house available on property. Replies, which will be treated confidentially, should state experience, salary required, availability and should be addressed to Box No. 3378-V.

TWO OR THREE MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

MINING ENGINEER

MINING ENGINEER, with good experience, is required by a company in Brazil, South America, engaged in the mining and smelting of lead. Successful candidate would have complete authority to operate mine, and in addition to salary would have house accommodation provided. Salary open. Apply to Box No. 3321-V.

MISCELLANEOUS

CONSTRUCTION AND MAINTENANCE ENGINEER and a DESIGNING ENGINEER, preferably witb pulp and paper mills experience are wanted for a paper mill in Newfoundland. Salaries would be from $250. a montb up depending on qualifications. Apply to Box No. 3239-V.

PRODUCTION ENGINEER, eitber graduate or with good practical experience is required by a manufacturer in eastern Ontario. Candidates should be 30 to 40 years old and should have experience in production methods in the manufacture of small parts and assemblies, and in cost control. Apply to Box No. 3257-V.

GRADUATE ENGINEER in mechanical and electrical is required for a junior position as assistant to the works engineer of a company in southern Ontario engaged in the manufacture of wire, fences, gates, mesh, etc. Apply to Box No 3278-V.

GRADUATE ENGINEER with a good knowledge of the manufacture of steel containers such as oil drums, etc., and with sales and manufacturing inclinations is required by a manufacturer of this type of product in Toronto. Apply to Box No. 3281-V.

SALES ENGINEER, not necessarily a graduate but with engineering qualifications and aptitude, is required by a firm in Ontario engaged in selling machinery to tbe construction industry. Veteran preferred. Apply to Box No. 3290-V.

DRAUGHTSMAN, not a graduate, is required by a firm in Montreal engaged in beating and ventilating work. Prefer young man with little or no experience, to be trained. Apply to Box No. 3293-V.

SERVICE REPRESENTATIVE is required by a firm in Toronto to sell automotive, electrical and fuel system parts, and to train automotive mechanics. Position would be in Ontario and salary is open according to qualifications. Apply to Box No. 3295-V.

ARCHITECT, graduate, preferably, but with some reasonable experience, with good background and personality is required by a firm in Montreal. Interested in someone willing to start at tbe bottom with prospects of eventually becoming a partner in the firm. Apply to Box No. 3298-V.

DRAUGHTSMAN, preferably someone experienced in process piping work in food industries is required by a firm in the Montreal area engaged in consulting work Apply to Box No. 3299-V.

DRAUGHTSMAN, not necessarily a graduate but experienced, to assist in tbe work of preparing machinery, pipe arrangements and details of cargo ships, is required by a firm on tbe west coast. Salary about $225. a montb. Apply to Box No. 3302-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of bigb grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose pbotograph to Box No. 3303-V.

SALES ENGINEER, witb some experience and if possible, bilingual, is required by a company in Montreal handling contractors' equipment, road building equipment, electrical devices sucb as generators and vibrators and snow machinery. Salary open according to qualifications. Apply to Box No. 3304-V.

TECHNICAL SALES ENGINEERS are required by an oil company in tbe Montreal area. Candidates must be bilingual, and experience may range from recent graduate up. Salary will be $150. to $250. a montb depending on qualifications. Apply to Box No. 3320-V.

YOUNG ENGINEER, age 25-30, not necessarily a graduate, interested in pbotography, publicity, editorial and journalistic work, is required to act as assistant to the Sales Development Manager of a large company in the Montreal area. Salary $200-$225 a montb. Apply to Box No. 3322-V.

DESIGNING ENGINEER witb four or five years experience in designing and detailing is required for work with consulting engineer in Vancouver. Salary is open according to qualifications. Apply to Box No. 3325-V.

TWO INSTRUMENTMEN, one experienced on layout and quantities on beavy construction, the otber experienced in transit surveys and levelling, are required for survey work in eastern Ontario. Standard salaries will be paid and work will last for possibly two years or more. Apply to Box No. 3327-V.

TWO DESIGNERS, witb a minimum of tbree years draugbting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V

GRADUATE ENGINEER, age 25-35, preferably married wtb five to 10 years experience in the design of complicated machines to be trained in the designing of sboe machinery. Starting wage will range from $60. to $75. a week for five-day week. Apply to Box No. 3330-V.

TWO ARCHITECTURAL DESIGNERS AND DRAUGHTSMEN, or arcbitects with some experience in modern materials and design are required by a young progressive firm of architectural designers and engineers in Alberta. Salary will be commensurate with ability. Apply to Box No. 3331-V.

GRADUATE ENGINEER, veteran, interested and talented in editorial work, age 27-30, is required for work in Montreal. Salary open. Apply to Box No. 3349-V

TWO ENGINEERS experienced in heating and ventilation work in the newsprint field are required by a pulp and paper mill in eastern Canada. Salary open according to qualifications. Apply to Box No. 3356-V.

ONE MECHANICAL AND TWO ELECTRICAL OR CHEMICAL graduates are wanted for a two-year course witb a firm manufacturing electric wire and cables, telepbone equipment, etc. Training through various departments of several factories, including some sales. Salary about $175. a month. Apply to Box No 3364-V.

MECHANICAL, ELECTRICAL OR CIVIL ENGINEER, recent graduate wbo must bave fluent knowledge of Spanisb, preferably under 30, is required by a firm in the Montreal area for technical work in connection with production. Some travelling. Salary open according to qualifications. Apply to Box No. 3373-V

RECENT GRADUATE in cbemical, mechanical or electrical engineering is required to be trained in beating and ventilating field with a company in Montreal. Candidates should be completely bilingual. Salary $30. to $50. a week. Apply to Box No. 3375-V.

DRAUGHTSMAN is required for design work, preferably witb some experience in the construction field. Work will involve estimates and detailing of precast concrete work. Salary about $250. a month depending on qualifications. Apply to Box No. 3376-V.

ENGINEER, witb considerable experience in foundry work and administration, is required for a senior position by a firm of manufacturers witb head office in Toronto. Salary range $5000.-$8000. a year. Apply to Box No. 3379-V.

RADIO ENGINEER

Graduate engineer with six years' experience preferably in aircraft radio and radar installations design. Must be thoroughly familiar with aircraft electrical design standards and methods. Permanent position. Good salary.

Apply: Canadair Limited, P.O. Box 6087, Montreal, P.Q.

ELECTRICAL ENGINEER

Graduate engineer with six years' experience preferably in aircraft. Four years in aircraft electrical system design and at least two years in aircraft instrument installation design. Must be thoroughly familiar with aircraft electrical design standards and methods. Permanent position. Good salary.

Apply: Canadair Limited, P.O. Box 6087, Montreal, P.Q.

STEAM PLANT ENGINEER

Wanted, fully qualified technical man, with at least five years' practical experience. Must be thoroughly familiar with thermo-dynamics, combustion control, steam turbines, mechanical refrigeration, hydraulics, etc.

Permanent position and attractive salary for the right man. Apply to Box No. 3177-V.

ELECTRICAL AND CIVIL ENGINEERS

Steady positions with large public utility, location Toronto, ages 30 to 40; 5 to 10 years' experience, salary range, $250. to $350. per month depending on experience.

Electrical engineers required for estimating, designing and general engineering work on hydro-electric generating or transformer stations.

Civil engineers required for estimating, designing and general engineering of steel and reinforced concrete structures.

Apply stating experience, education and professional affiliations to Box No. 3429-V.

Situations Wanted

SENIOR REINFORCED CONCRETE DESIGNER and civil engineer, R.P.E. (Ont). experienced field and office, various countries, seeks first class opening. Apply to Box No. 107-W.

CIVIL ENGINEER, B.Sc.M.E.I.C., R.P.E. (Man.) and Dominion Land Surveyor, now in the army but expects early discharge. Experience comprises seven years air photo surveys, land subdivision, drainage plans, precise levels and topographic mapping and seven years administrative and technical direction in connection with sewers, water mains, roads, building and camp construction. Age 42, married. Apply to Box No. 589-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont.), age 42, married. Experience in general plant engineering work, design, layout and testing of equipment. Also worked as field engineer on various construction projects. Position in Ontario preferred. Apply to Box No. 1249-W.

EXECUTIVE ENGINEER available. Graduate in mining, Jr.E.I.C., age 35, married, two dependents. Five years' experience in mining and milling, mine development, construction and operation. Canadian and foreign experience. Five years' administrative experience, mass production, development and supervision. Was assistant superintendent of operations in large industrial munitions works. Capable of handling personnel and planning, seeks a responsible position in industrial business or mining. Available on short notice, registered with W.B.T.P. Apply to Box No. 1423-W.

GRADUATE CIVIL ENGINEER, M.E.I.C., P.E.Q., 20 years work on hydraulic plants as designer and superintendant of construction. Extensive experience in guniting, diamond drilling and pressure grouting. One month notice. Apply to Box No. 1527-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont). interested in mechanical design and production; experienced in hydro-electric station design, transformer and machine layouts and in development and design of radar equipment. Services available immediately. Location preferred: Toronto or Hamilton. Apply to Box No. 1693-W.

GRADUATE ENGINEER, B.Sc. (Civil) M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to Box No. 2440-W.

MECHANICAL ENGINEER, age 34, Lt. (E) R.C.N.V.R. soon to be discharged. Experience, 6 years' heavy maintenance on railroad; 5 years as charge hand on maintenance and renewal of mine and smelter equipment, 2 years foreman of large boiler shop; 2 years production engineer, job estimating and planning, two years with Navy of which 20 months have been at sea. Thorough knowledge of machine and boiler shop, able to plan and handle men, registered with W.B.T.P. Apply to Box. No. 2456-W.

CHEMICAL ENGINEER, young university graduate, previously engaged in war industry, desires permanent position. Available immediately. Apply to Box No. 2464-W.

CHEMICAL ENGINEER, single, age 25, B.Sc., Sask. '42. Recently discharged from the army. At present taking post graduate work. No significant industrial experience. Interested in a position in production or plant control. Services available in May 1946. Apply to Box No. 2593-W.

CHEMICAL ENGINEER, B.A.Sc., U.B.C., S.E.I.C., Jr.A.I.Ch.E., age 25, married, no dependents, residing in east, desires employment in production control and/or sales service in Ontario or Quebec. Apply to Box No. 2594-W.

ELECTRICAL ENGINEER, R.P.E. (Ont.) age 28, married, C.G.E. Test Course and Sales. Five years' plant experience in direct charge of engineering, maintenance and construction of several large chemical plants. Would consider employment with progressive engineering organization or in sales. Prefer Ontario. Apply to Box No. 2596-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 37, 12 years experience in pulp and paper industry, both technical and production, also three years research in paper containers, during war. Bilingual; would like to return to paper industry. Available at a month's notice. Apply to Box No. 2609-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng. (Ont.), vaailable with one month notice or less. Age 44, married, three children. Six months mining engineering experience, three years mechanical experience in large implement factory, supervision since 1940 for Inspection Board of U.K. and Canada of a large staff on inspection of electrical apparatus and equipment. Seeks position with considerable administrative responsibility based on electrical production or maintenance. Abl to go anywhere on continent. Apply to Box No. 2614-W.

INDUSTRIAL ENGINEER, graduate in civil engineering, B.Sc.A., M.E.I.C., single, age 30, bilingual. Experience in industrial engineering work; plant layout, time and motion study, wage incentive, work simplification, job evaluation, material handling, cost and production control, cost reductoin research available, prefer Montreal, highest references from former employers. Apply to Box No. 2616-W.

GRADUATE MECHANICAL ENGINEER, Prof. Eng. (Ont.) Jr. E.I.C.. married, age 31. Experience covers machine shop apprentice, engineering design, chemical plant design, field engineer on construction work, plant operation and superintendent in large plants employing modern plant management methods. Past 8 years have been with present employer. Now wishes to make change to smaller company with opportunity of securing position of responsibility. Apply to Box No. 2629-W

LIBRARY NOTES

(Continued from page 282)

A.S.T.M. STANDARDS ON ELECTRICAL INSULATING MATERIALS (with Related Information):

Prepared by A.S.T.M. Committee D-9 on Electrical Insulating Materials; Specifications, Methods of Testing; October, 1945. American Society for Testing Materials, 260 So. Broad St., Philadelphia. 545 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $3.25.

The specifications and test methods covering electrical insulating materials are here brought together, with several reports on the significance of the tests and other subjects of interest.

AMERICAN CHEMICAL INDUSTRY, the World War I Period: 1912-1922, Vol. 3:

By W. Haynes. D. Van Nostrand Co., New York, 1945. 606 pp., illus., tables, 10 x 6½ in., cloth, $8.00.

This volume covers the period of the first World War, during which the American chemical industry shook off its dependence upon Germany and laid the foundations for developments of later years. The advances in industrial, coal-tar and fine chemicals are described in some detail, and the chemicalization of industry is discussed. Many statistical tables and portraits of chemists are included, as well as numerous references to sources.

ART OF PLAIN TALK:

By R. Flesch, foreword by L. Bryson. Harper & Brothers, New York and London, 1946. 210 pp., tables, 8¼ x 5 in., cloth, $2.50.

Some two years ago Mr. Flesch published his Ph.D. dissertation, "Marks of Readable Style". Being a thesis it was not a very readable book, so he has rewritten it in simple language. This book is the result. It is not a book on Basic English. Scientific studies of readability have produced a formula based on sentence length, and on the number of affixes and personal references included. The main feature of this book is this formula which is intended only as a yardstick. Readers are warned not to wallow in the little rules and computations and thus lose sight of the principles of plain English. Examples of difficult material and the same rewritten in simple English are included. One reading of the book will not automatically make one a good writer.

AVIATION FACTS AND FIGURES 1945:

Edited by Aircraft Industries Association of America, Inc., R. Modley, editor. McGraw-Hill Book Co., New York and London, 1945. 173 pp., tables, 9 x 5¾ in., cloth, $2.50.

This is a comprehensive reference handbook of pertinent data and statistics on aviation as a whole, covering the entire field; the book gives particular emphasis on the aircraft industry. It deals fully with the civil and military use of aircraft, with exports, service facilities, and the relation of aviation to other means of transportation. Specifically a reference book for executives in the aircraft industry, transportation, finance and government, it is useful as well for editors and students.

FLUOROCHEMISTRY:

By J. De Mont. Chemical Publishing Co., Brooklyn, N.Y., 1945. 795 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.50.

The basic concepts of fluorochemistry are defined in this comprehensive work, with description of its characteristic phenomena. The applications of fluorescence, luminescence and radiation in science, medicine and industry are explained in simple language. The book describes methods for the preparation of the various luminescent organic substances, dyestuffs and coloring matters, ultraviolet-emitting inorganic and organic substances and gives qualitative and quantitative tests for their identification. Experimental research results are presented, and there is an extensive bibliography. A glossary of terms and notations is appended.

INDUSTRIAL OIL AND FAT PRODUCTS:

By A. E. Bailey. Interscience Publishers, New York, 1945. 755 pp., illus., diagrs., charts, tables, 9¾ x 6 in., cloth, $10.00.

Primarily a text on oil and fat technology, the greater part of this volume is devoted to a description and discussion of the commercially important oil and fat products and the processes used in the manufacture of these products. In two preliminary sections the chemical and physical nature of fats and oils is briefly reviewed, and the various fatty raw materials are considered with respect to their composition, characteristics and availability. Special attention has been given to the edible fats and oils and to the practical operations of refining, bleaching, deodorization and hydrogenation.

MACHINE-TOOL WORK, Fundamental Principles:

By W. P. Turner and H. F. Owen. 2 ed. McGraw-Hill Book Co., New York and London, 1945. 364 pp., illus., charts, tables, 8½ x 5 in., cloth, $3.00.

This textbook, based upon a course in the subject given at Purdue University, offers systematic instruction in the fundamental principles of the subject that will serve as a background for the necessary further study of industrial processes and practices.

NORMALISATION:

By J. Maily, preface by P. Salmon. Dunod, Paris, 1946. 472 pp., 9¾ x 6½ in., paper, 375 frs. (In French)

In this interesting study of standardization, attention is given especially to the legal aspects of the subject and on its effects on the general economy of a country. The principles and methods of standardization and the applications of standards are reviewed in the first section. The second deals with standardization in France. Standardization in Germany and England is briefly reviewed, as is international standardization.

THE ENGINEERING JOURNAL

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* * *

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COVER PICTURE

Under proper soil conditions, underground telephone cable is now laid in one operation. The cover picture shows a plough train progressing through a ravine. The train consists of the lead tractor equipped with derrick designed to handle four-ton cable reels, the No. 2 tractor equipped with a four-drum winch used for raising or lowering the plough share, and finally the plough itself followed by two cable reel trailers. (See Article on p. 299).

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A MODERN ELECTRIC BOILER INSTALLATION AT ARVIDA

F. L. LAWTON, M.E.I.C.
Assistant Chief Engineer

M. G. SAUNDERS, M.E.I.C.
Plant Engineer, Kingston Works, formerly Mechanical Superintendent, Arvida Works
Aluminum Company of Canada, Limited

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Introduction

This paper deals with a recent electric boiler installation at the Arvida Works of the Aluminum Company of Canada, Limited. Constructed in 1944, it embodies certain departures from previous practice which make it one of the outstanding electric-boiler plants in Canada.

The plant contains two electric boilers of the single-tank Kaelin type having a normal rating of 37,500 kw. at 6600 volts, and a maximum continuous rating of 40,000 kw. each. Provision has been made so that two additional boilers of the same rating can be readily added.

Existing Steam Production Facilities

Arvida Works already had available three electric steam generators, one of 8,000 kw. and two of 15,000 kw. rating, the first of which was installed in 1927 and the last two in 1937 and 1939 respectively.

The need for all available electric energy for the production of aluminum for war purposes made it imperative that coal-fired boilers be used instead of electric boilers. Consequently, the existing three 485 hp. coal-fired boilers were used together with six 131,000 lb. per hour pulverized-coal steam-generating units installed at various times throughout the war.

A comprehensive review of steam plant development at Arvida Works up to 1944 is contained in a paper "The Development of Steam Production at Arvida" by M. G. Saunders, presented at the 58th Annual Professional Meeting at Quebec, 11th February, 1944, and published in the June, 1944 issue of *The Engineering Journal.*

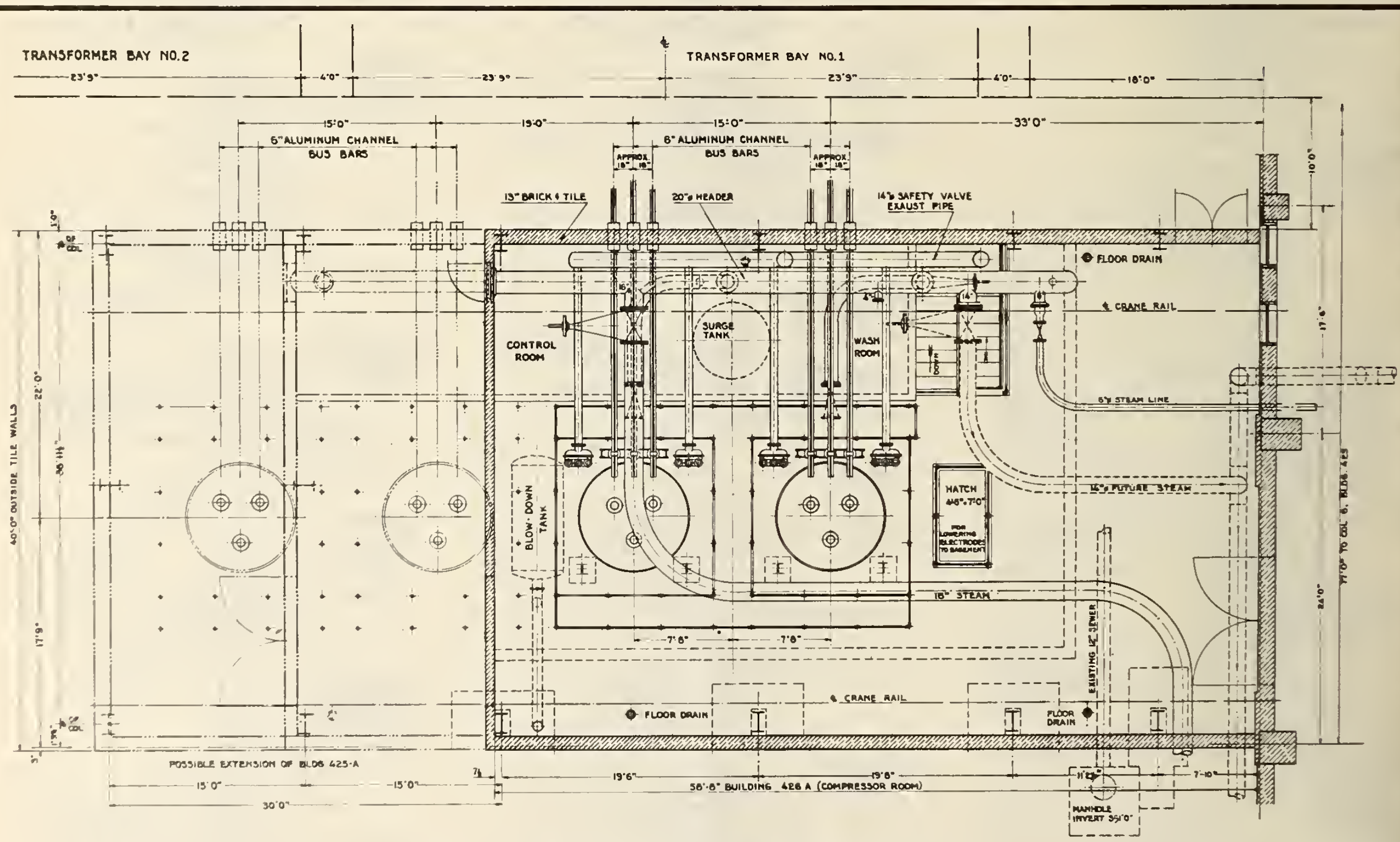
When it became apparent that surplus electric energy would once more be available for use, consideration was immediately given to the preparation of plans for additional electric steam generation.

After a careful survey, the initial electric-steam generating capacity was selected to meet all requirements for a reasonably optimistic post-war aluminum production.

In order to utilize this power to the best advantage it was decided that a final installation of four 37,500 kw. steam generators would be planned but that two such units would meet immediate needs.

Building

The building for the electric boiler plant is essentially an extension of the boiler plant serving Ore Plant No. 2. The existing fuel-fired plant in that location comprised two Combustion Engineering Corporation VU pulverized-coal units each with a capacity of 131,000 lb. steam per



NOTE:
PLAN TAKEN BELOW ROOF BEAMS

PLAN OF ELECTRIC BOILER PLANT
FIG. 1

hour. Consequently, a prime consideration in the design of the new plant was the usage of the same auxiliaries for the existing and new boilers, as it was very unlikely that the complete combustion and electric boiler installations would ever have to be operated in parallel.

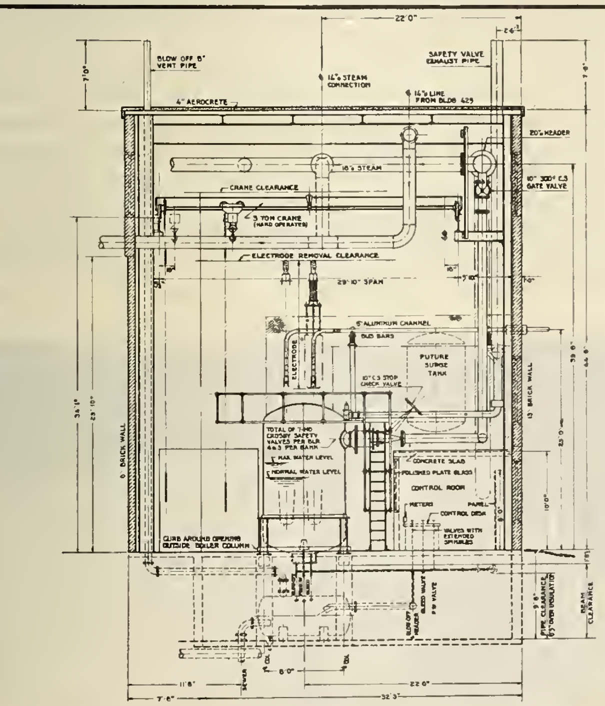
The addition matched the existing building and consisted of a structural steel framework, with 13 in. terracotta tile and brick walls, 4 in. aerocrete slab roof, reinforced concrete operating floor and concrete basement.

The design of the boiler house was such as to permit it being extended to take two additional electric boilers of the same rating at a later date and was so laid out that all operating controls could be run to a central operating table so located it would be in the centre of the final setup. A control room completely separated from the main boiler room was provided to protect the operators from injury in case of accident to the steam mains or boilers. Note Figs. 1 and 2. Figure 3 shows the control room to the right, with the hatch providing access to the basement for electrode repair, etc., in the foreground.

For the convenience of operating personnel, one end of the control room was enclosed, to provide toilet facilities.

The building provided rather more room than is usually allowed for electric boilers, which are ordinarily crowded into restricted areas in an existing plant, and embodied a 3-ton crane for handling the electrodes into and out of the boilers as required. As previously mentioned, it contained a basement in which all feed, bleed and blowdown piping could be carried on the ceiling so it would be readily accessible. This is a departure from usual practice in which such piping is ordinarily run in trenches below operating floor level. It is believed this feature will prove to be very advantageous in operation and maintenance over a long period. Figure 3 is a general view of the inside of the boiler room showing the end of the control room at the right. Accessibility to piping connections has been provided for in the design.

One of the difficulties frequently encountered in electric boiler rooms is the dusting of concrete floors due to maintenance work and the objectionable staining which sometimes occurs. For this reason, it was decided to finish the boiler room floor with Welsh quarry tile. This has resulted in an attractive and clean plant.



TYPICAL SECTION THROUGH ELECTRIC BOILER ROOM

FIG. 2

The cleanliness of the boiler room has been enhanced and the illumination improved by a dark dado above which aluminum paint has been applied directly to the tile walls and aerocrete roof slabs. The appearance of the boiler installation has also been enhanced by the use of aluminum railings on the platform at the upper heads and around the stairways and hatches, as illustrated by Fig. 3.

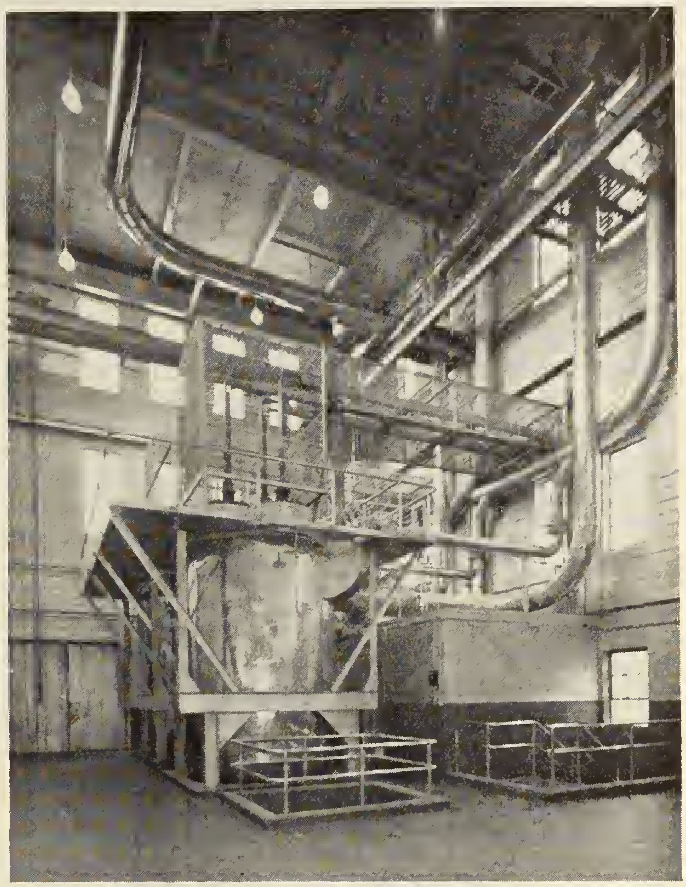


Fig. 3—Electric boiler plant, showing aluminum foil-air cell heat insulation on boilers and piping, aluminum railings and aluminum bus. Note control room to right.

Lighting

The operating floor is lit by eight 500-watt and two 200-watt Holophane prismatic glass units giving about 10 foot-candles on the working plane. To supplement this, four 100-watt RLM units are installed under the platform around the top of the boilers, to eliminate shading the area beneath.

The control room is lit by three fluorescent units, each unit consisting of two 40-watt fluorescent lamps. This room has an illumination of 30 to 40 foot-candles on the working plane. The units here were chosen so that there would be no undue heating from the lighting system. Because of the low ceiling a wide light source was necessary.

The basement is provided with seventeen 100-watt bare lamps in porcelain receptacles. Reflectors were not used because of the lowness of the ceiling; also the light painted surface acts as a reflector.

Particular attention was paid to lighting the water columns which register the water level in the boilers. Various schemes were considered, with four adjustable reflectors being provided. Two of these reflectors are above the gauge glass and two are below; 100-watt lamps are used and the light is so directed that no glare is experienced by the operator viewing the water columns.

Conventional lighting units are provided in the outdoor substation so that the operators can carry out switching at night and make their routine inspection of transformers and switchgear.

Factors Affecting Selection of Electric Boilers

In the operation of the first electric boilers at Arvida Works, a very good operating record had been built up, and with some changes in design it was believed the same type of units, namely single-tank Kaelin-type boilers, would give a very satisfactory operating performance. It was also considered that surplus electric energy would be available over a sufficiently long period of time to justify making a proper installation for its use.

Design of New Electric Boilers

A normal rating of 37,500 kw. per unit was chosen because of the capacity of the available transformers and also because it was about the limiting capacity which could be developed with the available feed water, the average conductivity of which is about 600 ohms per inch cube at boiler temperature, with the maximum size tanks (96 in. diameter) available.

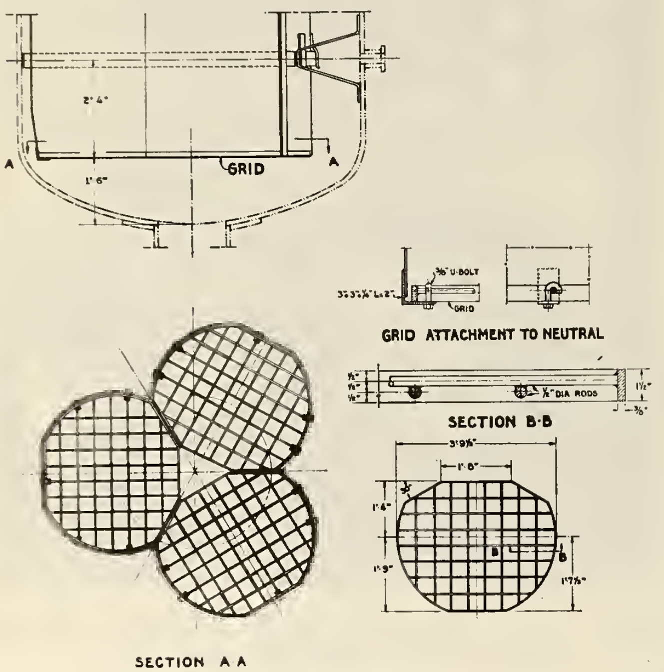


Fig. 4—Shielding grid for bottom head.

A welded design of electric-boiler tank was used. The welded design was adopted in order to get away from the leaks frequently experienced with large-size electric boilers due to the rapid temperature changes ordinarily encountered in operation: The welded design has proven itself entirely successful during the first eleven months of operation, even though this is the first time such large tanks with welded heads and connections have been used, so far as known, for electric boilers.

Careful consideration was given to the design of electrodes for the new boilers in order to avoid the rapid wear experienced with some of the older designs. The shape of these electrodes is essentially cylindrical in the upper portion with the lower section slightly conical and having a hemispherical tip, which tip is substantially thickened over previous practice. Although gray cast iron has given very good results, it was decided to equip one boiler with a set of electrodes made from Ni-resist cast iron, in order to obtain comparative results.

The electrodes are so shaped the current density is about 0.79 amps. per sq. in. with a boiler water conductivity of 600 ohms per inch cube, except on the tip where it reaches a maximum of 1.12 amps. per sq. in.

With some of the earlier installations of electric steam generators, and in particular the initial 8,000 kw. unit at Arvida, considerable pitting on the bottom head has been noted. Somewhat similar experience has been encountered with electric boiler installations in the paper-mill industry. The cause of this pitting is not definitely known but it appears to arise from chemical corrosion and arcing at low electrode immersions—that is to say, on light loads as a result of normal operation or during some emergency conditions, sludge accumulations on the botton head tend to develop localized current concentrations and burning at such points. To overcome this, an anti-pitting device consisting essentially of a shielding grid of bars covering the bottom head was provided, as shown by Fig. 4. This grid is composed of segments small enough to be introduced through the manhole or electrode openings. The bottom heads are made of fire-box grade steel, fully silicon killed and easily weldable.

General design of the electric boilers has been previously discussed but at this time particular note might be given the relatively low setting secured by having the clean-out sump below the operating floor level, so that it is accessible from the basement floor. By this means, approximately 3 ft. of head room was saved, as well as a certain amount of building height, which largely offset the cost of the basement.

In order to obtain an unrestricted working space alongside the boilers, the steam and blow-off leads and water columns are all located on the same side, which is shown by Figs. 2 and 3.

The electric boilers are designed for 250 lb. per sq. in. steam pressure, in line with the design of the entire steam system at Arvida Works, although present operating pressure is approximately 200 lb. per sq. in. As the length of distribution lines and losses, together with demand, increase, the pressure will be raised nearer to the design limit.

Feed-water Facilities

As the capacity of the electric steam-generator units is approximately the same as that of the previously-installed coal-fired boilers, it was planned to make use of the same feed-water auxiliaries, although, for electric boilers, feed-water treatment is not necessary.

However, the existing deaerating feed-water heater was used as it was believed that less expansion stresses would be placed on the boiler shell by using comparatively warm feed-water and there was no appreciable heat loss by so doing.

There was some extra feed-water heater capacity in the original plant design so it was felt that one or possibly more of the coal-fired boilers might be operated in parallel with the electric boilers. In order to make this possible, and to compensate for the additional amount of feed-water required due to the bleed from electric boilers, one large boiler feed pump was transferred from one of the other boiler houses to the new setup, but otherwise the existing feed-water auxiliaries were used as they stood.

Fig. 5—Preformed aluminum foil-air cell heat insulation "bats". The circular bats were used on steam pipes, whereas the flat bats were used on the electric boiler shells.

Operating tests indicate that one of the coal-fired boilers can be run at about one-third full load rating in parallel with the electric boilers before the feed-water heater becomes overloaded.

Steam Lines

General layout of the steam lines may be visualized from Figs. 1 and 2, as well as Fig. 3. It will be noted 10 in. leads are taken from each electric boiler through the customary tangential driers and stop-check valves, to a common 20 in. header. This header is so arranged that it can be readily extended at a future date to accommodate either the third or fourth boiler.

Each boiler lead contains a steam-flow meter orifice located just ahead of the gate valves immediately adjacent to the 20 in. header. These gate valves are arranged for chain operation from the operating floor level. To establish the steam connection between the 20 in. header and the outside distribution mains, a 16 in. line was provided. For operating convenience a gate valve was provided immediately adjacent to the header. With this connection and 256,000 lb. per hour steam production (two electric boilers), the pressure drop to the distribution or street main is estimated to be 10.5 lb. per sq. in. and the steam velocity about 7400 ft. per min.

Fig. 6—Preformed aluminum foil-air cell heat insulation bats applied to upper head of electric boiler.

Because there was a 14 in. line from the existing boiler plant, located on the electric-boiler room side of the common wall between the two plants, and because the combustion boilers would normally be shut down when the electric boilers were in operation, provision was made to tie in the 20 in. header with the existing line, also through a gate valve. The general arrangement is illustrated by Fig. 1.

In addition to ample provision for expansion and contraction by long radius bends, the steam lines are carried by spring-type suspension hangers inside the building and on saddles or towers outside.

All valves are 300 lb. per sq. in. cast-steel design. The possibility of leakage in the steam lines has been minimized by the use of all-welded construction except at valves, steam orifices and where necessary in a few cases for convenience in handling the lines.

It might be well to note that, should a third electric boiler be installed, pressure losses between the header and the street mains would be minimized by utilizing a 14 in. cross-connection between the 20 in. header and the existing 14 in. line to the street, in parallel with the 16 in. connection from the header to the street, actually installed. If and when the fourth electric boiler is added, an additional 16 in. connection to the street lines will be provided.

Fig. 7—Preformed aluminum foil-air cell heat insulation applied on vertical portion of electric boiler shell.

Exhaust from the two groups of safety valves (totalling seven) on each electric boiler is carried to atmosphere through 14 in. lines as indicated by Fig. 1. The simplicity of the layout of steam lines will be appreciated.

All feed, bleed and blow-off lines largely follow standard practice except that they are suspended from the ceiling of the basement, which provides a very flexible method of taking these lines to the control table as well as facilitating maintenance.

Heat Recovery Features

Provision has been made to recover as much of the heat loss from the bleed as is possible by running a connection from these lines to the existing feed-water heater system which was formerly used with the coal-fired units. Bleed is first passed through a flash tank and the water remaining passes through a heat exchanger and gives up further heat to the incoming feed-water.

A special steam-trap arrangement is used to recover the moisture removed by the tangential steam dryers, which is also returned to the feed-water heater directly. These features provide for the recovery of practically all heat losses from the boilers except radiation and heat loss in the blow-off or blow-down.

Heat Insulation

A unique feature of this boiler installation is that the boilers themselves are insulated with aluminum foil-air cell insulation covered with an outside casing of aluminum sheet. Also the main steam header, steam piping and connections to the main steam distribution line were insulated in a similar manner.

Reasons for the selection of aluminum foil for heat

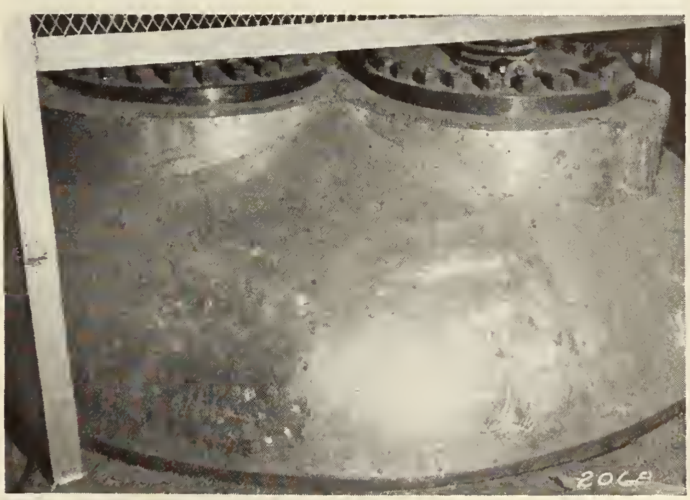


Fig. 8—Sheet aluminum protective jacket applied over preformed aluminum foil-air cell heat insulation, on top head.

insulation of the electric steam generators and steam lines, in addition to its high insulating value, were:

(a) Fireproof.
(b) Freedom from capillary absorption of water, so detrimental to most forms of heat insulation, in event of leakage.
(c) Permanency.

Aluminum foil-air cell insulation combines the low thermal conductivity of the air with the low emissivity or radiating power of bright aluminum foil in a structure designed to minimize air convection currents. The most practical structure for any particular application is necessarily a compromise between maximum thermal efficiency and cost, but it is possible to practically eliminate heat transfer due to radiation and convection, and approach the insulating value of still air, one of the best available forms of heat insulation.

There are two general methods of applying aluminum foil for heat insulation. The first involves supporting the

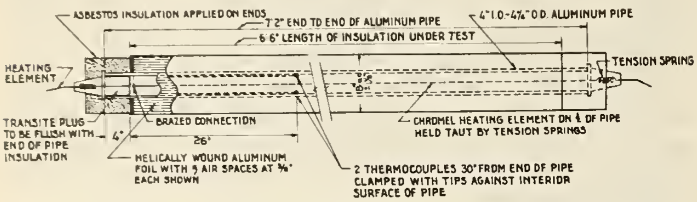


Fig. 9—Apparatus for testing effectiveness of heat insulation under conditions approximating field usage.

foil in such manner as to form a series of air cells between the bright foil surfaces. The second consists of first crumpling the foil and then partially stretching the sheets so that the wrinkles and high points separate the sheets when laid together, so forming air cells of irregular shape between the bright foil sheets.

It has been shown that the optimum spacing for aluminum foil-air cell insulation is between ¼ in. and ½ in., where maximum insulation must be secured in a given space. Convection plays very little effect under such make-up of foil and air spaces, but does above ½ in. spacing.*

* "Thermal Insulation with Aluminum Foil", by R. B. Mason, pp. 245-255, *Industrial and Engineering Chemistry,* March, 1933.

Fig. 10—Helically-wound aluminum foil-air cell heat insulation on pipe for use with cold water.

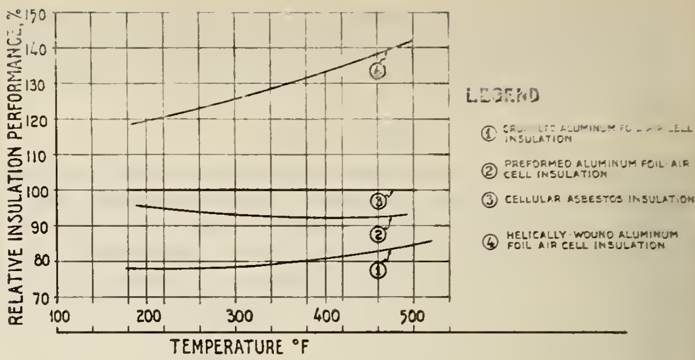


Fig. 11—Comparative insulation tests.

As no previous experience was available for the insulation of a boiler shell with aluminum foil, some experimental work was done in order to determine the best methods of application. Initially, it was planned to weld a steel grid frame to the boiler shell to support the aluminum foil but it was found that this frame transmitted a considerable amount of heat from the shell to the outer casing. In order to minimize this heat loss, the grid was finally clamped to the top flanges of the boiler shell, and was spot-welded to the boiler support channels. For further rigidity, asbestos spacers were inserted between this framework and the boiler shell where necessary. The

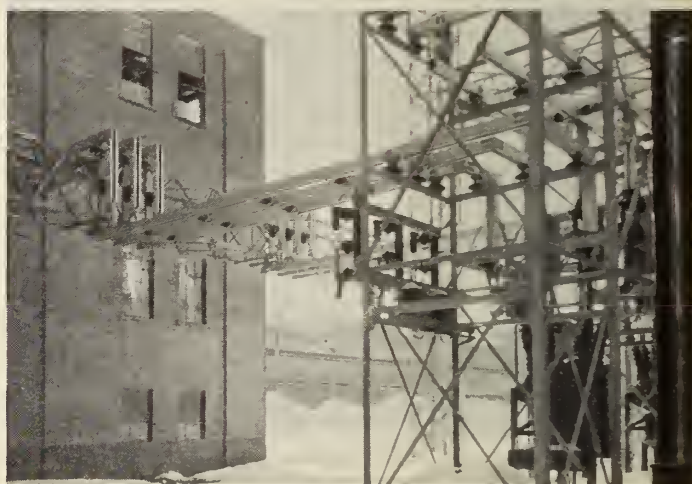


Fig. 12—6.6 kv. bus structure and electric boiler feeders for 90,000 kva. transformer bank supplying two 37,500 kw. electric boilers.

same procedure was followed for the section of the grid below the boiler support channels.

In preparing the foil for application to the boiler shell, instead of crumpling it by hand as has been common practice, a simple die was made up to do this work. Three sizes of corrugations were tried, these being ½ in., ¾ in., and ⅞ in. So far as can be ascertained to date, the ¾ in. size gave the best results as it seemed to form a more rigid structure. The foil was assembled in bats as shown in Fig. 5. As applied to the boiler shells, alternate sheets of foil were placed with the corrugations at right angles. Each bat consisted of ten layers of 0.0004 in. thick foil backed on both sides by chicken netting, ¾ in. mesh and No. 20 wire. These bats were held together by wire laced through from one side to the other and had sufficient structural strength to sustain their own weight without collapse. These bats were applied to the boiler shell as indicated by Figs. 6 and 7. Application was commenced at the bottom of the shell, working progressively upwards. Foil was allowed to project beyond the edges of the wire netting in making up each bat so that the joints could be overlapped. After the bats had been applied to the boiler shell, one further layer of foil was placed over the outside. When this work was completed an aluminum jacket, as illustrated by Fig. 8, was applied over the framework and held in position with self-tapping screws. This jacket consisted of 0.022 in. 23ST Alclad aluminum sheet. The top and bottom sections, which required considerable forming, were fabricated of standard 2S aluminum sheet.

The thickness of the aluminum foil-air cell insulation, as installed, varies from 4 to 4¼ in. With eleven layers of foil between the boiler shell and the protective jacket, there are twelve air spaces, Average thickness of the individual air cell thus is about 1/3 in.

The 10 in. steam leads from the boilers to the common header and the 16 in. main line from the header to the main plant distribution system were insulated with aluminum foil and covered with aluminum sheet applied in the same general manner. The difference in this application from that of foil applied to the boilers consisted in having the pipe inside the building insulated with preformed sections as illustrated by Fig. 5 in which the corrugations of all sheets of foil were parallel. Piping outside the building was insulated with hand crumpled foil and the metal casing was supported on metal supports.

Effectiveness of Heat Insulation

In order to secure a practical measure of the relative efficiency of the aluminum foil-air cell insulation, under conditions corresponding to field application, the apparatus shown by Fig. 9 was devised. Comparative measurements have been made to determine the performance of the insulation used as compared with other available heat insulation, such as cellular asbestos and 85 per cent magnesia.

It will be noted the test apparatus was essentially a closed vessel with a chromel heating element stretched along the axis by heavy springs supported on the transite asbestos closure plugs. The insulation under test was applied to the central 6 ft. 6 in. section of the aluminum test pipe, and end losses were minimized by a heavy carefully-moulded capping of asbestos heat insulation at either end.

Chromel-alumel thermocouples were clamped to the interior surface of the test pipe at several points, with the sensitive junctions in intimate contact with the internal pipe surface.

Although considerable initial difficulty was experienced in obtaining consistent internal surface temperatures at constant heating power inputs, these difficulties were gradually eliminated, and final observations were quite consistent. For the several test runs, the pipe position, thermocouple positions, etc., were standardized.

Experience showed that at least two hours should elapse between readings, with wattage input maintained constant.

In addition to cellular asbestos 1¾ to 1 13/16 in. thick, three forms of aluminum foil-air cell insulation were tested. The aluminum foil-air cell insulations tested consisted of four layers or sheets of 0.0004 in. foil spaced ⅜ in. with an outer protective jacket of 0.022 in. aluminum sheet, or a total insulation thickness of 1⅞-1 15/16 ins.

The helically-wound aluminum foil was applied in the manner indicated by Fig. 10. It should be noted the insulation shown in this photograph as helically-wound aluminum foil was intended for use on a cold water line but serves to demonstrate the method involved.

The preformed aluminum foil-air cell insulation was made up of bats as previously described, with the jacket

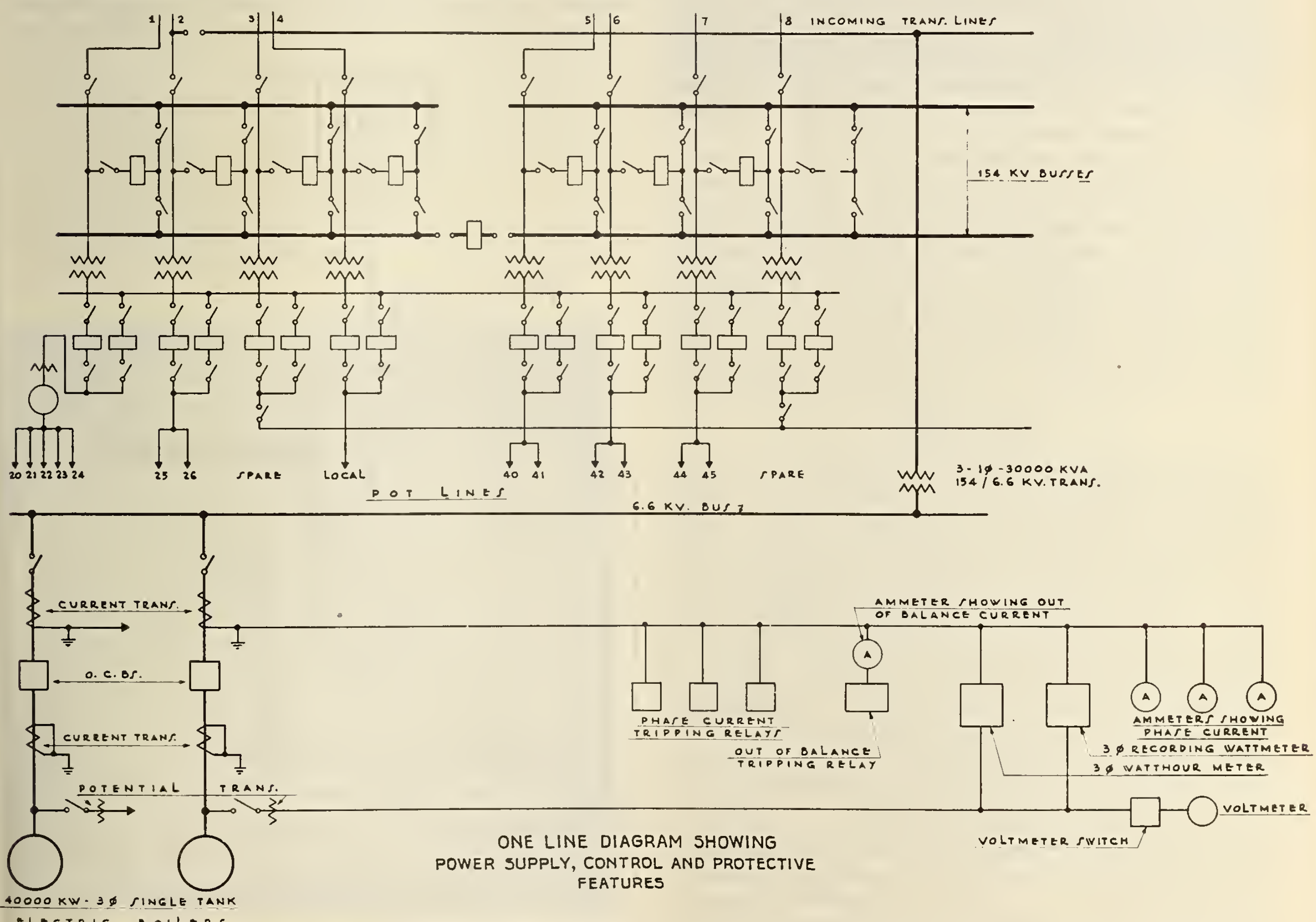


Fig. 13—One line diagram showing power supply, control and protective features.

Fig. 14—The compact control arrangements for the initial two electric boilers are shown to the left. This will be duplicated to the right, when additional boilers are added. The panels at the operator's back are the load dispatching board.

supported on transite-asbestos insulating "chairs" and rings. The preforming was carried out with a die and the individual sheets of foil had the corrugations running in the same direction.

The results obtained were quite consistent, as can be noted from Fig. 11. Apparently the preformed method of application is superior to the crumpled, and practically equivalent to cellular asbestos of equal thickness. On the other hand, the helically-wound method of application gives better results.

The comparative results are quite understandable, in that there are less areas or points of metal-to-metal contact and heat conduction with the preformed type as compared with the crumpled form. This is true in much greater measure with the helically-wound aluminum foil-air cell insulation, where the individual sheets of foil contact each other at scattered points and over small areas.

Several attempts have been made in the field to determine the heat losses from the shells and fittings of electric steam generators insulated with either aluminum foil-air cell or 85 per cent magnesia block and cement insulation. Difficulties in accurately measuring the small losses involved make it advisable to refrain from drawing any conclusions at this time but it can be stated the performance of preformed aluminum foil-air cell insulation in place on an electric steam generator compares very favourably with an equal thickness of 85 per cent magnesia block and cement insulation under similar circumstances.

Power Supply

Power for the electric boilers is furnished by a bank of three single-phase 30,000 kva. oil-insulated water-cooled transformers stepping down from 154 kv. to 6.6 kv. The transformers are located in a substation immediately adjacent to the boiler plant, as seen in Fig. 12. The transformers are supplied over a short 154 kv. steel-tower transmission line from the main step-down substation for Arvida Works. The single circuit consists of 477,000 C.M. A.C.S.R. conductors strung for a maximum tension of 9,000 lb. per sq. in. under ½ in. ice and 8 lb. wind loading at 0 deg. F. Provision has been made in the substation for an extension to accommodate a second bank of transformers if and when additional electric boilers are installed.

One of the outstanding features of the substation is the simplicity of the long-span 6 in. by 0.225 in. web, 2.99 lb. per ft. channeluminum 6.6 kv. bus which is clearly observable in Fig. 12. Spans of 16 ft. and somewhat longer are used, with two intermediate between-phase stiffeners.

It will be noted the bus is taken through wall bushings and carried inside a protective metal housing to the boiler electrode terminals. The simple long-span bus construction can be seen from Fig. 12. Flexible aluminum connections are provided at the boiler terminals, at the transformer terminals and the taps from the delta bus to the disconnect switches and circuit breakers.

The number of bolted joints in the channel bus has been minimized by the use of welded joints except where construction and maintenance convenience dictated the use of bolted joints. It is well worth noting that welded joints are of equal strength and conductivity to straight bus bar.

Figure 13 is a one-line diagram showing a portion of the power supply system and the control and protective features associated with the electric-boiler plant. It will be noted that the individual boilers are fed from the 6.6 kv. bus through gang-operated disconnects and 4,000 amp. oil circuit breakers.

All electrical equipment, including the substation structure, the transformers, 6.6 kv. circuit breakers and electric boilers, are thoroughly tied together through a heavy grounding network. This network is also tied into the general Works grounding net and the incoming transmission-line ground wires through a ½ in. ground wire on the 154 kv. line supplying the step-down transformers. The electric boilers are tied together through a 6 in. by ½ in. aluminum bus connection between suitable bosses on the boiler sumps, with the aluminum bus being tied into the network through two 400 MCM ground cables.

Control

As previously mentioned, the feed, bleed and blow-down lines are run on the basement ceiling to points under the control room. Extended valve stems are carried up to a control table fabricated of aluminum, which is so located in the control room that the operator can view the water columns of the several boilers through a large window provided with heavy plate glass. It will be noted that a

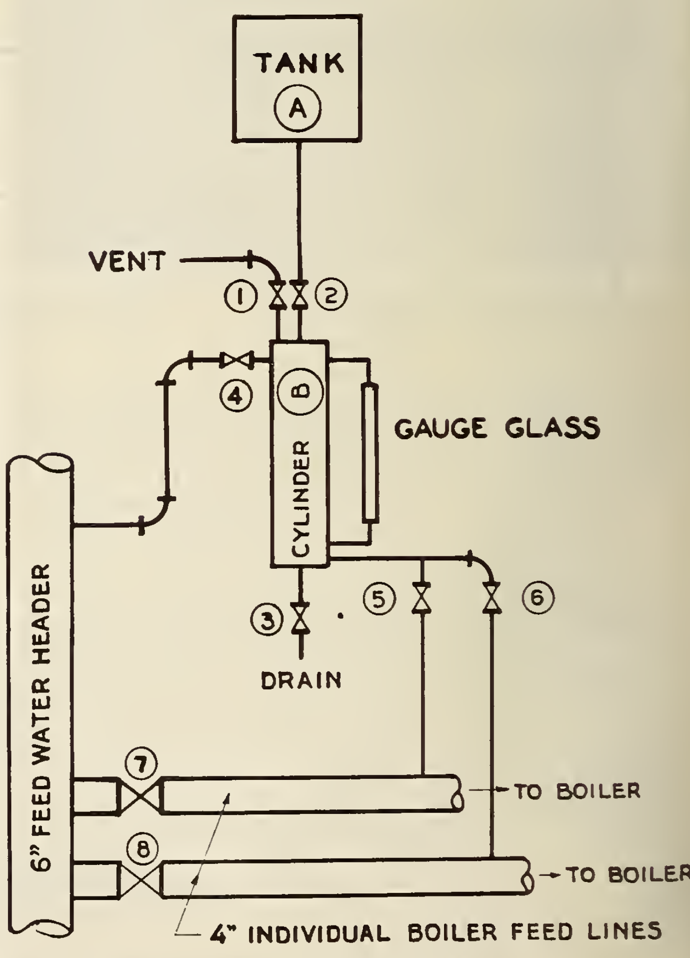


Fig. 15—Diagrammatic sketch of arrangement for doping electric boilers.

vertical section of the control desk carries the three-phase ammeters for each boiler so that the operator has before him at all times an indication of the current taken by each phase of the electric boilers. Immediately to his left are two control panels carying a three-phase watthour meter, a three-phase recording wattmeter, an ammeter showing the out-of-balance current and a voltmeter provided with a voltmeter switch so that the voltage on any phase of the 6.6 kv. bus can be readily ascertained. These panels also carry the protective relays of the inverse over-current type with instantaneous tripping feature. In addition, there is an inverse over-current relay operating on out-of-balance current. At the level of the ammeters indicating phase current a control switch is provided whereby the operator can immediately clear a boiler on trouble by tripping the 6.6 kv. circuit breaker.

A very compact arrangement for two boilers has been secured, and provision is made for duplicating this layout to the right, if and when the third and fourth boilers are added. Note Fig. 14.

Each boiler is provided with an integrating and recording steam-flow meter and graphic pressure gauge.

A 125-volt storage battery, trickle-charging motor-generator set and control panel located in the basement provides control power for the circuit breakers, indicating lights, etc., as well as emergency lighting.

As the electric boiler plant will be the nerve centre of steam production and distribution, at ordinary aluminum production levels, the dispatcher's steam control panel has been located immediately behind the operating table. This panel is shown in Fig. 14, and contains indicating meters which show the steam load on the various main plant units at any given time. This enables the boiler operator to immediately check where any sudden changes in demand may occur and allows him to regulate his boiler output accordingly. Telephone connection with the other boiler houses enables the operator to adjust the boiler loads to suit the demand from various sections of the plant. This board also contains similar meters showing air distribution for the plant as approximately one half the air compressor capacity for Arvida Works is located in the main building at this boiler plant.

Main water-supply meters are also located on this panel which makes the boiler operator the centre for the control and distribution of plant steam, air and water.

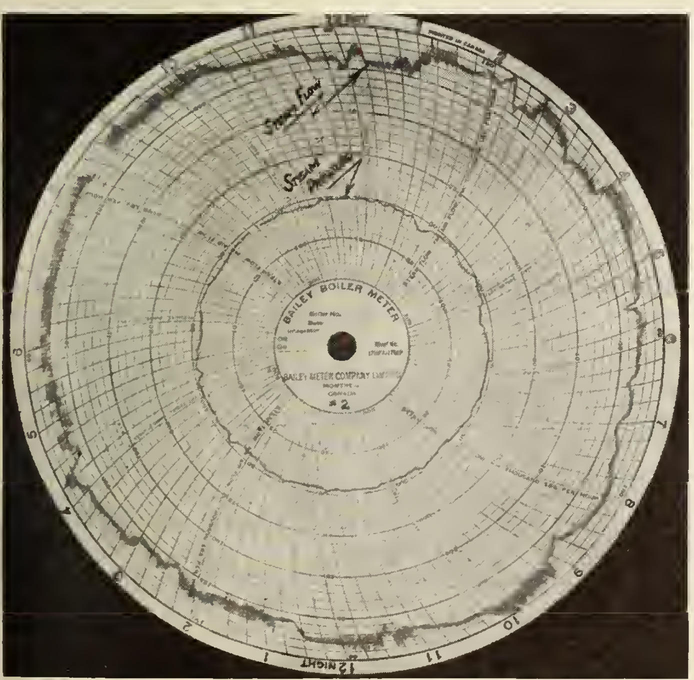


Fig. 16—Steam pressure and steam flow chart for No. 2 electric steam generator.

Serious consideration was given to the provision of automatic control for the electric boiler plant but it was not installed for several reasons, among which the following may be noted:

(1) Certain steam-plant personnel must be on duty, under provincial legislation. That is to say, a plant cannot be made completely automatic.
(2) Arvida Works' steam demand is relatively steady with few sharp surges. Consequently, it is quite easy for an operator to maintain a very steady pressure.
(3) Present automatic boiler control has not yet reached that stage of development where it leaves relatively little to be desired.

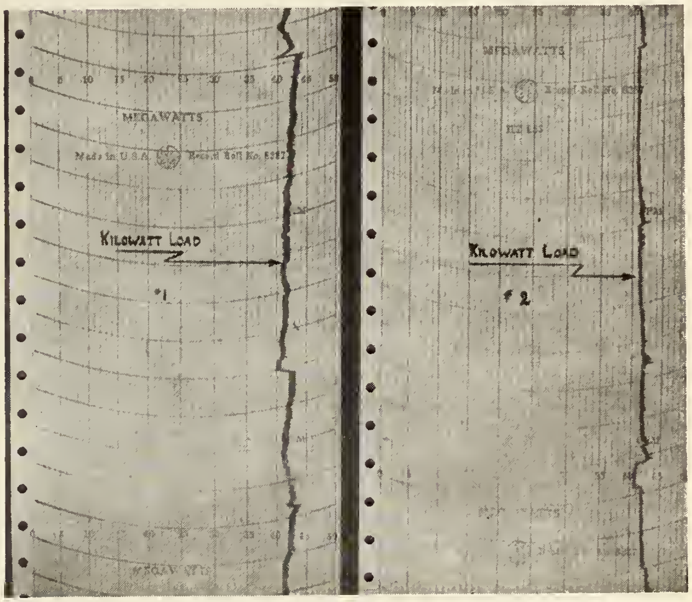


Fig. 17—The steady load developed by the electric steam generators is exemplified by the wattmeter charts for Nos. 1 and 2 boilers.

To take care of load fluctuations, facilities have been provided in the control room so that the operator can raise the conductivity of the boiler water rapidly by allowing a strong solution of soda ash to be injected into the boiler feed water. A diagrammatic sketch of the " doping " arrangement is shown in Fig. 15. The necessary control valves and gauges are mounted on the control-room wall at the height of, and just above, the control table as shown in Fig 14.

Tank (A), having a capacity equivalent to one to two weeks' requirement of " dope ", depending on operating conditions, is located at a sufficient elevation above the controls to permit gravity flow to cylinder (B). The charge of dope is of a concentration which will not crystallize at room temperature.

When boiler load conditions necessitate the addition of dope, the operating procedure is as follows:

> All valves being normally closed,vent valve (1) is opened. Valve (2) is opened allowing dope to flow to cylinder (B), the quantity being indicated in the gauge glass. With the required dosage admitted to (B), valves (1) and (2) are closed. Valve (4) is opened slowly admitting water at boiler feed pump pressure to the cylinder (B). With pump pressure on (B), valve (5) or (6), depending upon which boiler requires the increased dope content, is opened while valve (7) or (8) is throttled to increase the differential pressure across the cylinder and move the dope into thê boiler.
>
> The operation complete, valve (7) or (8) is reset to the normal operating position. Valves (4), (5),

TABLE I—Boiler Efficiency

	Test No. 1	*Test No. 2*
Date	2nd May, 1945	5th May, 1945
Duration of test	4 hours	4 hours
Average pressure (Boiler)	209.2 lb. ga.	204 lb. ga.
Average pressure (Orifice)	183.5 lb. ga.	184 lb. ga.
Orifice design pressure	200 lb. at 2% moisture	200 lb. at 2% moisture
Steam quality	98.44%	98.68%
Average temperature of feedwater	217° F.	215° F.
Average room temperature	80° F.	80° F.
Heat content of steam as measured	1184.8 B.T.U.	1187.2 B.T.U.
Kilowatt hour consumption	154,554 kwh.	137,137 kwh.
Steam production	522,042 lb. dry steam at boiler temperature and pressure	456,944 lb. dry steam at boiler temperature and pressure
Actual evaporation/kwh	$\frac{522{,}042}{154{,}554}=3.37$ lb./kwh.	$\frac{456{,}944}{137{,}137}=3.33$ lb./kwh.
Equivalent evaporation/kwh	$\frac{999.8}{970.4}\times 3.37=3.47$ lb./kwh.	$\frac{1004.2}{970.4}\times 3.33=3.42$ lb./kwh.
B.T.U. Input to steam/kwh	$(1{,}184.8-217+32)3.37=3{,}369.3$ B.T.U.	$(1187.2-215+32)3.33=3{,}343.9$ B.T.U.
Efficiency of boiler	$\frac{3{,}369.3}{3{,}412}\times 100=98.7\%$	$\frac{3{,}343.9}{3{,}412}\times 100=98.0\%$

(6) and (2) are closed. Valve (1) is opened to release any pressure on cylinder (B). Valve (3) is then opened to drain (B) to the sewer.

The dope used, of course, is an aqueous solution of soda ash.

Operating Experience

The general experience to date with these boilers has been entirely satisfactory. They have operated continuously for a period of eleven months under an average load of 40,000 kw. and at times for short peaks as high as 45,000 kw. So far as can be ascertained no injurious results have been met with and no overheating of electrical connections has been noticed. Recent tests indicate that these units operate with at least one per cent higher efficiency than the best of the previous units.

On examination of these boilers, made during the first week in April 1945, after they had been in continuous service for approximately six months, their interior condition appeared to be very good. Very little wear was noticed on the electrodes and the grid had apparently done a very satisfactory job in protecting the bottom head from pitting. This may not be conclusive as the water level was generally quite high in the boilers and it is possible that at low levels some difference might be found. Some evidences of wear were noticed on the neutral plates but this was to be expected and it would seem that both electrodes and neutral plates should give at least two years service if operating conditions do not change.

The specimen steam pressure and steam flow chart (Fig. 16) shown herewith indicates the load conditions are in general quite steady, even when operating at loads continuously well above normal rating. Little steam is lost through the operation of safety valves and bleed is held fairly constant at from 2 to 4 per cent. The steady nature of the load developed by the boilers is illustrated by Fig. 17.

In order to prevent accumulation of sediment in the bottom of the boiler, occasional charges of soda ash are injected into the feed water and the boiler blown down heavily. This results in a surging action which removes a considerable amount of the accumulated sediment. Operating experience has indicated that additional blow-down of this kind might be beneficial and the operating schedule now calls for the injection of soda ash once per shift, accompanied by a 6 to 10 in. boiler water level blow-down.

The steam dryers have operated satisfactorily, producing steam with a quality of approximately 98.5 per cent as compared with the guarantee of 98 per cent. At high water levels, this quality tends to fall off and, as far as can be determined, averages between 96 and 97 per cent. A number of runs have been made to determine boiler efficiency, two of which are embodied as Table I. A similar test on a previously installed unit showed an efficiency of 97 per cent as compared with the 98.7 and 98.0 per cent results on the new units.

It is worth noting that, beyond a leaky tangential dryer, not a single leak has developed in the welded boilers or main steam piping.

Acknowledgements

The authors wish to express their indebtedness to Messrs A. G. Joyce, H. Brayne and W. Fraser, M.E.I.C., as well as other members of the supervisory and technical staffs, for timely suggestions and help.

"MULBERRY" HELPS SOLVE HOUSING PROBLEMS

To help solve one of Britain's major postwar problems, the replacement and repair of the 4,500,000 homes destroyed or damaged by German bombs, the aid of "Mulberry", British portable harbors that were such a surprise to the Nazis on D-Day, has been enlisted. A firm that designed and built portions of it is now applying the experience gained to the housing problem and has developed a new and revolutionary type of prefabricated house. The basic unit of construction is a reinforced concrete panel of standard width, precast at the factory. Openings are left in some of the panels for doors and windows. After these components are assembled at the building site, it is a simple matter to erect the outside walls merely by hoisting the concrete panels into position with a crane. When they are placed side by side, liquid concrete is poured between the units, thus forming a solid wall. Within a week the outside is completed, and within a month an attractive permanent house is ready for occupancy.

THE CONSTRUCTION OF BURIED CABLE IN CANADA FOR LONG DISTANCE COMMUNICATION

M. J. AYKROYD, *Outside plant engineer.*
G. A. CALDWELL, *Exchange plant engineer.*
Western Area, The Bell Telephone Company of Canada, Toronto, Ont.

From the inception of the telephone industry, the practice has been to construct telephone lines by means of poles and open wire attached to them. During the past few years, changes have taken place in the means and methods of giving service. The open wire lines have had phantom circuits placed upon them, then, later, single and three channel carrier systems. More recently, a twelve-channel carrier system has been designed, all channels of which are superimposed on the voice frequency circuit.

This open-wire type of plant is subjected to all vagaries of nature. Often severe physical damage from sleet and wind results in service interruption and heavy associated expense. The emergency restoration of plant is costly as the work is carried on under abnormal conditions.

With increasing demands for service, cable construction has provided a satisfactory answer to the continuing growth of facilities on long distance routes and from the standpoint of service insurance the placing of such cable underground is attractive. Here again the development of a carrier system applicable to cable has made the use of cable plant increasingly attractive from the standpoint of costs and physical size. In the cables which have recently been installed on long distance routes between Montreal and Toronto, use has been made of what is known as the " K " carrier design.

This facility with a speed of transmission of the order of 100,000 miles per second, stabilized feed back amplifiers and other desirable transmission features, provides good transmission over long distances. This application is economical where a large number of circuits are to be provided, many of which will be ultimately several thousand miles in length.

The conception of ploughing cable directly into the ground is not novel. Back in the 1840's, the first known plough was designed by Mr. Ezra Cornell, the founder of Cornell University. The circumstances of this case are still interesting. A contract was undertaken to construct a telegraph line from Baltimore to Washington. At that time the stringing of wires on poles had not been proposed, so the first circuits were to be placed underground. Mr. Cornell built a machine and demonstrated—when his ponderous horse-drawn equipment moved forward, the cable was buried directly into the ground. Our history of the machine is not very clear, but it must be assumed that many difficulties arose since the machine was abandoned.

Many years went by before a successful cable laying plough was developed and used. Present-day equipment drawn by caterpillar tractors has power undreamed of one hundred years ago.

Design of Buried Cable Route

The first essential in the engineering of a specific buried toll cable project is the design of a satisfactory route. Into this design enter many considerations. One of the major ones is that of cost. Thus, the proposal to place cable between any two points will necessarily introduce a possibility of alternative routes on a buried cable basis. These routes will differ with respect to the obstacles to be encountered, conditions of terrain, towns to be passed through, length and so forth. Considerations of transmission layout also will suggest alternatives in the matter of location of repeater stations. It is generally the case that such layout will permit some degree of latitude in one or more of these sections and will allow for deviation of the route to permit the avoidance of major obstacles in construction. All of these factors must be reviewed and compared for the several alternatives which may be practicable in the light of cost.

Another factor which has been found to be of great importance from the point of view of construction costs is introduced by the existence of rivers and creeks in the territory covered and the strengh of the bridges spanning these. In a recent case, this factor was of sufficient importance to influence against one of the alternative routes, since the bridges were inadequate to carry construction equipment, and the crossing of frequent creeks and rivers would have introduced serious delays in the ploughing operations.

In general, in our territory, the construction of buried toll cable will introduce problems requiring conduit construction adjacent to and passing through cities, towns and villages along the route. Here it is most desirable to take a long term view of possible housing or other development along the route in such location. The decision should be based on the latest available studies of such development. In the same connection, where cities and towns are encountered along the route it is desirable, from the standpoint of service insurance and particularly where carrier cable construction is involved, to establish " in " and " out " cables on separate routes, where this can be achieved without important increase in cost and compatible with the development in exchange telephone plant in the location concerned.

Another factor to be considered in route design is the lightning hazard. Factors which have a bearing on this

Fig. 1—Gas pressure reading being made on cable prior to entering plough sheath.

hazard are the surface earth resistivities along the proposed route, the presence of isolated trees adjacent to the route and the lightning storm frequency in the territory. All of these require detailed consideration and the first two will generally exercise considerable influence on the route to be chosen. The lightning storm frequency factor derived from consideration of available isoceraunic charts will not generally influence the route design itself since these data are applicable usually over the entire section of country concerned. The factor, however, may be allowed to influence the cable design structure as will be discussed later. The foregoing data, of course, are always supplemented by observations made locally with respect to lightning conditions as evidenced by damage to pole lines, trees and other objects in the territory.

The lightning hazard in buried cable construction has been found to be influenced by the presences of long fences in open country on which there are no specific arrangements which provide for lightning drainage. In such cases it has been found advantageous to provide insulating panels in the fence lines where they cross over the buried cable routes.

Preliminary consideration of routes is also influenced by the presence of high tension power lines. Proximity to such lines may cause low frequency induction effects to be introduced in the telephone system at times of power line disturbances involving high tension short circuits to ground. In this study, earth resistivities at depth constitute a factor.

The presence of main line railways is also a consideration in route design, as it is desirable to keep the number of crossings of such railways to a minimum.

Accessibility for maintenance purposes is vital in view of the number of facilities involved and which would be affected in the event of damage to the cable.

It has been found by experience that it is necessary to give attention to problems of erosion where cable routes cross rivers and small creeks. In such locations, the ploughing operation provides a form of runway for drainage and it has been found that in the course of a few years the earth coverage over the cable may be substantially reduced. In the case of small creeks, care should be exercised to effect a point of crossing which will not be disturbed when the creek is in flood, due to change in direction of flow. If this is not done, in some cases where the flooding is heavy, sections of the bank will be washed away and the cable become exposed. Means of preventing erosion where it is liable to occur are the shoring of the bank by standard creosoted planking and back filling the trench or slot firmly by hand with earth and stones. However, it is believed that the most effective method is to choose a desirable crossing location with the possibility of reducing erosion as far as practicable, having in mind the problems of drainage and

Fig. 2 Skyline view of plough train underway.

flooding. It is of interest to note that a new design of plough now being considered includes a tamping arrangement which forces the back fill into the slot cut by the plough share.

In weighing the foregoing considerations, it has been found advantageous to make use of the topographical maps provided by the Department of National Defence, having a scale of one mile to the inch, and supplement these with aerial survey maps. The latter have been found helpful in the carrying out of the preliminary field survey work.

The procedure in obtaining right-of-way for buried cable plant involves the optioning of a strip of right-of-way 20 to 25 ft. wide from property owners. These options are taken up and registered as the survey progresses. The easement arranged for entitles the company the right to place and maintain buried cable in this strip of land.

At the time negotiations are proceeding for the purchase of right-of-way, it has been found convenient to arrange with the property owner to prepare fences to allow for the passage of the plough train equipment by the placing of new posts on both sides of the right-of-way and the provision of a temporary fence between, which can swing back to allow the train to pass. This work involved in clearing of the right-of-way of brush and isolated trees is generally done by the property owner, although in some cases the work is handled by contract.

Cable Reel Allocation

In the design of cable facilities over long distances, it is essential to establish reasonably uniform electrical conditions throughout the length of the cable to insure satisfactory transmission characteristics from the point of view of quality and service stability. To help achieve this result, it is advantageous to arrange for cable manufacture sufficiently far ahead of the actual field construction work to provide the engineer with full information on the characteristics of each reel of cable made. It is then practical for him to locate his reels in the field to the best advantage from the standpoint of the known electrical characteristics.

This is done by shipping the reels, usually by rail, each to the location closest to its final position in the field as recommended by the engineer. From this point the reel will be transported to its position, usually by a contractor. It has been found convenient for this purpose to use a small farm tractor or reel trailer equipped with tractor treads. Each reel contains about 3,000 ft. of lead sheathed, jute protected cable and weighs about four tons.

It might be noted that the cable itself is manufactured under controlled conditions of humidity, and every reasonable precaution is taken to avoid deviations from uniformity in electrical characteristics.

The cable is shipped from the factory under a gas pressure of about 9 lb. per sq. in., this pressure rating being recorded on a tag affixed to the reel. Before the cable is placed by the construction forces, this pressure is checked to insure that the reel is not placed in a damaged condition. Dry nitrogen gas is used for this purpose. Figure 1 illustrates field check of gas pressure on new reel length immediately before the cable is entered into the plough share prior to placing.

Ploughing Equipment

The plough itself weighs about five tons. It is mounted on two wheels with drawbar, 72,000 lb. shear pin, sod cutter and a 9-ft. vertical share which cuts a slot in the ground 3 in. wide and 30 to 50 in. deep. Oil spraying equipment is mounted on the plough frame to provide for lubrication of the cable as it passes into the share and is effective in reducing cable tension to less than 1,000 lb.

The lead or No. 1 tractor is a D8 full Diesel caterpillar with a 24-in. track. It weighs, equipped, about 20 tons

Fig. 3—Plough train in operation across flat country. Open wire line in foreground.

with a drawbar pull on the level of about 30,000 lb. The Hyster towing winch of 780-ft. ¾-in. steel line capacity has a pull of 76,000 lb. at a speed of 55 ft. per minute. The derrick on this tractor is designed to handle four-ton cable reels.

The No. 2 tractor has 85 hp. full Diesel caterpillar with a 24-in. track and is equipped with a four-drum winch which is used for raising or lowering the plough share and for loading the cable reels on the trailers. This tractor is coupled directly to the plough.

The cable reel trailers weigh about 6,000 lb. and are equipped to handle reels up to 84 in. dia. and 4 ft. 6 in. wide.

Ploughing Operation

Operation varies dependent on soil conditions, nature and frequency of obstacles. In clay or sandy soil, for example, with few obstacles, tractor, rooter plough, cable laying plough and tractor trailers can all be connected in the one train. The front plough roots through the earth with a 3¾ in. share loosening and breaking up the ground to a depth of from 30 to 50 in., thus insuring uninterrupted passage of the following plough which deposits the cable in the ground. The 100-ton train moves at a brisk walk under such conditions. Pauses are needed only to change reels or remove major obstructions.

In Southern Ontario, the farming subdivisions, side-roads, streams, wooded sections and other frequent obstacles make a modified operation desirable. One crew with a rooter plough, equipped with 85 hp. tractor bull-dozer, works about 3 to 6 miles ahead of the cable placing train. The job of this crew is to open up the earth to a depth of 30 in. or more along the route of the buried cable, to remove boulders, tree roots and other obstacles, to grade steep banks at side roads or other places, to see that fences have been so arranged as to facilitate the passage of the train and to remove isolated trees in exposed locations which are designated by the engineer as hazardous from the standpoint of lightning.

Figure 2 illustrates the plough train underway as described in the foregoing. The train, it will be observed, consists of the lead or No. 1 tractor equipped with derrick followed by the No. 2 tractor, the plough itself and two cable reel trailers. This arrangement was the one most generally followed in placing buried cable between Toronto and Kingston.

This month's cover picture illustrates the train emerging from a wooded section where the going was difficult because of a ravine and tree root conditions. In this section it was found advantageous to use the front tractor to "winch out" the train as described below.

Figure 3 shows the plough train in progress across flat country and indicates the slot cut in the ground by the routing operation ahead of the plough train.

In ploughing, the train may become stalled in ploughing up hill or through a ravine. In such cases, the front tractor with its single drum winch proceeds ahead to firm ground and prepares to "winch out" the train by making a two to one pull on the second tractor which remains coupled to the plough. When this procedure is necessary, the driver of the front tractor first puts tension on the winch line and sets the winch brake. He then guides the caterpillar tractors into firm ground, pulling against the taut winch rope until the tracks are sufficiently dug in to give the tractor firm footing for the pull. Now with the track brakes set on the front tractor, the winch pulling and the rear tractor exerting whatever forward effort with its tracks the condition of the ground permits, the train moves ahead. The winch line is coupled to the No. 2 tractor through a wire rope block attached to the tow hook at the front end of the tractor. The sheave of this block will take up to 1-in. wire rope and is equipped with a bronze bushing with runs on a 2-in. dia. sheave pin.

One caterpillar tractor's maximum draw bar pull is about 30,000 lb. on the level. In moving up hill, of course, the pull is decreased in proportion to the steepness of the grade since it is necessary to raise the tractor weight of some 40,000 lb. With the aid of a double line pull from the heavy duty winch of the forward tractor, the effort exerted may reach as much as 150,000 lb. On a well chosen route, there are few situations where this arrangement is not adequate.

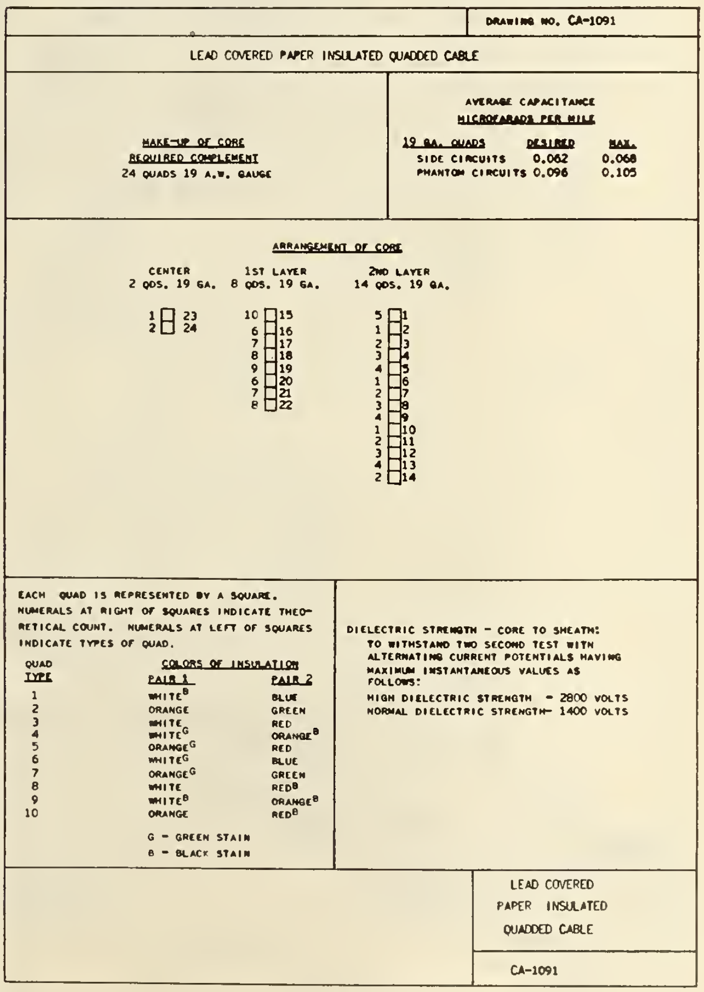


Fig. 4.

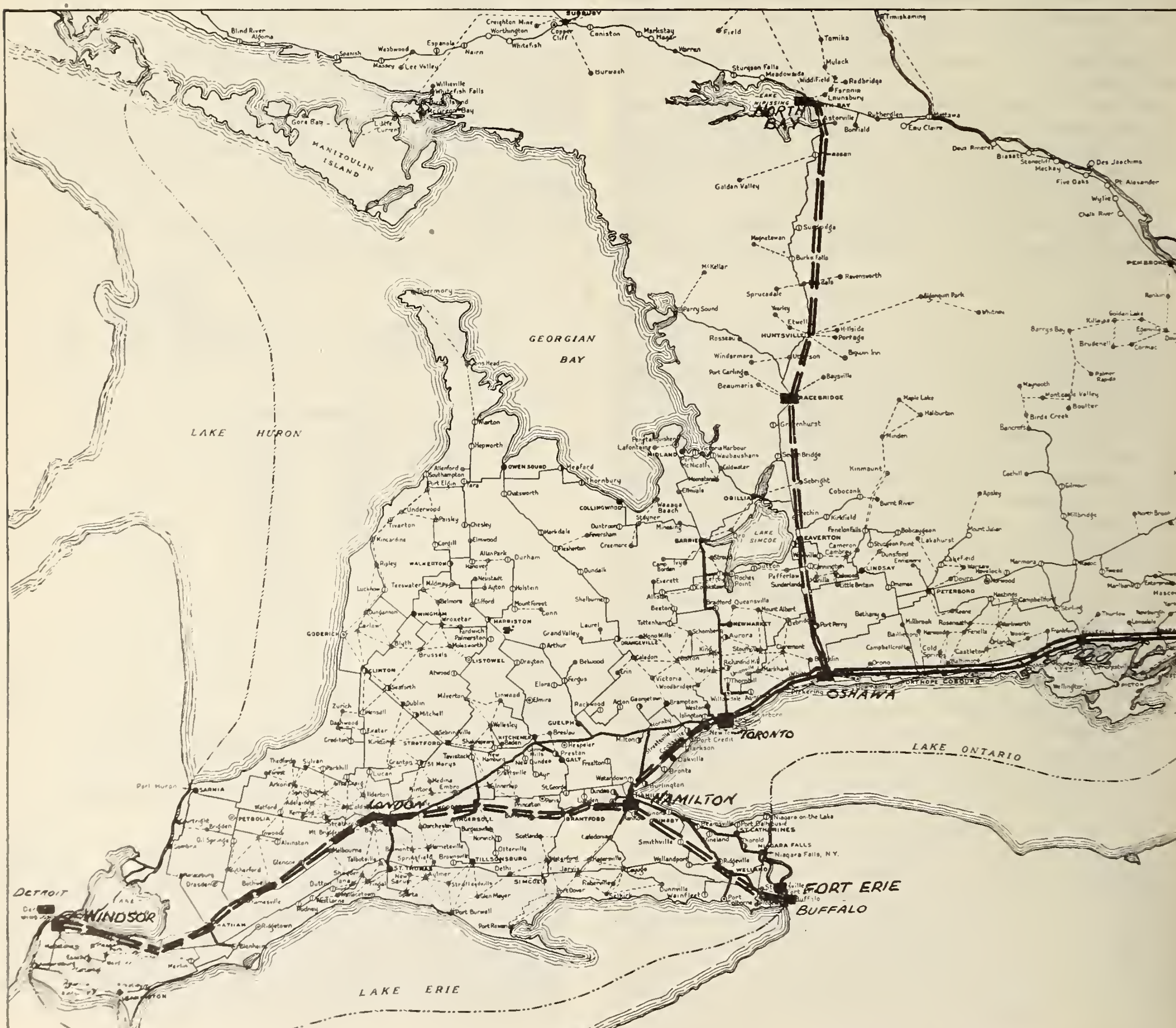
After passage of the plough, disturbed ground is restored to its former condition as far as practicable, particularly in the case of roads and ditches. Usually, in the case of straight runs on right-of-way, the soil is not sufficiently disturbed by passage of the plough to require back filling. We have found it satisfactory to mount beneath the rear trailer, in such a location as to take part of the weight of the trailer itself, a "V" shaped backfiller. This arrangement under ordinary conditions will pack most of the disturbed soil over the slot which has been formed by the passage of the ploughshare. Completion of the back filling can be accomplished readily by running one track of a service tractor over the top of the slot.

Splicing

The lay-up of cable used between Montreal and Toronto is shown in Fig. 4. This cable consists of a core of 24 quads of 19-gauge conductors This core is bound by two wrappings of paper providing a breakdown voltage between core and cable sheath of 2,000 root mean square volts at 60 cycles per second as compared with the normal arrangement of one paper wrapping providing a rated voltage breakdown of 1,000 root mean square volts at 60 cycles per second. Cables have been shipped, heretofore, on reels containing two lengths of somewhat over 1,500 ft. both on the same reel. However, in the projects now being planned, it is proposed to have one continuous length of somewhat over 3,000 ft. on the one reel. From the standpoint of splicing effort this is obviously advantageous.

In general there are three basic groups of circuits in the cable:

1. *The "K" Carrier Group*—Usually this group consists of about 10 quads segregated from direct adjacencies by voice frequency quads. This arrangement is advantageous from the standpoint of interference between carrier systems.
2. *Voice Frequency Quads* — These comprise the quads segregating the carrier quads and are utilized usually for the shorter haul facilities serving intermediate points between carrier system terminals.
3. *Control Quads*—These two quads are set aside for cable and maintenance purposes. One of the quads is available only at carrier terminals and at the intermediate carrier repeater stations located along the route, generally at intervals of about 17 miles. The other quad is established to provide a linemen's talking circuit and a gas pressure alarm pair. Both of these are made available at terminals provided for the purpose throughout the length of the cable. These terminals are mounted on marker posts adjacent to the cable and are connected to it by a



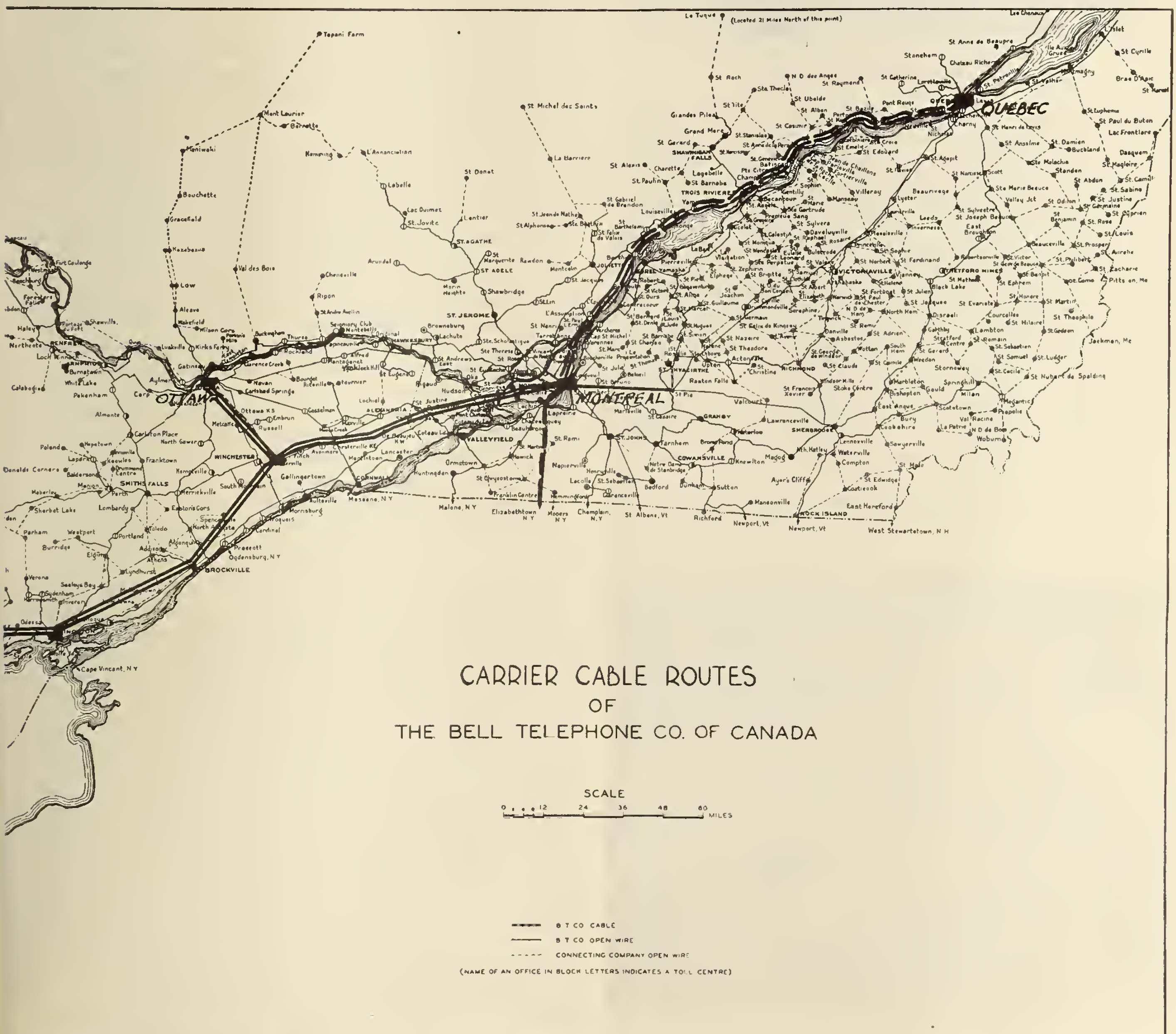
small size, light covered jute protected cable.

The requirements for splicing these various groups of conductors differ. On the carrier group the splicing is so designed as to minimize the length of proximity of any two quads in the group between carrier repeater stations. The splicing design is therefore on a planned basis with this objective. It might be pointed out that since a single cable is used for carrier purposes for transmission in one direction only, so called direct near-end cross talk effects are not involved. The design of the cable lay-up with regard to length of twist is arrived at with this in mind. In the case, however, of the voice frequency group, where the circuits are loaded and may be used on a two way basis to provide service to intermediate points, the near-end effects are important and special measures must be taken in the splicing procedure to insure satisfactory arrangements with respect to the capacitance balance between the wires of any quad. This is accomplished by field measurements, made by the splicing crew, of capacitance unbalance and the value reduced where the measurements so indicate by the use of small balancing condensers. This arrangement is supplemented by the selection of quads in the voice frequency groups in both directions from the splice point on the basis of reducing the capacitance unbalance, by association of groups in the splicing operation.

It has been a general practice for many years in splicing toll cable conductors to use solder. However, in the case of all the buried toll cable construction carried out here, splicing has been done by electric welding, the equipment used being a standard 6-volt storage battery and carbon electrode connected to one terminal and a suitable device connected to the other terminal so arranged that, when a joint is made by this means, a globule of metal is formed between the two conductors insuring a very satisfactory permanent and easily made joint. This procedure is not suitable for splicing in manholes associated with conduit plant because of the importance of avoiding arcing contacts in enclosed atmospheres in which may be present even a small portion of explosive gases. The use of the method is therefore being restricted to aerial and buried cable construction. A photograph of an enlarged sample joint is shown in Fig. 5.

Gas Pressure Installation

Upon completion of splicing, the cable is placed under gas pressure of about 9 lb. per sq. in. Contactor points are spaced about 10,000 ft. apart. In the event of a sheath break or puncture allowing the gas to escape, the pressure will fall in the cable and when it has reached a predetermined value at a contactor, the resultant operation of the contacts will close an alarm circuit bringing in a signal to the Central Office. Between contactor



CARRIER CABLE ROUTES OF THE BELL TELEPHONE CO. OF CANADA

Fig. 5—Illustration of welded joint splice used in buried cable sections.

points, the valves are placed about 3,000 ft. apart. Pressure readings made in the field in the vicinity of the cable fault, as indicated by the contactor operations, will specify the location of the trouble.

There is some variation in operating practices in the extent of gas sections. These vary from 50,000 up to about 200,000 ft. in the case of single full size toll cables. In the cases of twin cable installations, such as for carrier cable operation, the most desirable arrangement is to establish circular gas sections made up of the two cable sheaths between repeater stations spaced about 17 miles apart. This provides a satisfactory reservoir to protect cable against the ingress of water or moisture at the point of failure and is helpful also in determining the location of the fault by readings of the direction of gas flow supplementing pressure readings at valve points.

The reservoir of gas so provided is sufficient to insure, even under quite severe conditions of cable sheath fracture, adequate time for an employee to travel to the location of the break before pressure is reduced at the point of break to a level which would permit an ingress of moisture. In the case of most fractures, a time interval of as much as 48 hours depending upon the location of the break in the case of single cable jobs, would be available for maintenance attention. By check measurements at valve points and analysis of contactor operations, the control office can determine the seriousness of the situation.

Repeater Stations

Unattended repeater stations for the carrier circuits are located along the routes generally about every 17 miles. The circuit equipment including repeaters, cross talk balancing frames, etc., as well as the power, ventilating and electrical heating equipment are used in buildings having a standard floor plan design, the size of the buildings being about 17 ft. by 24 ft. Building locations are chosen having in mind specially the matter of accessibility and the availability of the commercial power supply, as well as having a desirable location from the point of view of the repeater arrangements on the overall carrier system layout.

Fully attended stations are provided about every 50 miles. At these stations, voice frequency repeater arrangements are usually provided. It has been possible in our territory to locate these stations in towns or cities where normally full attendance is available.

Maintenance

It has been pointed out in the foregoing that reasonable accessibility to all points on the route was a consideration in the design. This is most desirable from the standpoint of maintenance of the system after installation. It will be noted that every effort is made in design to select a route of cable likely to be free from disturbances, either electrical or physical. Nevertheless, trouble is to be expected to some extent and it is generally the case that the majority of these troubles arise because of trenching or digging operations by public contractors or others across the cable route. These occurrences are often due to their lack of precise knowledge as to the location of the cable or due to the fact that this location has been forgotten by such contractors or others. To warn the public and to help avoid these troubles and also to assist the maintenance man in locating the cable route, markers are used. These markers consist of posts of treated red or jack pine having about 5 in. tops, usually set in fence lines or other convenient locations where they will not interfere with agricultural or other operations. It is proposed in the Toronto-Windsor section to use 15-ft. markers that will be readily visible from a distance. These markers also serve, where necessary, as convenient mounts for the gas pressure valves and associated terminals located at the 3,000-ft. points along the cable route.

An instrument which has been used to advantage in buried cable locating work is the M-Scope. The set consists of a modulated radio frequency transmitter and a separate receiver, each unit having its own loop antenna. The path of an underground cable or pipe can be determined with this instrument where it is impractical to make a physical connection. For this use the receiver and transmitter are separate and operate as two units, the transmitter being used to introduce the signal into the cable or pipe while the receiver picks up the secondary radiated signal as it is carried along from the pipe or cable. The transmitter frequency is about 135 kilocycles. This instrument is of value also in route selection work where underground metallic structures along the route may be encountered.

It is of interest to note that trouble experience on buried toll cable jobs has been low and most satisfactory in comparison with aerial toll cable experience.

Future Developments

The accompanying map of Southern Ontario and Quebec illustrates the extent of the major communication cable network between Quebec City and Windsor. The section of this network linking Montreal, Ottawa, Toronto, Hamilton and London has been completed. Outside Plant construction work associated with the placing of the cable between London and Windsor was substantially completed this year. As far as practicable the network has been constructed in buried cable in the manner described above. In sections of country where rock is encountered near the surface, such as in the immediate vicinity of Kingston, buried construction is, of course, not practicable and aerial design has been provided. Plans are now actively in hand for the extension of this network east from Montreal through Three Rivers to Quebec and south and east from Hamilton to Fort Erie as shown on the map. Another extension which is foreseeable now is that to North Bay. It will be observed that connections are provided with the communications network of the United States at three principal points, viz., south of Montreal, Elizabethtown, N.Y., at Buffalo, N.Y., and at Detroit Michigan.

WARTIME PRODUCTION OF PRECISION OPTICS IN CANADA

D. C. R. MILLER, M.E.I.C.
Development engineer, Fiberglas Canada Limited, Oshawa, Ont., formerly production superintendent of optical shops, Research Enterprises Limited, Toronto, Ont.

This is the second of four instalments of a paper describing the establishment, as a result of war exigencies, of a new industry in Canada. The first instalment appeared in the April issue.—Ed.

(Continued from previous issue)

Production Methods—Planar Optics

As with lenses, production of planar optics begins with the receipt of raw glass from the glassplant. The glass may be in the form of mouldings, if the requirements warrant the expense of a mould, or otherwise in the form of slabs or plates of sufficient size and thickness for the economical production of the particular part. Because of the function of prisms in most applications, a higher quality of glass is needed than for lenses. The glass must be better annealed, and freer from striae or inhomogeneities, bubbles or seed. For many windows and graticules, however, the requirements are less exacting than for lenses.

PLANAR GRINDING

The operations covered under the heading of planar grinding include virtually all those involving the use of abrasive on the work—sawing, grinding, milling, disc-cutting and edging.

If the glass for prisms is supplied in plate or slab form, the first operation is to saw it into roughly the size and shape which would be supplied if mouldings were used. This is done with a rubber-bonded silicon carbide wheel of 10-14 in. diameter and .040 in. or .060 in. thick, revolving at 4000-6000 surface ft. per min. with water coolant. The cutting speed of such wheels, using 125 micron abrasive, is almost as high as with diamond-loaded copper wheels, and danger of damage from chipping is less. In the smaller saws the work is fed into the wheel manually; in the larger ones hydraulically. Some idea of the rate of cutting may be gained from the fact that a piece of glass of 1 in. square cross-section may be sawn through in slightly over 30 seconds, with a single cut. From .040 to .090 in. is left on each face of the moulding or sawn blank for subsequent removal.

After sawing to rough shape, the next operation on prism blanks or mouldings is milling. Before this can be done it is often necessary to select and grind whichever surface is to be used as the locating surface in milling. This is done by hand on large vertical-spindle cast-iron plates, known as roughing wheels, fed with 125-180 micron silicon carbide and water. These wheels are about 2 ft. in diameter, revolve at a surface speed of 1200 ft. per min. and were at one time the basic machines for planar grinding.

For planar milling, the best machines are tool-room vertical-spindle grinders, as these are designed with precision-type high-speed spindles of maximum rigidity. Almost any vertical-spindle machine can be made to serve the purpose, however. One of our first machines was a Pratt & Whitney grinder with a 24 by 72 in. table, fitted with a 14 in. diamond cup wheel, and used for rough milling large prisms of the tank periscope type or large numbers of smaller pieces. Such an arrangement is illustrated in Fig. 14. Later machines included Norton vertical grinders with 6 x 18 in. magnetic chucks and reciprocating tables and Blanchard grinders with 16 in. diameter revolving magnetic chucks, together with special-purpose machines of similar type and of our own design. Of these machines, the Blanchard is undoubtedly the best. Fitted with 10 in. diameter cup type diamond wheel, 15 hp. motor on the cutter spindle and automatic feed, it can remove glass from a 16 in. diameter surface at the rate of .023 in. per min. This machine is illustrated in Fig. 15. As with lens milling, precautions must be taken to permit this powdered glass to settle out in the coolant sump. Metal-bonded diamond wheels of about 90 micron grain size (180 mesh) give the best compromise between speed and finish. Wheels as fine as 26 microns (400 mesh) can be used and with them the finish is limited by the machine rigidity. Within the limits of the machine, the higher the surface speed, the better: 4000 ft. per min. may be regarded as a minimum.

The width of cutting face in the cup-type wheels is a matter of considerable importance. Heavier cuts can be taken with ½ in. face wheels than with 1 in., since with too wide a face, the coolant has difficulty taking away the powdered glass, and this tends to load the diamond wheel and cause overheating and slow cutting.

The method of holding the glass blanks while they are being milled is of great importance in affecting accuracy of angles and cost. The simplest methods are those involving waxing the blanks onto steel or cast-iron angle-bodies or flat plates and holding these on the magnetic chuck of the machine. Before any angles can be milled, the locating surface and one adjacent side must be milled flat, so as to provide a locating edge which is butted against a stop to prevent introduction of pyramidal or skew errors in the angle. Often the first operations are to mill two opposite sides parallel, subsequent to which the prisms are blocked together into sticks with wax, so that the angles on half a dozen or more prisms may be milled at the same time. In such cases, parallelism must be held to .0005 in. or less to prevent cumulative cross-angle errors. For these blocking operations paraffin wax usually gives sufficient adhesion. It is applied as a liquid by heating the blocking plates, angle bodies or work, as the case may be, and allowed to set. After milling, another heating process is necessary to de-block the work, from which the wax must then be removed by immersing in a suitable solvent. Because of the time entailed in these blocking, de-blocking, and cleaning operations, and danger of damage through extra handling, mechanical methods of holding the glass are to be preferred wherever possible. Glass parts are not easily held this way, and the provision of such fixtures taxes the ingenuity of the tool designer. One useful fix-

Fig. 14—Pratt & Whitney prism milling machine with 14″ diameter diamond cutter.

ture is shown in Fig. 16 and is suitable for milling parallel both sides of any 45°-45°-90° prism. The prisms are held loosely in groups of four inside the rectangular steel frame, separated where they meet by a cruciform spacer of bakelite or linoleum. The frames are then placed as close together as possible in the magnetic chuck and both sides milled in succession. Another way of reducing the amount of handling is to use a form of jig which is capable of being turned over into two, three, or more positions for milling successive angles and sides. Two such jigs, one for milling both 45° faces and vertex of binocular prisms, the other for milling three sides of a rangefinder pentagonal prism, are also shown in Fig. 16. Still other types of mechanical holding fixtures are shown in the background.

With proper care in blocking, and angle bodies accurate to one minute or less, angles may be milled to an accuracy of 1½ to 3 minutes. The care necessary may be imagined by considering that an angle of one minute represents a departure of .0003 in. per inch. Use is made of this fact

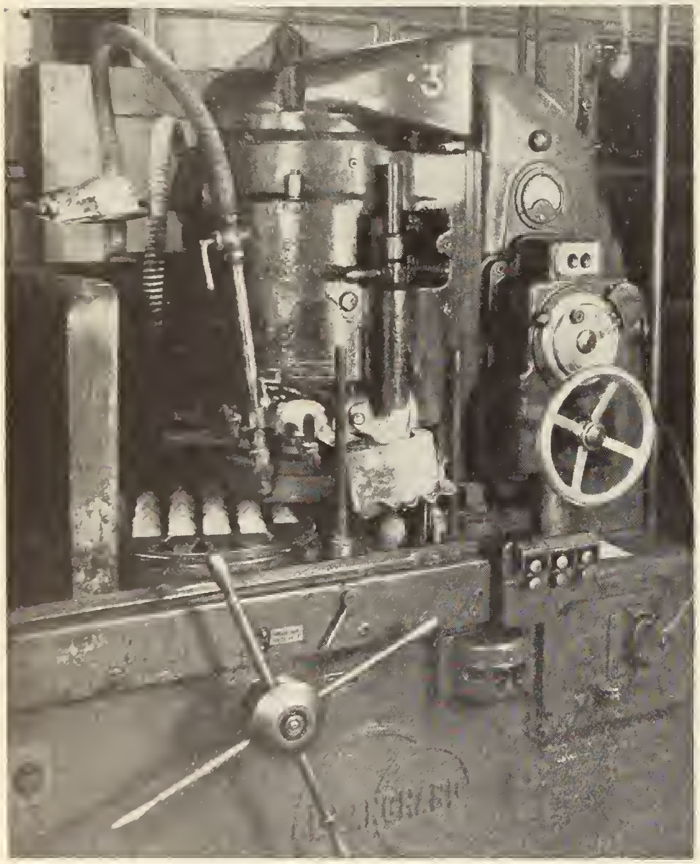


Fig. 15—View of Blanchard vertical grinder set up for prism milling.

for measuring angles by means of a direct-reading dial indicator graduated in 1/10,000ths. With its contact point about ½ in. from the base of the prism, this device will measure angles within about ½ minute. It may be used for any angle, and is set to zero with an accurate master prism. Angular tolerances of less than one minute involve control during polishing, and will be dealt with later. For many purposes an adjustable square, set from a master, is all that is necessary. These mechanical angle-checking devices are illustrated in Fig.17.

Lineal dimensions are seldom held to closer tolerances than ± .001 in. and can be maintained without undue difficulty. Allowance must of course be made on surfaces which are later to be polished, for the thickness of glass which will subsequently be removed in medium and fine grinding.

After prism blanks are milled, other operations, such as bevelling, radiusing, or slotting may be necessary. Wherever possible, bevelling is done on sticks of prisms, using a medium abrasive on a flat 10 in. or 12 in. cast-iron vertical-spindle grinding wheel. Individual prisms may be bevelled very quickly on a 10 in. diameter flat face-cutting diamond wheel mounted horizontally. Delta disc-sanding machines serve admirably for this purpose, the prism being held at the proper angle on a fixture and fed into the wheel by hand up to a stop. This method may also be used for heavy chamfers up to ¼ in. or more, and for removing corners.

The same machine also serves for radiusing the ends of prisms such as binocular prisms, using a fixture which pivots the prism around the centre of curvature while it is fed into the wheel. Both ends may be radius milled by this means at the rate of about 50 prisms per hour. The bevelling of such curved surfaces is done by hand on horizontal-spindle fine abrasive wheels with water coolant.

Circular windows, graticules, or filters, are sometimes made from moulded discs of optical glass, but it is often cheaper to cut them from commercial colourless plate glasses. The plate glass is cut into 6 in. by 6 in. squares with a glass cutter and these squares waxed onto a brass plate. This is immersed in a pan of kerosene and cut into discs on a drill press, using a hollow tubular steel or copper cutter with the end charged with diamond dust by nicking and rolling over. ¼ in. plate glass can be disc-cut in this way into 1 in. diameter pieces at the rate of 120 pieces per hr. Using high-speed drills of the Desoutter type and metal-bonded tubular cutters, it is expected that this output could be more than doubled. After milling parallel and to thickness, the discs are edged to diameter by blocking them into cylindrical sticks up to 6 in. long, using a special high-adhesion cement.* These sticks are prepared for cylindrical grinding by fastening hardened steel centres onto each end with sealing-wax. They are then edged to size between centres on a standard tool-room cylindrical grinder, equipped with a 14 in. diameter edge-cutting diamond wheel with 1 in. face. The discs are usually made about ⅛ in. oversize on diameter to allow for chips in disc-cutting and blocking errors. Tolerances in diameters vary from ± .0005 in. to ± .002 in. A stick 1 in. diameter and 6 in. long may contain 50 or more pieces, and can be edged to size in 10-15 minutes. This method is a great advance on earlier methods in which the pieces were edged singly or a few at a time on lens centering machines. Even greater cost savings may be possible if present experiments with centreless grinding are successful.

Slotting or grooving of faces and edges, when required, may conveniently be done on small horizontal milling machines using steel wheels and loose abrasive or metal-bonded diamond wheels. Graticules are often required to have a narrow slot at the edge to prevent the engraved surface from rotating after assembly. These slots are milled after the stick has been edged to size, and before de-blocking.

Inspection of the milled blanks for chips, flaws, bubbles, correct angles and dimensions is done at the end of each important operation.

PLANAR POLISHING

The methods used for planar polishing vary in accordance with the degree of accuracy required of lineal dimensions and angles. The variance lies chiefly in the methods used for supporting the glass during polishing, that is, the blocking methods; but regardless of what method of blocking is used, the methods of polishing have much in common. The polishing machines operate on the same principle as those used for lens polishing, but as they are usually designed to accommodate blocks 12 in. and more in diameter, the spindle spacing is larger, the construction heavier and more rigid, and the speeds lower. A typical planar polishing machine is shown in Fig. 18.

Medium and fine grinding are done on machines identical

*See (*) on page 307.

Fig. 16—A group of mechanical holding fixtures for prism milling.

with those used for polishing, operating at their highest speeds. The grinding tools are flat cast-iron discs of slightly larger diameter than the blocks. Abrasive is applied manually or, for the less precise work, by the rotating bowl and scoop method previously described. Two or three stages of grinding are used, depending on the finish of the work as received from the grinding shop. With a good milled finish, a medium grinding with 22½ micron abrasive for 1 hour followed by a first fine grind with 18 micron for ¾ hour and finish fine grind with 9-12½ micron for 20 minutes gives good results. About .010 in. of glass is removed in these combined grinding operations. In some cases, grinding must be continued until specific sizes are reached. All grinding is done upside-down, that is, with the block on top and the grinding tool on the revolving spindle of the machine.

The flatness of the grinding tools is of prime importance. Flatness is best checked in the same way as curves are checked in lens fine-grinding—by giving the work a quick shine on a polishing spindle and checking with a large optical flat. Sometimes the grinding tools are smooth enough to permit direct test glass readings to be taken. If the flatness is found to be off by only a few fringes across say 1/3 of the block, this may be corrected by utilizing the available adjustments on the grinding machine to give a selective grinding action. If the tools are out by a larger amount, emery paper is used to true them. For still larger errors, the tools are sent to the grinding shop and hand-ground on vertical revolving laps until flat to a straight edge. In work of the highest precision, where no error of more than one or two fringes is permissible across a 10 in. block, lower grinding speeds and constant checking are necessary, so that the grinding times given may be increased several-fold in the final stages.

The polishers used in planar work are of the same materials as for lens polishing, and the same remarks apply. The greater the flatness requirement of the surface being polished, the harder should be the pitch, otherwise ' edge-roll ' is apt to develop in the work, due to the edges being polished away more rapidly than the centre. The use of hard pitches is apt to result in scratching and this adds greatly to the difficulties of high precision work. The polishing shells are thin ribbed plates either of aluminum or cast-iron, usually of slightly smaller diameter than the block. They are coated with pitch by being stood face upwards and level, and pouring the pitch on to a thickness of ¼ in. to ½ in. The pitch is prevented from running over the edge by a rim of gummed paper stuck round the circumference of the tool. After cooling, the polisher is grooved either radially and circularly as with lens polishers, or in a pattern of squares with a heated grooving tool. For most work the polisher is now ready for use, but for work of the highest precision, a polisher is used which has already been ' broken in ' on slightly less accurate surfaces.

For all but the most precise work, polishing is done upside down, as this considerably reduces polishing time.

The degree of flatness necessary varies with different types of work. One quarter wavelength is usual for reflecting faces of prisms or mirrors in the objective system, one half to one wavelength for entrant and exit faces. For other surfaces, one wavelength is the standard tolerance, although with most focal plane surfaces, or surfaces in the eyepiece system, curvatures of 2½ wavelengths or more are quite acceptable.

Turning now to blocking methods, there are four such methods in common use. They are, in order of increasing precision: steel angle-body blocking, plaster blocking, glass angle-body blocking and contact blocking. These will now be discussed in turn.

Steel Angle-Body Blocking

Steel angle-body blocking cannot economically be justified unless the quantities required are very high—of the order of several hundred thousand prisms. This is because with any smaller number the cost of tooling would more than offset any savings attained. For that reason, we only used this method for 45°-45°-90° prisms is 6 x 30 binoculars (see Fig. 3). These prisms were polished on the two 45° faces by sticking them in groups of five on to the hypotenuse face of steel bodies, about 5 in. long, locating the prisms against a stop at one end. A special blocking jig is used to centre and align the prisms accurately on the bodies. A particularly strong cement * is required, composed of 20 oz. of rosin, 4 oz. of flake shellac and 1 oz. of beeswax. The bodies and prisms are heated and the prisms stuck to the bodies and to each other. Scrupulous care must be used to avoid dirt or dust between the prisms themselves and between the prisms and the bodies, and all traces of wax must be removed from the mounting faces of the latter. After cooling and cleaning, the bodies are mounted in groups of 14 on aluminum blocking plates, by means of Allen-head screws from underneath. The prisms at this stage are rough mouldings still on the 45° faces. After blocking, the whole block of 70 prisms is milled to the right height, fine ground, and polished. Without de-blocking the angle-bodies are then removed, cleaned, turned over 90°, and the same operations repeated on the second 45° face. Figure 19 shows the appearance of such a block at this stage. After de-blocking and cleaning, the hypotenuse face is polished by plaster blocking. In large-scale production, this method resulted in low costs, but with war-time labour the rejections for angle errors, particularly pyramidal error, in excess of 5 minutes, were seldom less than 15 per cent. Hence the method is limited to prisms with relatively large angle tolerances. Polishing times for the 45° faces in 10 in. blocks vary from two to three hours, one man operating 6 spindles.

Plaster Blocking

Plaster blocking is the most generally used of all blocking methods since no expensive tooling is involved and it is applicable to all commonly encountered classes of work. With plaster blocking, the prisms are cemented face downwards with paraffin wax onto a flat blocking

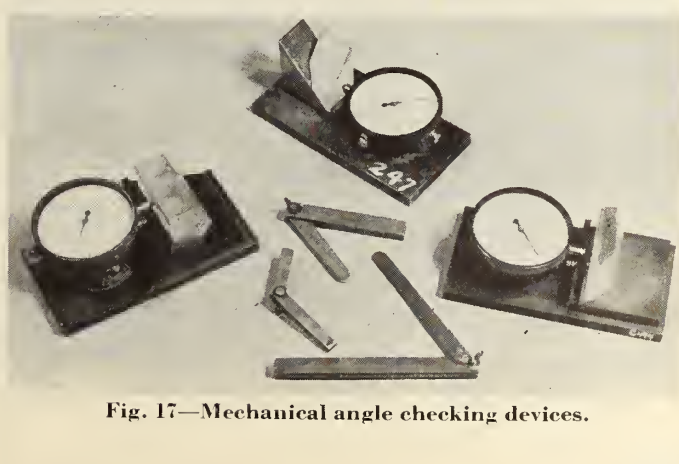


Fig. 17—Mechanical angle checking devices.

tool. A wide brass band is clamped round the rim of the tool and more melted paraffin wax poured over its surface and round the prisms to a depth of ⅛ in. The plaster mixture is then made up and poured in to the full depth of the band, which may be 4 in. or more. When this has partially set a backing plate with numerous large holes is placed on top and the plaster forced through the holes. After the plaster has set hard, this plate, which carries a hub for engaging the arm of the polishing machine, is keyed in place by the plaster which has overflowed through the holes. The block may now be removed by heating the blocking tool and sliding off. The layer of paraffin wax round the prisms is next scraped off, leaving the work projecting about ⅛ in. above the plaster surface. After shellacking to make waterproof, the block is then ready for fine-grinding and polishing. Some idea of the appearance of plaster blocks may be gathered from Fig. 18. Three points require careful attention up to this stage: first, the blocking tool must be accurately flat, the more so the closer the angular tolerance; second, the blocking tool and work must be kept scrupulously clean to avoid angular errors; third, the composition of the plaster must be carefully controlled. If too soft, the prisms will sink during grinding and polishing, and angle troubles result; if too hard, difficulty may be experienced in deblocking and the prisms may be damaged. A very good composition for this purpose is a mixture of 50 per cent. high quality (dental grade) plaster of Paris, and 50 per cent. of a special plaster made by the U.S. Gypsum Company known as Hydrocal 811. Blocks made with this mixture can be used within 12 hours. After polishing the first side, the polished surfaces are shellacked and the prisms removed by carefully tapping the block from the back until it breaks up. For many prisms all that is then necessary is to clean the prism, re-shellac the polished face, and block up in the same way, repeating the operation as many times as there are faces. With reasonable care, angles can be held within 5 minutes, usually within 2 minutes, but there are always some errors in the milled blanks and these may be superimposed on the blocking and grinding errors to cause rejection. Similarly, with two adjacent polished faces, each may make the correct angle with reference to a third face, but the cross-angle between them may be out by the sum of the individual errors. For these reasons, wherever angle tolerances of less than 5 minutes are involved it is wise to check the angle of the first polished face with the ground face next to be polished, and correct the latter if necessary, before proceeding. These hand-grinding operations are repeated for each successive face and ensure that angle rejections in the finished prisms will be low.

Fig. 18—A row of planar polishing machines with plaster blocks.

Measurements of angular errors are made optically on auto-collimating goniometers. Three types of such instruments which we designed and made ourselves are shown in Fig. 20. These are comparison devices, in which the image of an illuminated scale in the eyepiece of the viewing telescope is projected in a parallel beam, and reflected from the surface under test back onto the eyepiece scale. The co-ordinates of the reflected scale relative to the fixed scale are a measure of the amount and direction of error, the two images being first set in superposition from a master prism of correct angle. Accuracy to 1/5 min. or 12 sec. is possible. If the surface under observation is ground, a small parallel polished window is stuck to it by breathing in order to provide the necessary reflection. Correction of angle is made on a small stationary lapping disc using a medium abrasive. If the errors are of only a few minutes, a trained operator will correct 5 to 8 prisms per hour, depending on size.

A trouble frequently encountered with plaster blocks is staining. This occurs on polished faces in the plaster block and appears to be due to alkaline water penetrating the shellac from the plaster, or otherwise leaking under the shellac. Flint glasses, especially extra dense flints, are very susceptible to this trouble. Careful shellacking or a coat of clear lacquer over the shellac are both helpful. Light stains may be removed by rubbing with ceria on a soft cloth. Bad stains may necessitate hand-polishing using a pitch polisher and ceria.

Plaster blocks may be of any suitable size. 10 and 12 in. are the most common and 14-18 in. about the largest that can conveniently be handled, although blocks up to 24 in. are used by some firms. Polishing times vary with the accuracy of flatness required, size of block, and size of each individual surface in the block. For 10 in. blocks, polishing times run from 2½ to 4 hours, and with 12 in. blocks from 3 to 4½ hours. As 12 in. blocks contain nearly 50 per cent. more prisms, they are the more economical. With larger blocks still there is little increase in polishing time and even greater economies may be effected, although the difficulties in maintaining flatness are increased proportionately. An operator runs from 4 to 6 spindles, depending on the degree of precision of the work.

Glass Angle-Body Blocking

The biggest drawback of plaster blocking is the lack of control over lineal dimensions, since after blocking there is no reference surface available from which measurements may be made. This also implies some loss of control over angles, as during fine-grinding more glass may unwittingly be removed from one side of the block than the other. For these reasons we adopted glass body blocking for prisms where both angles and lineal dimensions had to be closely held. The method was particularly valuable for the intricate centre prisms in rangefinders (see detail, Fig. 4).

The angle bodies used for this purpose are made from a low-expansion glass and may be either single or double-sided—that is, the work may be blocked on either one or two faces. The bodies have ground surfaces and must be very carefully hand-corrected to the required angles and sharp height. Blocking is done with a high-adhesion cement of the type already described, the body being slightly elevated and rotated with its vertical axis horizontal. The work is then stuck on to the uppermost inclined face and slid down this until one edge locates against a horizontal stop. To ensure accurate alignment, this edge of the prism blank must be left sharp. Consideration will show that with this method of blocking there is a tendency while the cement is setting for the prisms to slide outwards, away from the body at the lower edge. This results in a slightly wedge-shaped film of cement between the prism and the body. Experience shows that the angle of the body must be increased from 1½ to 2 minutes to compensate for this—that is, a body for blocking a 45° prism face would be made with a lower base angle of 45°-1½ minutes.

After blocking, the bodies are cemented to an accurately flat base plate using a low melting-point wax, and returned to the grinding shop for rough and medium grinding of the uppermost edge. This is done by hand on vertical-spindle revolving laps about 12 in. in diameter and is an operation requiring care, and skill of a fairly high order. If the prism blanks are of correct size and the bodies all uniform in sharp height, accurate dimensions between prism faces may be held by controlling the height from the base plate as the work proceeds, using a depth micrometer. This control is continued during fine-grinding, after which polishing follows as usual. In certain cases, additional support during grinding and polishing is necessary and this is furnished by sticking supplementary supporting bodies onto the inclined face of the angle-body, in the manner shown in Fig. 21. After the first side has been polished the prisms are de-blocked, cleaned, and checked for angle. With care and experienced blocking, this method yields results such that 95 per cent of the prisms are within 3 min. of correct angle. The few which are off angle are allowed to accumulate until there are sufficient for a block. They are then re-blocked and re-polished. In addition to holding angles within 3 minutes, lineal dimensions of intricate prisms may be held within ± .002 in. The cost of tooling is not excessive and may be justified by any requirement of the order of 1,000 prisms or more.

As only precision surfaces are handled in this way, polishing times are fairly long—from 3½ to 4½ hours for a 10 in. block. One man usually operates 4 polishing spindles. Polishing is done right way up throughout.

Contact Blocking

Where angular tolerances of less than 1 min. are necessary, one is obliged to resort to contact blocking, if the work is to be done by machine rather than hand-polished. With contact blocking, the work is supported, from a face already polished, by pressing it into optical contact with the polished surface of the glass mounting body. If the parts in question were parallel windows, they would be contacted onto a 1 in. thick optical flat of the required diameter, preferably not less than 10 inches. Wedges of low angle such as rangefinder deviating wedges (Fig. 4) are contacted first onto angle bodies of the required wedge angle, then the pair are contacted as a unit onto the optical flat, which is secured to a backing plate by numerous sealing-wax points to prevent distortion and minimize temperature effects in polishing.

The optical contacting of two pieces of glass, which is analogous to the wringing together of Johanssen gauge blocks but gives a much stronger and more rigid bond, is no simple operation. Both surfaces must be perfect optical flats (within ¼ λ or less). They must be absolutely clean, as the least film of oil or speck of dust will prevent contact. This cleaning is done first with a cloth soaked in a soap-base solution with added detergent, followed by final cleaning with ether and a camel-hair brush to remove lint and dust. These precautions are of no avail unless the operator is of a dry-handed, unemotional type. If not, moisture coming from the hands and fingers will cause excessive trouble. The attainment of contact is indicated by progressive disappearance of the Newton's fringes and increasing difficulty in obtaining relative movement between the two surfaces. Many months of training are required to attain proficiency at contact blocking. After contacting, the edges in contact are shellacked to exclude water during grinding and polishing. Otherwise, contact may be broken later through capillary action.

Fig. 19—Block of 70 binocular prisms on steel angle bodies.

Let us now consider what is involved in polishing a block of parallel windows to an accuracy of ± 1 sec. An error of one second represents a departure of about .000005 or 1/200,000 in. per inch. If the block is 10 in. in diameter, this means that the parallelism of grinding across the full width of the block must be held within 1/20,000 in. This is just within the limit of what can be measured with a depth gauge of the most sensitive dial-indicator type. During grinding, the thickness of the block across several diameters is constantly checked and held inside this limit. But this is not enough. Additional errors may be introduced if the block as a whole is concave on convex. A concavity of only 5 rings would introduce a tilt at the outside of the block of 4 seconds. A high order of flatness must therefore be maintained across the whole block during grinding and polishing, and this requirement applies even more so to the optical flat to which the work is contacted. From every consideration it will be apparent that the larger the block, the higher the accuracy which is possible. Angle tolerances of ± 5 sec. can be maintained on contact blocks of 6 or 8 in. diameter. Tolerances of ± 2 sec. can be maintained with an average recovery of 75 per cent on 10 in. blocks. Where closer tolerances still are required, the pieces are made as near as possible on the machine, then individually hand-polished to perfection.

Contact blocking may be used to advantage on the important class of prisms known as roof prisms. These are usually of the form of a 45°-45°-90° prism in which the hypotenuse face, instead of being flat, is shaped like a roof whose 90° angle must be held within ± 2 sec. For polishing the last side of the roof angle, such prisms are blocked as shown in Fig. 22, being contacted first to heavy vertical bodies, and the latter contacted to the base flat. The vertical bodies wear down with each successive use and must eventually be replaced. There are other interesting methods of making roof prisms, but unfortunately space does not permit description here. This is the most difficult class of contact work, requiring great skill in blocking. If sufficient skill is available, prisms requiring reprocessing of either roof surface may be re-blocked with such accuracy that no fine-grinding is necessary.

De-blocking is accomplished by thermal shock which causes the surfaces to separate through the strains introduced. A gas flame may be used for this purpose, or ether poured on and caused to evaporate rapidly by blowing.

Fig. 20—Three types of optical goniometers.

Owing to the high order of flatness required over large areas, test glasses 4 in. or more in diameter are used for contact work. As the polishing reaches the final stages the block must be removed from the machine and allowed to cool to equilibrium before testing for flatness. For this reason, it is advantageous to work two blocks on the same spindle, alternately. Even so the lowest speeds must be used as polishing approaches completion. A skilled polisher operating four spindles may produce up to four 10 in. blocks in an 8-hour shift.

For checking angles to a tolerance of 1 sec. or less a Hilger interferometer is used after polishing is complete. This is the most sensitive comparison method available, the deviation in angle between the test piece and master prism being visible in the form of interference fringes. Estimates may be made to 1/10 of a fringe or 2 seconds with a 1 inch surface. The absolute accuracy of the master prism must be checked by mechanical methods. We used for this purpose an accurately divided circle, such as is available on the largest and most accurate spectrometers. With this, by averaging a large number of measurements across many different diameters of the divided circle, absolute accuracy is possible to $\pm$ ½ sec. across a 3 in. face. This is about the limit attainable. For checking parallel surfaces, no master is required, as the interferometer method is an absolute one. Other firms use methods of checking the work while still on the block by sensitive auto-collimators or portable interferoscopes, but we did not find such means necessary.

Windows, Filters and Graticules

For polishing windows, filters or graticules where parallelism of ½-2 minutes or more is all that is required, slightly different methods are used. For the first side, the pieces are fastened directly to the blocking plate with paraffin wax, ground, and polished. For the second side, they are laid on a flat tool with the polished face (protected by shellac) uppermost and transferred onto the blocking tool by picking them up with a thick pad of cheesecloth impregnated with high-adhesion cement. A layer of pitch may be used for this purpose instead of the cheesecloth and cement, but less trouble with sinking is encountered with the latter. The planar side of lenses may be polished by either of these last two methods, depending on the steepness of the curved side, or by blocking on a flat tool with shallow machined recesses into which the curved side is cemented.

Polishing times for 10 in. blocks are from 1 to 3 hours, depending mainly on the surface quality required. One man may run 6 or 8 spindles.

The distinction between graticules and windows lies in the quality of polish required. As these surfaces are engraved and viewed through the eye-piece of the instrument under high magnification, minute scratches, pits, seeds, or other imperfections normally invisible can be seen. Such focal plane surfaces may occur on prisms or lenses when these serve as graticules, or are cemented to them. Glass surfaces close to the focal plane also require the same order of finish as actual focal plane surfaces, and the higher the eyepiece magnification, the higher the quality required. As the magnification may be as high as 14 times, and normally lies between 8 and 12, the necessary quality of surface may be imagined.

The highest possible quality of polish depends more than anything else on great care in medium and fine grinding.

It was our experience that best results are secured by medium-grinding graticule blocks by hand on fast vertical spindle laps at 1200 ft. per min. or more. This grinding is done in two stages—25 minutes with 22½ micron, removing .005 in., and 25 minutes with 18 micron abrasive, removing .004 in. After this, the blocks are machine fine-ground in two stages, 1 hour with 12½ micron, finishing with 20 minutes with 9 micron abrasive. The actual thickness of glass removed at each stage should be checked, as damage to the surface extends much below what is apparent. The quality of abrasive and polishing agent and dust-free atmosphere are also important.

All polishing is done upside-down with very long polishing times to ensure removal of all grinding pits and other surface imperfections. For 10 in. blocks, polishing times vary from 4 to 6 hours, one man operating 6 spindles.

During and after polishing, the work is inspected on the block under the strongest light with a 7-power magnifier. The greatest skill is required for this inspection as defects are much harder to see by reflection than by transmitted light—a remark which applies to all block inspection, not only to focal plane surfaces. A polishing recovery of over 50 per cent is exceptional for graticules. The normal rates for pieces with two polished sides run from 25 to 45 per cent. The rejects are reprocessed until they become too thin.

The most difficult optical surfaces to work are focal plane prism surfaces where high surface quality must be combined with accuracy of flatness and close dimensional tolerances. Fortunately, there are not many of these.

PRODUCTION METHODS — HAND POLISHING

Before leaving the subject of polishing, a short description of hand polishing applications may be of interest. At one time all polishing was done by hand, using the same fundamental methods as those described except that the random motions and selective polishing of the machine were replaced by similar actions manually applied, usually

Fig. 21—Block of prisms on glass angle bodies with supplementary glass supporting bodies.

to one piece at a time. The trend nowadays is more and more away from hand polishing, and we carried this to the limit for two reasons: first, the almost total absence of skilled hand polishers in Canada; second, the high cost of such methods. We therefore used hand polishing mainly for the production of test glasses, both planar and spherical, for correcting contact bodies and flats, for finishing certain rangefinder parts, for emergency repairs on damaged surfaces of valuable prisms, and for correcting very small angular errors—of the order of a few seconds.

Wherever possible, all test glasses should be made from fused quartz, to minimize distortions due either to temperature differentials between the glass and the work, or to heat from the hand of the user. Quartz is harder than glass, hence more difficult to grind and polish, but the same methods are used.

Test glasses for lenses are made in pairs, one master pair of convex and concave glasses being made first for each new curve. Small diameter grinding tools are made specially for grinding test glasses. The curve on the tools is trued as accurately as possible to brass gauges which are machined to the correct radius within .0005 in. After grinding the test glass blanks in these tools, which are used for each successive stage of grinding, pitch polishers are formed in the tools and the test glasses hand polished on a slowly revolving spindle. The convex glass is usually made first and its radius checked with a precision spherometer of the Abbé type to an accuracy of approximately one part in three thousand. The attaining of correct radius is a matter of trial and correction. As soon as the radius appears to be correct, the concave glass is worked using the convex as a test glass. The polishing is completed by checking each glass against the other in a number of different relative positions and working each until perfect sphericity is attained to less than 1/4 wavelength. A pair of test glasses can seldom be made with less than 24 hours of hand work. From this master pair, working masters are then made for shop use by similar methods, and these take nearly as long to make as the original masters. On large production runs test glass making is a continuous job, as the working masters become scratched and worn after a few months' use and are subject to damage from careless handling.

Test flats are hand-worked as close as possible to a perfect reference flat. A flat is considered perfect if within 1/10 wavelength*, a condition which is harder and harder to obtain as the size increases. The large flats used for contact blocking are first polished on machines as close as possible, and then hand corrected to perfection, if necessary. With a highly skilled workman, perfect 10 in. optical flats can be made directly on the machine.

Space does not permit description of hand polishing techniques, except to mention that the greatest difficulty lies in avoiding distortions due to the heat of polishing and transmitted heat from the hand of the operator. Months of training are necessary for the simplest handwork, while the more difficult work is a craft which can only be acquired by years of practice.

Production Methods—De-Blocking and Cleaning

The importance of de-blocking and cleaning methods has never yet been sufficiently emphasized in print.

The simplest method of deblocking lenses is to chill the blocks in an electric refrigerator until the pitch becomes brittle and loses adhesion with the glass. A temperature of 0 deg. F. or lower is advisable for this purpose. First side lenses usually present no difficulty but second side lenses tend to stick in the block, because the shellacked first side is imbedded in the pitch which bonds to it strongly. Any conditions which necessitate prying of the lenses or hammering the block are bound to cause trouble either from chips, scratches, or pits caused by the excessive adhesion lifting out small particles of glass from the polished surface. Adhesion of the shellac to the pitch may be reduced by adding to the former 60 per cent. or more of rosin. After removal from the refrigerator the lenses must either drop off, or easily lift off the block.

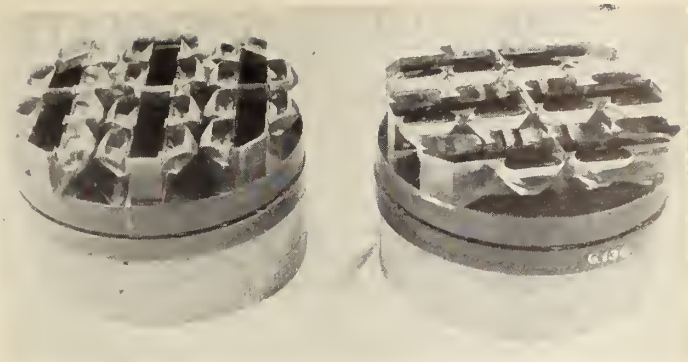


Fig. 22—Two contact blocks of roof prisms.

If sealing-wax points are used for blocking, the lenses may be de-blocked by freezing only if coated with the rosin-shellac mixture, otherwise they must first be heated off, then the sealing wax dissolved by prolonged soaking in alcohol. At one time this method was used for all lenses and prisms for removing shellac after de-blocking, but more rapid cleaning with less handling is obtained by first removing any residual pitch in a standard trichlorethylene vapour degreaser. The optics are then immersed in a series of tanks, the first with hot alkaline cleaner, followed by several hot water rinsings and wiping off. The work is loaded into wooden racks designed to prevent any possibility of contact between pieces, and the racks handled from one tank to the next, several at a time, by means of an overhead monorail. The strength, temperature, and time of immersion in the alkali are of great importance, as errors in any of these may ruin thousands of dollars worth of optics due to etching of the polished surfaces. The etching can cause a scratched appearance—perhaps through penetration and chemical attack below the surface through invisible flaws remaining from milling or grinding. A suitable alkali solution appears to be: sodium hydroxide 58 per cent, sodium carbonate 34 per cent, tri-sodium phosphate 6 per cent, detergent 2 per cent—used in the porportion of 5½ lb. to 40 gallons of water. With this solution, immersion for 2 minutes at 160 deg. F. gives satisfactory results. If a 1 to 3 per cent solution of soft soap is used in the last tank and allowed to dry on the glass, this will facilitate cleaning and prevent water stains. Care must be taken with large prisms as thermal shock may cause breakage when they are suddenly plunged into the hot cleaning solution. Flint glasses, particularly extra dense flints, are so subject to chemical attack that the closest control must be kept over all the factors mentioned to avoid trouble. Valuable prisms of such glasses are usually therefore cleaned individually, after soaking in pans of alcohol.

In handling the optics during processing, there are two fundamental points to watch: first, individual pieces or blocks must be prevented from coming into contact with each other at any point (with lenses in trays, perforated cardboard sheets are a convenient means); second, wherever pieces rest on polished surfaces, these surfaces should be protected from scratches and rubs by a piece of soft clean paper, frequently renewed. These rules for correct handling are so simple and obvious that for this very reason they seem to get overlooked or ignored, resulting in high losses or expensive repairs to finished pieces.

(To be continued in the June issue.)

* This is, of course, a purely arbitrary definition.

THE FOREMAN'S STATUS IN THE ORGANIZATION

E. R. COMPLIN

Industrial relations manager, Canadian Industries Limited, Montreal, Que., and Employers' representative, Wartime Labour Relations Board, Ottawa, Ont.

An article written at the request of the Institute Committee on Industrial Relations, being one of a series prepared for the *Journal*.

The observed tendency of foremen in the United States to listen to the advocates of unionism is leading to considerable inward scrutiny of itself by management in that country. A similar scrutiny in Canada may be beneficial whether a parallel situation is likely to arise or not.

Most companies refuse to admit any identity of interest between their foremen and the unions representing the rank-and-file employees on the grounds that disciplinary action would be seriously impaired, and that management cannot bargain collectively within itself. Such companies recognize, in words at least, that foremen, when properly titled, are a part of management. The problem is to satisfy the foremen that this is so.

What is a Foreman?

As the title "foreman" is used somewhat indiscriminately throughout industry to label men whose duties would more properly be described all the way down from superintendent to leading hand, it would be well to start with the following definition:

> "A foreman is the member of supervisory management in operations in closest direct personal contact with the working force. In general, he plans, controls and directs the work of subordinate employees, participating little or not at all in such work: his responsibilities include the operation and maintenance of the equipment in his unit of supervision subject to established production and quality control standards; and the effecting, or the effective recommendation, of the engagement, promotion, transfer or dismissal of employees in his unit."

The foregoing description excludes persons on the second and higher levels of supervision, as well as employees variously called charge-hands, group leaders, leading hands, working foremen, etc. who are characterized by (a) the absence of responsibility and authority in connection with the planning or controlling of work, and (b) regular participation in the work of the employees they lead.

Because the description appears to some management people to overstate the degree of responsibility and authority of foremen, or to lend unaccustomed dignity to the position as they know it in their own shops, there has arisen a school of thought which seeks to beg the question by denying that a foreman is any part of management, and by attempting to refer to his status as that of an agent of management. Any company, dealing with its rank-and-file employees under the terms of a union agreement which clearly sets forth a grievance procedure in which the first step is recourse to the foreman, appreciates the unfortunate results which would ensue from looking upon the foreman as an "agent". In any event, if there is anything further needed to confirm in a foreman's mind that he is a lone wolf and would be better off running in a pack devoted to the enhancement and protection of the objectives of the pack, it is for management to deny him a place within the portals while holding him responsible for results and at the same time maintaining that he may not identify himself with the employees he supervises.

There is no law forbidding foremen to be members of a union. Many foremen as a matter of course maintain membership in the union to which they belonged before promotion to foremen rank. Some laws governing collective bargaining bar foremen from inclusion in the bargaining unit designated as suitable for rank-and-file employees. Some unions will not represent foremen.

Foremen's Unions

While it is clear that foremen can be members of a union devoted to the representation of foremen's interests solely, the legal right of such a foremen's organization to compel the employer to enter into collective bargaining is not clear at the present time. In the United States, the Foreman's Association of America (F.A.A.) is the most active agent, not to be confused with the National Association of Foremen or the National Council of Foremen's Clubs (bodies which eschew collective bargaining and are devoted to the promotion by foremen of a better understanding of the nature of foremanship). The F.A.A. which has thousands of members and many locals, largely centred in the Detroit area, several months ago was the beneficiary of a ruling by the National Labour Relations Board directing the Packard Motor Car Company to negotiate with it. Recently that Board reaffirmed the ruling but, acknowledging its understanding that the employer was seeking a court decision in the matter, stated that a judicial review would be desirable in such an important issue. The issue has not yet been settled.

In Canada, one of the isolated instances of a union for foremen failed, at least temporarily, to secure certification from the Wartime Labour Relations Board for Ontario. The situation in this country is beclouded by the wording of the Wartime Labour Relations Regulations, P.C. 1003, which, while excluding from the benefits of the legislation any person "having authority to employ or discharge employees" with the intention of thereby eliminating foremen, fails to recognize that these forms of absolute authority have been passing out of existence in industry for years past.

In modern industry, absolute authority in many functions previously reposed in foremen is today placed one or two levels higher in an organization. The multiplicity of those matters, for which a foreman is now nonetheless customarily held responsible in order that he may give effective supervision, is so great that it has become necessary to introduce specialists in several lines of endeavour such as personnel, production planning and control, methods engineering, whose job it is to relieve the foreman of the necessity of devising the best procedures and to co-ordinate the application of these procedures by all foremen. This fact, coupled with the tendency of the specialists to fail to consult foremen, has led to the erroneous conception by some foremen that their importance in the general scheme has been minimized. It would appear that the majority of foremen are not concerned about having new or extended authority. Rather they are confused as to exactly what authority they are intended to possess and exercise in the various aspects of their responsibilities.

Foremen's Grievances

The more important reasons why foremen in the United States have not been impressed by management's statements that they are part of management are said to include the following:

1. Men whom he supervises may receive larger earnings than he does, and management has not appeared

concerned except to point out that the relative positions will be restored in the future.

2. The foremen see a company blithely sign an agreement with the men's union which forfeits the foreman's right to seniority credit for years spent as a foreman, if he should be demoted to the ranks.

3. The union steward knows about company decisions before the foreman does.

4. The men have recourse to a grievance procedure. It is said that the foremen can go one-over-one with personal grievances but few believe that they will be forgiven for making use of the procedure.

5. The union stewards are better trained in an understanding of the union agreement.

6. The foreman is not consulted in matters of policy affecting his men or himself but his men, through their union, have a say in matters concerning them.

7. Staff specialists such as engineers, personnel men, time clerks, etc. either countermand the foreman's orders, sell higher management without the foreman's knowledge on matters affecting his department, or issue directions without going through the foreman.

8. Conditions surrounding the jobs are sometimes less favourable than those accorded clerks who are not members of management and may themselves be unionized.

9. The foreman's responsibility and authority are not clearly defined — he is continually being charged with errors of commission or omission.

10. The company's policy in many matters is not known, and the foreman is left in the position of always having to postpone direct answers while he finds out, if he can, what the policy is.

Most of the reasons stated above could be operative in Canadian plants: all could be possible in a plant where the rank-and-file employees are unionized. Probably the higher density of union organization in the other country has brought the situation to the fore there before it has assumed any proportions in Canada. Canadian industrial relations practitioners usually watch events in the United States as an indication of what to expect here eventually unless timely first-aid is rendered. There are old adages about " forewarned " and " an ounce of prevention."

This paper opened with a reference to inward scrutiny by management in the United States where, early in 1944, a panel under the chairmanship of Dr. Sumner Slichter of Harvard University was established by the government to investigate the reasons for supervisory grievances. The extensive hearings were followed in 1945 by the publishing of a report by the American Management Association (A.M.A.) titled " The Development of Foremen in Management " which was based on a study of the Slichter Panel's report, the evaluation of questionnaire replies from almost 100 companies, interviews with many executives, discussion with a number of foremen, and a wide survey of published sources. Recently the National Association of Manufacturers of the United States issued a pamphlet " Strengthening Management Teamwork " which states the fundamental methods and techniques in much the same form as the A.M.A.'s report but without reference to the findings and reasoning which makes the latter the more outstanding contribution for the company which wishes to acquire a thorough understanding of the elements involved.

Effective Supervision Essential

Today, as never before, efficient industrial operation is required; the degree to which this objective is achieved depends in large part upon good supervision and sound relations within management. It will be found that the things which can be done to strengthen the foreman's position and improve the opportunities for him to be a manager in fact are many instances fairly simple to introduce but some may require an almost drastic, albeit beneficial, revision of many ideas and practices. A continuous organized programme of development training, one of the essentials, entails expense as well as constant attention and participation of all levels of supervisory and executive personnel.

It must be recognized also that the pursuit of effective supervision is bound to involve an investigation of how supervisors are selected, rated, and promoted if the maximum benefit is to be derived from the other class of steps to be taken. It is in this field that industry has been particularly handicapped due to lack of criteria. Much has been written about the supervisory process but little has been done yet clinically. Before selecting a supervisor, the qualities and characteristics to be sought should be clearly identified. It has been said that the vague and conflicting notions of supervisory quality entertained by managements are so sketchy that they cannot even be stated, much less measured. It is clear, of course, that quality of workmanship or long service are not indicative of a potential supervisor. Some better way than usual must be devised to determine whether a supervisor is strong or weak, in which qualities he is strong or weak, and the relative importance of the possession of various characteristics or knowledge. Lacking such indications, development training may fail to improve supervisory performance as much as it could do when the programme is tailored to fit the known needs of the organization. The difficulty envisaged by the foregoing remarks should not be permitted to discourage attempts to improve.

The A.M.A. report very aptly ends with the observation " remedial action by top management must not be confined to foremen alone, but must include their immediate supervisors as well lest a new category of ' forgotten ' men be created." As the status of men on any level is studied, the next higher level apparently becomes automatically involved. This looks like a chain reaction holding in store some rather startling effects if it proceeds far enough.

It is somewhat unfortunate that the current scrutiny of the foreman's status stemmed initially from the movement towards unionism rather than from desire to institute a sound application of the principles of organization, management, and applied psychology. However, regardless of the motivation, the important point now is that something be done to clarify the position of this member of management who has been described as the " key " man but who has not always been accorded commensurate thought nor given the training which makes it possible for him to act effectively.

It hardly seems necessary to point out that any attempt to improve the status of foremen should be proceeded with slowly, and judgment must be exercised in the selection of the stage at which to stop in light of local circumstances. It is possible to identify foremen with management too closely, and to surround him with " signs of office " to the extent that the people he supervises, with whom he may have had excellent relationships from any point of view, withdraw from him by leaving him out of their activities, out of the shop jokes and gossip, and out of their thoughts as one to whom they can turn for guidance and leadership. A reaction of this kind may be guarded against by giving adequate attention to the human and personnel aspects of good supervision in the lay-out of the development programme.

It is interesting, and provoking, to notice that whenever a group of foremen who scrutinize a list of their responsibilities are asked to indicate the topics which they feel are the most important to them, and which of these they would like to discuss first, invariably select those matters which touch upon an understanding of the human side of operations.

From Month to Month

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

A FUND TO PROVIDE EDUCATION

Before this *Journal* is distributed, all members will have been approached in reference to the creation of an educational fund by the Institute. It is hoped that, within the specified time, the full sum will have been subscribed.

The fund will enable the Institute to realise two of its objectives; firstly to commemorate the name of Harry Bennett, and secondly to play its part in providing education to deserving students of scholarship calibre who otherwise might not attend university. Both objectives are thoroughly worthy of support.

It is encouraging to have the approval of the Government in the form of tax exemption for contributions. Not only are the contributions deductible from income for tax purposes, but the fund itself will be exempt from tax. The notice from the Deputy Minister reads in part:

> "The Inspectors of Income Tax have been advised that donations to the above fund will be deductible from taxable income under the provisions of section 5 (j) and (jj) of the Income War Tax Act. The fund itself will also be exempt from tax under the provisions of section 4 (e)."

A fund of this kind is new to the Institute, but not to several other professional organizations. The history of such endeavours shows there is a genuine need for them in many fields. The broad terms under which the fund is established, will enable the money to be used for a variety of purposes, all or any of which can be changed if changed circumstances so warrant. It is a mistake to fix too firmly the conditions that control the distribution or use of such funds.

The committee handling the collection of subscriptions has done an exceptionally fine piece of work. Chairman James A. Vance of Woodstock has been well supported by R. E. Heartz of Montreal and E. V. Buchanan of London. With such careful and painstaking planning, success is bound to follow.

LEGISLATION IN QUEBEC

For several years the Corporation of Professional Engineers of Quebec has been working on amendments to the provincial engineers Act. The situation became acute last year when the provincial architects were successful in their suit to prove that an engineer was not legally permitted to design an industrial building. In addition to supporting the appeal of the court's decision, early in the year the Corporation applied for amendments to the Act that would return to the engineer his previous rights with regard to buildings.

After considerable preparation and negotiation, the amendments were brought before the Public Bills Committee for final consideration on March 26th and 27th. As opposition was offered from a variety of organizations the bill was withdrawn by the Corporation. The *Journal* understands that it is proposed to approach the legislature again shortly.

It is interesting to note the interests that opposed the amendments. There were the architects, of course, and certain others, some of whose interest in the case it was difficult to discover. There were also agronomists, contractors, miners, chemists and forest engineers.

It is disturbing to find with the opposition, representatives of such organizations which doubtless have been considered by the Corporation as "sister" societies. If the proposed amendments were not in their best interests, the Corporation would have been sympathetic to a private request for modification. It was evident that the Corporation had no intention of restricting them in any way, and if the legislation appeared to do so it was simply a misunderstanding.

This public conflict of technical groups was bad enough when it was restricted to the Architects Association and the Corporation, but it is definitely worse when other societies, seemingly more closely allied to engineers, join in the opposition. As a basis for promoting the much talked of cooperation between such groups, it is not as encouraging as could be desired.

The Corporation now faces the task of reconsidering its procedure. There was nothing basic in the proposals that should have developed opposition any place—perhaps not even with the architects. It was not the intention to infringe on the legitimate field of any individual or group. The main purpose was to remove the ambiguity of the legislation in relationship to the engineer and buildings, which had been indicated by the court's decision. Other objectives included minor matters proposed principally to bring about a clarification of wording.

It is regrettable that this temporary situation has developed, and the fact remains that it must be only temporary. The Brian Perry case is still proceeding, and it may be that a reversal of the decision here will make unnecessary any changes in the Act. It looks now at this writing as if the appeal will be heard this Spring.

A CORRECTION

Attention has been called to the statement at the foot of the fees tabulation recently circulated with the ballot for by-law amendments relative to the relationship between the grade of Fellow in the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, and the grade of Member in The Engineering Institute.

This foot-note stated that "Qualifications for Fellow A.S.M.E. and A.I.E.E. are approximately the same as for Member E.I.C.". A casual study of the qualifications indicates immediately that the two are not at the same level. The grade of Fellow in each of the American organizations requires much more professional experience than does Member in the Institute, in addition to which recognized status in the profession is required. It is apparent that Fellows are selected largely for their attainments or their contributions to professional knowledge, rather than on an academic record.

The Institute's statement was based principally on the fact that graduation or an examination are not required for the Fellow grade. It was thought, in making the comparison, that the lower academic requirement balanced the higher requirement of experience and attainment.

It is difficult if not impossible to evaluate satisfactorily the two sets of qualifications, but the fact remains that no useful purpose was served in the first place by making the comparison and certainly it would not have been done had it occurred to the committee that offense might be given to members of the American Societies. Fellows of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers are distinguished members of the profession and the committee regrets that its report could have been interpreted as implying anything else.

SOUTHWARD HO!

As has been foretold for many months, great numbers of Canadians are now moving to the States. In its demand for decent wages for engineers, the Institute has pointed out the inevitability of this trend under existing conditions. In particular has it been brought to the attention of the Federal Government with the hope that salary adjustments might be made before it was too late. The following paragraph taken from the April 1st issue of *Time* indicates the urgency of the situation. Note the third paragraph in particular.

"Everybody seemed to want a U.S. visa. In 14 U.S. consulates, from Halifax to Vancouver, hard-pressed clerks interviewed Canadians, laboriously filled out long forms, took fingerprints of prospective new Americans. Last week consular officials paused to look at the record. In the last six months of 1945 they had okayed permanent visas for 8,767 Canadians. If the present pressure continued, 20,000 Canadians will migrate to the U.S. in the 1945-46 fiscal year. Not since 1931 had so many Canadians pulled up stakes and moved south.

"Officials did not have far to look for the reasons behind the increased emigration: 1) relaxation of the wartime Canadian law requiring a labor permit to leave the country; 2) easing of exchange restrictions on taking money out of Canada; 3) increased urban unemployment in the Dominion; 4) continuation of rigid Dominion wage controls.

"What worried Canadian authorities most was the sharp increase in the number of visas issued to top-class citizens. Visas for professional, clerical and other white-collar categories had shown the biggest rise of any group, 2,232 issued in the last six months of 1945, compared with 1,770 in the year 1944-45.

"For Canada this posed a major problem. The Dominion had lost one-sixth of her population to the U.S. before 1930. Stringent immigration and wartime controls had helped dry up that stream. Now the stream was rising again."

COLUMN RESEARCH COUNCIL

The announcement of the creation of this organization appeared in the October, 1945 *Journal*. It is now possible to tell something of the organizational setup, of the financial implications and the programme of work. The following paragraphs are taken from the minutes of the executive committee and the various technical committees.

The executive committee reports a revised "Statement of Purpose" as follows:

"Since existing knowledge relating to the design of compression members is inadequate, there is confusion and lack of harmony in the column formulas in the many and various specifications in use. There is an urgent need, in the interests of standardization, economy, and public safety, to bring about a general agreement among the specification-writing bodies, and thereby remove the present unsatisfactory condition.

"The purpose of the Council therefore is to review existing knowledge of the theory of columns and other compressive elements of metal structures, and of the properties of metals available for their construction; plan and carry out a program of research and tests to supplement and improve existing information regarding properties of materials and the functioning of compressive elements under various conditions in different types of structures; study the application of the results of this program to the design of such elements; develop a comprehensive, consistent set of formulas or rules covering their design; and promote the widest possible adoption of such formulas by designers and specification-writing bodies."

The chairman announced that $15,000 had been made available to the Council, and that the amount would be doubled as required. Further, it was indicated that the work of the Council would extend over several years, and that eventually it might cost as much as $250,000.00.

An initial organization was proposed to include four sub-committees as follows:

(a) Mechanical Properties of Materials.
(b) Initial Eccentricities of Compression Elements.
(c) Local Buckling of Compression Elements.
(d) Columns in Structural Frames.

It was agreed that a questionnaire be circulated, the answers to which would assist the Council in directing its initial activities towards the most urgent problems in the design of columns and other compressive elements of metal structure. Here are the questions:

1. What are the most important structural problems, involving stability against buckling, that you or your organization have encountered? In your answer to this question, please cover the following points, in addition to any other that you may consider:
   a. A clear description of the member or part of the member involved.
   b. The specification and specific design formula, used, if any.
   c. A specific reference to any research which substantiates the specification or formulas.
   d. Your opinion or experience as to the adequacy or inadequacy of the specification and formulas.
2. What structural design problems, involving stability against buckling, have you encountered or do you expect to encounter in the future, on which additional experimental or analytical research is needed? In your answer to this question, please indicate the factors which you believe have an important bearing on the buckling strength, and where the emphasis in research should be placed and why.
3. What metals do you expect to use in future structural designs? In your answer to this question, please specify clearly the particular alloys.

Your answer should be addressed to:

Shortridge Hardesty, Chairman,
Column Research Council,
101 Park Avenue, New York 17, N.Y.

The Institute representatives on the Council are P. L. Pratley and R. S. Eadie of Montreal and Dean J. N. Finlayson of Vancouver. Following is the latest list of participating organizations:

Engineering Foundation, New York.
American Society of Civil Engineers, New York.
Association of American Railroads (American Railway Engineering Association) Washington, D.C.
American Society of Mechanical Engineers, New York.
American Institute of Consulting Engineers, New York.
The Engineering Institute of Canada, Montreal.
American Institute of Steel Construction, New York.
Public Roads Administration, Washington, D.C.
American Association of State Highway Officials, Washington, D.C.
National Bureau of Standards, Washington, D.C.
Chief of Engineers, U.S. Army, Washington, D.C.
Bureau of Yards and Docks, Washington, D.C.
Bureau of Ships, Washington, D.C.
U.S. Coast Guard, Washington, D.C.
Society Naval Architects & Marine Engineers, New York.
American Standards Association, New York.
American Institute of Architects, Washington, D.C.

Pacific Coast Building Officials Conference, Los Angeles.
Structural Engineers Association of Southern California. Los Angeles.
Structural Engineers Association of Northern California. San Francisco.
American Iron and Steel Institute, New York.
Aluminum Company of America, Pittsburgh.
Steel Plate Fabricators Association, Chicago.
Institute of the Aeronautical Sciences, New York.

A LIST OF MEMBERS OF THE INSTITUTE

At last conditions seem propitious for printing a new list of members. The last one is dated 1938. No one would have thought it possible to carry on this long without a printed list, nor would anyone have dared to do so except under the unusual conditions of wartime. Shortage of paper has been the major difficulty, and of itself was sufficient to cause delay for several years. Shortage of staff and frequent change of address were two other important reasons.

It is planned to produce a list before the end of the year, perhaps in September or October. Under today's conditions of labour and materials, no one would be bold enough to say definitely when it would be ready, but shortly every member will receive a form upon which he will be asked to record certain information necessary for such a list. A facsimile of the form will appear in subsequent numbers of the *Journal* for the convenience of those who may not have received the first one, or who may have misplaced it.

A membership list is a heavy undertaking. This one will be particularly so. With over 8,000 names and addresses to arrange, and hundreds of changes going on all the time, it will not be easy to do, but it is under way and eventually will be completed.

ONE THOUSAND DOLLAR PRIZE FOR INVENTION AND RESEARCH

President Sidney Smith of the University of Toronto, announces that the University has adopted new regulations designed to encourage scientists, inventors and research workers whose discoveries may entitle them to special recognition under the terms governing the McCharles Prize. The conditions governing the Prize are as follows:

(1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale;

(2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light;

(3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line.

"The prize is offered through a bequest of the late Aeneas McCharles and is awarded by the Board of Governors of the University of Toronto.

"A committee will likely be giving consideration to an award of this prize early in 1946.

"Every candidate must be proposed in writing by some duly qualified person other than the candidate.

"Any discovery or invention claimed must be proved to the satisfaction of the award body, to possess the special practical merit indicated by the terms of the bequest.

"List of Winners of the Prize:

Mr. T. L. Willson of Ottawa, won the first award in 1909 for the invention of a process of manufacturing in a commercial way the carbide of calcium which is used in the production of acetylene gas.

Prof. S. F. Kirkpatrick won the award in 1917 for the invention of a new and improved process for the precipitation of silver from its solution in the ores of Cobalt, and also for a process for the separation of cobalt and nickel in solutions made from Cobalt ores.

Mr. S. G. Blaylock of the Consolidated Mining & Smelting Co. of Canada, won the award in 1924 for his achievements in connection with the production of electrolytic zinc and the solving of the difficulty of treating complex lead, zinc and silver ores.

Mr. R. W. Diamond of the Consolidated Mining & Smelting Co. of Canada, won the award of 1934 for (a) contribution to the solution of the concentration problem presented by the Sullivan orebody, and (b) work in the Chemical and Fertilizer Department of the Company in utilizing the roaster gases from the Trail plant.

Professor H. W. Price of Toronto won the award in 1935 for an invention in connection with the regulation of the electric power supply.

Dr. D. A. Irwin of the University of Toronto, and Dr. W. D. Robson of McIntyre Porcupine Mines, won the award in 1939 for joint investigation in connection with prevention of silicosis by metallic aluminum.

The latest recipient of the award was Dr. L. M. Pidgeon, developer of the Pidgeon Process for the production of magnesium metal from dolomite.

Any proposals for the awarding of this prize should be forwarded with necessary supporting documents to the *McCharles Prize Committee, c/o Mr. C. E. Higginbottom, Secretary, Board of Governors, University of Toronto.*"

INTERNATIONAL CONFERENCE ON LARGE ELECTRIC SYSTEMS (C.I.G.R.E.)

Reopens in Paris June 27th to July 6th

After a lapse of seven years the International Conference on large electric systems (Conférence Internationale des Grands Réseaux Electriques) will reconvene in Paris for the eleventh biennial session, which will be held from June 27th to July 6th, 1946. During the war these sessions were discontinued and the international exchange, through this organization, of operating experience and technical developments in the art of power generation and transmission was consequently discontinued.

It is anticipated that a large number of the forty-one nations represented at the 1939 Conference will participate in the discussions at the forthcoming meeting. The administrative Council of the C.I.G.R.E. has approved a programme of discussions on subjects which are of special interest due to wartime developments, or on account of technological improvements that have taken place during recent years.

The purpose of the C.I.G.R.E. is to promote the exchange of information on the design and operation of large electric systems, and through the appointment of international study groups to advance the art in all branches of the industry. These special committees, through association with the International Electrotechnical Commission, are able to formulate requirements for new or revised international standards.

The organization maintains a permanent secretariat in Paris and is administered by a Council presided over by Mr. Ernest Mercier, President of l'Union d'Electricité. International co-ordination is maintained through the individual national committees, the chairmen of which are eligible for the Administrative Council. The national committees are usually identified with a department or agency of the governments of their respective countries and members receive their appointment by this authority.

Canadian Representation

The Canadian National Committee functions under the ægis of the National Research Council at Ottawa and consists of the following members:—Mr. John Morse, M.E.I.C., Vice-President, Shawinigan Water & Power Company, Montreal—*Chairman*; Dr. C. J. Mackenzie, M.E.I.C., President, National Research Council, Ottawa—*ex-officio*; Dr. R. W. Boyle, M.E.I.C., Director, Division of Physics and Electrical Engineering, National Research Council, Ottawa —*ex-officio*; Mr. A. J. Grant, National Research Council, Ottawa—*ex-officio*; Mr. B. G. Ballard, M.E.I.C., National Research Council, Ottawa; Mr. E. V. Caton, M.E.I.C., Chief Engineer, Winnipeg Electric Company, Winnipeg; Prof. C. V. Christie, M.E.I.C., Faculty of Engineering, McGill University, Montreal; Dean E. P. Fetherstonhaugh, M.E.I.C., Faculty of Engineering and Architecture, University of Manitoba, Winnipeg, Man.; Mr. G. A. Gaherty, M.E.I.C., President, Calgary Power Company, Ltd., 244 St. James St. W., Montreal; Mr. Gordon Gale, M.E.I.C., President, Gatineau Power Company, Ottawa; Mr. R. A. C. Henry, M.E.I.C., Chairman, Air Transport Board, Ottawa, Ont.; Dr. T. H. Hogg, M.E.I.C., Chairman, Hydro-Electric Power Commission of Ontario, Toronto, Ont.; Prof. V. G. Smith, Faculty of Applied Science and Engineering, University of Toronto, Toronto, Ont.; Mr. J. W. McCammon, M.E.I.C., Commissioner and General Manager, Quebec Hydro-Electric Commission, Montreal; Mr. E. V. Leipoldt, M.E.I.C., Shawinigan Engineering Co. Ltd., *Acting Secretary* P.O. Box 6072, Montreal.

The Canadian National Committee has undertaken the sponsorship of three technical reports for presentation at the forthcoming meeting in Paris. These papers cover some of the outstanding contributions of Canadian engineers in the development, design and operation of large power systems as indicated by the following titles:—

(1) "A Review of Transmission Developments in the Systems of the Hydro-Electric Power Commission of Ontario," by A. H. Frampton and H. J. Muehleman.

(2) "Canada's 2,000,000 H.P. Hydro-Electric Saguenay System Provides Unusually Reliable Service," by F. L. Lawton, M.E.I.C.

(3) "Stability Problems on Interconnected Power System in the Province of Quebec," by John Morse, M.E.I.C.

The development of Canada as one of the world's leading producers of electric power, and as a manufacturer of electrical equipment on a large scale, entails a national responsibility to the industry and profession. The burden of this responsibility is carried by individuals who are willing to participate in the technical meetings and councils of the world, and contribute their share of knowledge.

The international organization of the C.I.G.R.E. is the natural medium for representing our interests and for exchanging technical information on operation and design which may be of mutual benefit. Anyone seeking further information about this organization or the forthcoming conference in Paris may communicate with the acting secretary of the Committee.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Royal York Hotel, Toronto, on Saturday, April 27th, 1946, convening at ten o'clock a.m.

Present: President J. B. Hayes (Halifax) in the chair; Past-President deGaspé Beaubien (Montreal); Vice-Presidents W. R. Manock (Fort Erie, Ont.), and C. E. Sisson (Toronto); Councillors P. E. Buss (Thorold); G. J. Currie (Halifax), J. R. Dunbar (Hamilton), A. R. Jones (Peterborough), W. H. M. Laughlin, (Toronto), E. Lavigne (Quebec), G. L. Macpherson (Sarnia), Norman Marr (Ottawa), C. A. Peachey (Montreal), J. B. Stirling (Montreal), J. A. Vance (London), and W. S. Wilson (Toronto); Treasurer J. A. Lalonde (Montreal); General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past-Presidents T. H. Hogg and C. R. Young of Toronto; Past-Vice-Presidents R. L. Dobbin (Peterborough), and E. P. Muntz (Montreal); Past-Councillors H. E. Brandon, J. G. Hall and A. U. Sanderson of Toronto; F. R. Pope, chairman, Peterborough Branch; C. P. Haltalin, immediate past-chairman, Winnipeg Branch; P. A. Pasquet, secretary-treasurer, Niagara Peninsula Branch; G. A. Gaherty (Montreal), member of the Committee on Professional Interests; Wills Maclachlan (Toronto), chairman of the Committee on Industrial Relations; G. Ross Lord (Toronto), president of the Association of Professional Engineers of Ontario; R. C. Wiren (Toronto), chairman of the Ontario Section of the American Society of Mechanical Engineers; E. A. Cross, chairman, E. G. Tallman, secretary-treasurer, D. G. Geiger, member of the executive, J. Dibblee and Harvey Self, members of the Toronto Branch.

Conference of Empire Engineering Societies—The general secretary reported that word had been received from the British societies to the effect that every organization invited had accepted the invitation to the conference to be held in London in September next. He asked councillors to submit any subject which they thought should be included on the agenda.

Community Planning—The general secretary reported that he had been approached by Mr. Bland of the Department of Architecture at McGill University relative to the re-establishing of the Town Planning Institute. Mr. Bland believes that such an organization should be established, and wished to know if the Institute would collaborate.

Mr. Wright explained to Mr. Bland that a similar proposal had been before the Institute and the Royal Architectural Institute of Canada over a year ago, and at that time the Institute was active in getting such an organization under way. He had found, however, that there was no continued support for it from the R.A.I.C. Mr. Wright reported that Mr. Bland was to get in touch with him again with regard to a meeting.

Mr. Wright reported further with regard to the replanning of the City of Ottawa as a national memorial. Some progress had been made towards getting the situation clarified, and he had been informed by the chairman of the Federal District Commission that the government's final policy should be released through the press shortly.

A letter from the vice-president of the Central Mortgage and Housing Corporation, Major-General H. A. Young, was presented to the meeting. It reads as follows:

"24 April, 1946.

"The President,
Engineering Institute of Canada.
Dear Sir:

I learn with considerable interest and satisfaction that the Engineering Institute of Canada contemplates an active part in various aspects relative to what is commonly called "Regional and Community Planning".

Undoubtedly the provision of suitably designed homes in situations which reflect conditions of health and happiness have not received the consideration by us in the past which they should have done. Our Canada is, of course, a new country. We have only to think of the size of what our present large cities were 75 years ago, or of the number that have come into being within that time, to realize we are still a youthful country. Our efforts in most instances have been directed to the development of Canada and that is quite understandable.

But the time has now come, I feel, when we must make strong effort to make good the deficiencies of the past. It is true that to-day the word " Planning " has become a familiar word to many people, and this is a step in the right direction. But there is very much still to be done.

Various provinces throughout the Dominion are now considering suitable legislation and many municipalities have organized planning committees. One phase of the work of the Central Mortgage and Housing Corporation will be to render assistance in this connection.

We are progressing but practical fulfillment still lags behind theoretical discussions. Now, to my mind, the man who actually gets things done is the engineer. Consequently, we are dependent upon him, as a result of the various planning committees, to obtain the finished product in this development. Because of this fact, I welcome most strongly the proposed course of action by the Engineering Institute of Canada in supporting developments relating to this important field of activity.

With kindest personal regards, I am,

Sincerely,

H. A. YOUNG ".

Harry Bennett Memorial Fund—Mr. Vance, chairman of the Harry Bennett Memorial Fund Committee, reported that there had been some delay in getting material for the campaign in the hands of the branches, largely due to the fact that it had been necessary to have the Board of Trustees properly set up and authorized in order that donations to the fund could be made deductible from taxable income under the provisions of the Income War Tax Act. The necessary authorization had now been received from the Department of National Revenue, and the campaign was well under way. Encouraging reports were being received from the various branches, which indicated that the appeal was being well received by the membership. The London Branch had reached three times its quota, and the Windsor Branch was well over its quota. This progress report was noted.

A.S.M.E. Semi-Annual Meeting—Mr. Trudel gave a brief report on the semi-annual meeting of the American Society of Mechanical Engineers to be held in Detroit on June 17th to 20th inclusive, in collaboration with The Engineering Institute of Canada. He read the list of subjects to be discussed. A tentative programme appears in the April number of the *Journal,* and it was suggested that it would be very helpful to Headquarters if councillors, after having read the list of subjects, would submit names of any possible discussors. This report was noted.

The Engineer in the Civil Service—Mr. Beaubien, as a member of the Committee on the Engineer in the Civil Service, reported on the appearance made before the Royal Commission by the committee, and the brief presented at that time. He mentioned the highlights of the brief as being the recommendation that an engineer be appointed to the Civil Service Commission, and that there be an Interdepartmental Professional Technical Panel. He reported that the committee was well received, and had an interesting, and they hoped profitable discussion. The brief itself appears in the April number of the *Journal.*

Proposed Ontario Provincial Division—Mr. Sisson reported that following the suggestion made at the last meeting of council, a meeting of Ontario councillors had been held just previous to this council meeting, at which the general question of co-operation with other engineering bodies received considerable discussion. The final concensus of opinion was that this matter could best be furthered by the formation of a provincial division as provided for in the by-laws of the Institute, and he presented the following report:

> "At a meeting of the Ontario vice-presidents and councillors, at which were present representatives from the Ottawa, Peterborough, Hamilton, London, Toronto, and Niagara Peninsula Branches, the following resolution was passed unanimously:
>
> > 'Whereas there are specific problems peculiar to Ontario facing The Engineering Institute of Canada at this time, it is resolved that this meeting is in favour of the organization of a Provincial Division of The Engineering Institute of Canada, in accordance with the provisions of Sections 69 to 74 of the by-laws ' ".

Following some discussion, on the motion of Mr. Sisson, seconded by Mr. Wilson, it was unanimously resolved that council take the necessary steps to implement the resolution of the Ontario councillors. It was pointed out that the by-laws required that the majority of corporate members in the province request that a division be formed before it can be established. The general secretary was instructed to take the steps necessary to submit the proposal to the corporate membership in Ontario.

Resolution from the Toronto Branch re Canadian Council—A resolution from the Toronto Branch, submitted at the previous meeting, respecting the Canadian Council of Professional Engineers and Scientists, was dealt with by Mr. Stirling, chairman of the Committee on Professional Interests. A general discussion followed which was too long to be reported verbatim. As a summary of this discussion would not do justice to the many expressions of opinion, and as the matter was considered of such importance by all concerned, it was felt that the membership should be fully informed through an article which will be forthcoming in the *Journal.*

Toronto Branch Resolution re Salary Schedules—The general secretary, at the request of the chairman of the Committee on Employment Conditions, Mr. R. E. Heartz, reported that the committee had been working for some time in an endeavour to secure a salary schedule that would be suitable for printing on the employment page of the *Journal.* Mr. Heartz had found that there was a great variation between schedules as prepared by various organizations, and he wishes to make a very wide search before making a recommendation.

Mr. Self suggested that the resolution which had been sent to the council may have been misunderstood. It was the intention of the Junior Section that a series of salary schedules be published—not just the same one in every issue.

After considerable discussion, it was agreed that salary schedules would be printed in the *Journal,* starting with that of the Ontario Association—it being noted that these were not prepared by the Institute but were being published simply for the information of employers and employees. At the same time it was agreed that Mr. Heartz' committee should continue its work to find some one schedule that would meet all the conditions.

Appointment of Committees—A letter was presented from Mr. C. A. Peachey, advising that it would be impossible for him to accept the chairmanship of the Library and House Committee at this time. The general secretary reported that Mr. R. C. Flitton had kindly consented to act, and it was unanimously agreed that he be appointed to this office and that he be asked to name the other members of his committee for approval at the next meeting of Council.

Joint Committee on Engineering Legislation in Quebec—Mr. Beaubien, as a member of the Institute's panel on the Joint Committee, reported that the original field of the joint committee had been altered to include only considerations related to the appeal of the Brian Perry case. Considerable work had been done, and there was a possibility that the appeal would be heard some time in the month of May.

Engineering Education (Conference of Deans) — The general secretary reported that at the Conference of Deans held in Montreal during the anual meeting of the Institute, a resolution had been passed as recorded in Minute 4405 of the March meeting of Council. He reported that in accordance with instructions from council, he had written Dean McKiel and quoted from letters received from Deans Fetherstonhaugh, Young and Spencer. However, before this reply had reached Dean McKiel, a letter had been received from him stating that a date had been selected for a joint meeting to be held with the deans of engineering and representatives of certain technical professional societies. He asked the Institute to name a representative.

At the president's request, Dean Young outlined in considerable detail the discussions at the Conference of Deans which had led up to the resolution. It was the opinion of that meeting that any assistance that could be secured from engineers outside the professional educational ranks should be obtained, although it seemed evident that the educationalists themselves were better informed and more interested in the subject than most engineers in other circles.

The object of the resolution was to indicate to non-teaching bodies that the deans desired the benefit of the judgment and opinions of other persons interested in the subject. He explained that the Conference of Deans had not agreed that a joint committee should be established, but did wish to leave the door open so they could obtain the sound judgment of engineers practising in other fields. He went on to point out the trend that was developing and told of the work of the Society for the Promotion of Engineering Education. He thought the 1944 report of that committee was a firm basis for further consideration of the subject.

As far as the Universities' Conference was concerned, he thought that the deans and teachers of engineering would like to have a meeting by themselves, and that probably the engineering societies would like the same arrangement, but that this was a matter for the societies themselves to determine. He referred also to a suggestion that a Canadian section of the Society for the Promotion of Engineering Education be established in Canada.

The president thanked Dean Young for his very full and interesting statement. In view of the importance of the delegate to represent the Institute, he asked council if it would be agreeable to leaving the selection to him. This was agreed to unanimously.

Sixtieth Anniversary, 1947—The general secretary called the attention of Council to the fact that this important event was due to be celebrated at the next annual meeting. He wanted some instructions from council as to whether or not some special programme should be arranged to mark the event.

The president thought some special notice should be taken. He believed that after the long years of war, some special programme would be thoroughly justified.

Mr. Cross stated that an item on the agenda for the next meeting of the executive of the Toronto branch was consideration of inviting the Institute to hold its 1947 annual meeting in that city. He could not commit the executive in advance, but he believed the proposal would be well received. Mr. Laughlin supported him in this suggestion.

Canadian Construction Association—The general secretary presented a communication from the Canadian Construction Association in which was included a copy of a resolution passed by the Association relative to the federal and provincial governments' custom with regard to general contracts, and in particular the clause relating to the responsibilities of the contractor for determining foundation conditions.

Messrs. Muntz, Haltalin, Stirling, Young, Laughlin and Gaherty all spoke in strong support of the resolution. Eventually it was moved and seconded and carried unanimously that the Institute approve the resolution of the Canadian Construction Association and that notice of its approval be sent to the various departments of government concerned. The resolution of the Canadian Construction Association reads as follows:

"WHEREAS:—It is the practice of various Federal and Provincial Government Departments when calling for tenders on construction projects to furnish certain information regarding sub-soil conditions;

AND WHEREAS:—Said Departments place in their specifications a clause stating that all tendering parties must examine the site and obtain for themselves all necessary information for the proper carrying out of the work, and further stating that the Government does not guarantee any information furnished to the contractor regarding the nature, amount and class of materials to be excavated, and that no after claim will be allowed or entertained for any work or material that may be requisite and necessary for the proper execution of the work;

AND WHEREAS:—The obtaining of accurate sub-soil information before tendering is impracticable:—

(a) because for each tenderer so to do would cause unnecessary expense which directly or indirectly becomes a charge against the cost of carrying out the work;

(b) because it is usually impossible to make the necessary tests and borings within the time allowed for preparation and submission of tenders;

BE IT RESOLVED:—That this Association petition the Government Departments concerned to amend their specifications and Contract terms to provide,

(a) The furnishing of necessary sub-soil information based on tests made by Departmental Engineers.

(b) That in the event of Actual Sub-Soil conditions varying from the conditions described in the specifications an equitable adjustment will be made with the Contractor.

AND BE IT FURTHER RESOLVED:—That a similar petition be addressed to the R.A.I.C. and the E.I.C.".

Resolution passed at 28th Annual General Meeting, Winnipeg, January 16th, 1946.

Committee on Professional Interests—Under the heading of New Business, Mr. Dunbar moved that a sub-committee of the Committee on Professional Interests be appointed for the Province of Ontario, to be headed by an Ontario vice-chairman, the personnel of the committee to be recommended by the chairman of the committee in consultation with the Ontario vice-presidents. This motion was seconded by Mr. Stirling. Mr. Sisson pointed out that there were already three Ontario representatives on the committee, and he suggested that the sub-committee might properly be recommended by the Ontario provincial Division which was now being considered. On being put to the meeting, the motion was carried without any dissenting votes.

Mr. Sisson pointed out that if the 1947 annual meeting comes to Toronto, it would afford an excellent opportunity to complete the development of the proposed Ontario Provincial Division.

Mr. Stirling reported that since the meeting had begun, there had been a discussion between the five members of his committee who were present, and he now wished to submit the following resolution:

"That Council concurs with the recommendation of the Committee on Professional Interests that a statement reiterating and explaining the policy of the Institute along the lines outlined in the Committee's interim report dated April 12th, 1946, and that every member of council be requested to assist the committee by making observations regarding the draft, so that the statement may be accepted unanimously when presented for approval".

This was seconded by Mr. Marr, and carried unanimously.

Before adjourning the meeting, the president explained that this was the first branch meeting he had attended as president. He was very grateful for the hospitality and the warm welcome extended to him by the Toronto members. He was certain that if the Toronto branch extended an invitation to hold the Diamond Jubilee in Toronto, he would be most happy to be present.

It was noted that a regional meeting of council would be held in Trail, B.C., on May 18th, the day following the inaugural meeting of the Kootenay Branch.

The Council rose at five forty-five p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered, and the following elections and transfers were effected:

Members

Craig, Gordon Harbison, B.Sc., (Elect.), (Man.), sales engr., Mumford Medland Ltd., Winnipeg, Man

Graeb, John William, B.A.Sc., (Toronto), instrument engr., St. Clair Processing Corp., Ltd., Sarnia, Ont.

Heron, Bruce O., B.A.Sc., (Toronto), executive asst. to Director of Inspection Services, Inspection Board U.K. & Canada, Ottawa, Ont.

Lockeberg, Rolf Sigurd, B.Sc., (Mech.), (Queen's), F/L., R.C.A.F., (awaiting discharge), Ottawa, Ont.

Rose, Donald Charles, B.Sc., M.Sc., (Engrg. Physics), (Queen's), Ph.D., (Cambridge), chief supt., Armament Research & Development Establishment, Valcartier, Que.

Ross, Alexander Stirling, equipt. & bldg. engr., B.C. Telephone Co., Vancouver, B.C.

Treloar, George Edward, B.A.Sc., (Toronto), chief engr., Sarnia Bridge Co., Ltd., Toronto, Ont.

Young, Minto Duncan, B.Sc., (Elect.), (Manitoba), asst. general supt., Winnipeg Hydro, Winnipeg, Man.

Juniors

Gillean, Ian, B.Eng. (Elect.), (McGill), jr. engr., Canadian Marconi Co., Montreal, Que.

Lockwood, Robert Orville, B.Sc., (Mech.), (Sask.), Capt., R.C.E.M.E., Saskatoon, Sask.

McCay, James Tackaberry, B.A.Sc., (Chem), (B.C.), heating & ventilating engr., Duwright Agencies Co., Ltd., & National Heating Products Co., Ltd., Montreal, Que.

Affiliate

Chisholm, Edward Owen, Capt., R.C.E., Oakville, Ont.

Transferred from the class of Junior to that of Member

Hunt, William Sinclair, B.Eng., (McGill), Major, R.C.E.M.E., (awaiting discharge), Montreal, Que.

Lilley, Ledford George Chester, B.Sc., (Elect.), (N.B.), Lt. Col., R.C.E., Executive Officer, N.D.H.Q., Ottawa, Ont.

McGeachy, Duncan Donald Cameron, B.Sc., (Mech.), (Queen's), student, Western Univ., London, Ont.

Transferred of the class of Student to that of Member

Eastwood, John Russell, B.Eng., (Mech.), (McGill), project engr., Canadian Industries Limited, Upper Almaville, Que.

Keeler, Russel Bruce, B.Sc., (Civil), (Sask.), F/O., R.C.A.F., Winnipeg, Man.

Schofield, William Douglas, B.Eng., (McGill), mech. supt., Slack Bros., Waterloo, Que.

Transferred from the class of Student to that of Junior

Archambault, Jean Henri, B.A.Sc., C.E., (Poly.) service manager, Lasalle Coke Co., Ltd., Montreal, Que.

Dancose, Leon Paul Emile, B.A.Sc., C.E., (Poly.), engr., mtce. of way, Canadian National Railway, Quebec, Que.

Monti, Thomas Attilio, B.A.Sc., C.E., (Poly.), assistant, Ecole Polytechnique, Montreal, Que.

Mundee, Lawrence Sterling, asst. equipt. engr., New Brunswick Telephone Co., Ltd., Saint John, N.B.

Steele, Owen Stevenson, Sub. Lieut., B. Eng., (Elect.), (N.S. Tech.), R.C.N.V.R., St. John's ,N'fld.

Whillans, Thomas George Douglas, Lieut., (E.M.E.), B.Sc., (Mech.), (Queen's), R.C.E.M.E., Ottawa, Ont.

Admitted as Students

Healey, Albert James, B.A.Sc., (Elect.), (B.C.), test course, Canadian Westinghouse, Hamilton, Ont.

Lynch, John Duncan, (N.S. Tech.), 86 Windmill Road, Dartmouth, N.S.

O'Keefe, Ronald Thomas, (N.S. Tech.), 248 Robie St., Halifax, N.S.

Vaughan, John Davidson, (N.B.), 117 Leinster St., Saint John, N.B.

Students at Mount Allison

Annand, C. A.	Jones, K. G.	Thompson, D.
Duclos, M. B.	Leary, C. H.	

Students at University of Manitoba

Bouchard, L. J.	Gow, W. M. G.	Morris, L. R.
Brown, D. N.	Greenfield, P. N.	Oddson, L. T.
Brownlee, W. R.	Hughes, J. C.	Osipov, L.
Danylkiw, D.	Jones, R. H.	Reed, W. A.
Danyluk, D.	Malanchak, S. H.	Schurman, P.
Ellis, D. W.	McKenzie, E. J.	Scott, W. S.
		Sniezek, J. T.

Students at University of British Columbia

Burnham, G. A.	Hewlett, C. G.	Poole, W. H.
Bushfield, R. E.	Hilton, H. B.	Olsen, J. N.
Cook, R. M.	Holtby, L. G.	Racine, R. W.
Douglas, C. McK.	Kent, N. S.	Rhodes, E. S.
Eastman, J. H.	Lye, R. G.	Robertson, J. D.
Edwards, J. S.	McDill, W. A.	Robinson, M. C.
Elliott, D. R.	Nelson, S. J.	Smith, J. E.
Genge, G. M.	Parent, L. E.	Tapay, H. M.
Gray, W. M.	Pitman, D. L.	Taylor, C. C.
		Waller, A. B.

Students at University of Toronto

Alberts, R. S.	Lount, A. M.	O'Sullivan, G. J.
Brown, K. A.	MacGregor, A. R.	Parratt, W. A. D.
Brown, W. R. J.	Macke, W. R.	Price, P. S.
Bodwell, J. C.	Mark, A. W.	Rosborough, J. McA.
Burrell, C. E.	Martin, R. F.	Schneider, R. J.
Croker, D. M.	Martin, W. A.	Scott, F. B. B.
Dand, H. S.	Matheson, J. G.	Scott, W. L.
Denford, W. R.	Mayberry, W. G.	Shaughnessy, J. O.
Duncan, N. M.	McBride, W. T.	Shaw, G. R.
Eland, F. E.	McIntosh, L. G.	Shears, J. W.
Evans, J. E.	McMichael, J. D.	Silk, W. F.
Garriock, L. A.	McPhail, A. C.	Singer, R. A.
Gray, J. J. R.	Metherell, C.	Stee, T. R.
Groom, C. A.	Mews, J. E.	Stringer, D. M.
Hassell, J. V.	Miall, C.	Trevironus, K. S.
Heenan, N. I.	Milrod, R.	Van Wyck, K. R.
Jackman, A. H.	Mulholland, D. G.	Wallace, J. B.
Kennedy, J. E.	Mullinger, H. H.	Young, K. J.
Kerfoot, J. T.	Newell, T. L.	Zabner, S. J.
Kyles, J. S.	Northcote, J. A.	
Lewis, W. R.	Oliver, H. E.	

Students at Queen's University

Betts, V. A.	Goodwin, F. L.	Potts, W. H.
Bradbeer, W. S. R.	Grignon, A. A.	Price, S. R.
Carroll, R. H.	Langston, A. E.	Rukavina, M. K.
Coulby, W. G.	Leaver, G. J.	Sterne, F. E.
Frappier, F. H.	Lemmon, T. G.	Van Berkum, R. A.
Fulcher, E. L.	Mills, J. F.	

Students at McGill University

Baird, S. L.	Hoskin, E. D. E.	Kerr, J. J.
Bonin, R.	Huza, J. P.	Kert, M. H.
Dodds, D. J.	Izard, J. A. W.	Monarque, G. J.
Douglas, J. H.	Keith, J.	Muir, W. K.

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

SASKATCHEWAN

Members

Frombach, Maurice Fredolean, B.Sc., (Civil), (Sask.), engr., Natural Sodium Products Ltd., Bishopric, Sask.

Hilts, Ira Frederick, B. Sc., (Mech.), (Univ. of Montana), Dept. of Transport, Dominion Government, Winnipeg, Man.

McCallum, Francis, B.Sc., (Civil), (Sask.), district engr., P.F.R.A., Regina, Sask.

Juniors

Bothwell, William Thomas, B. Sc., (Chem.), (Alberta), plant chem. control, Imperial Oil Ltd., Regina, Sask.

Coons, Robert Melvin, B.Sc., (geological), (Sask.), geological asst., Univ. of Saskatchewan, Saskatoon, Sask.

Dokken, Lorne Albert, B.Sc., (agri.), (Sask.), engrg. dept., Imperial Oil Ltd., Regina, Sask.

Shienfield, Irvine, B.Sc.(Civil), (Sask.), jr. hydraulic engr., P.F.R.A., Regina, Sask.

Students

Boal, Alan Reginald, St. Andrew's College, Saskatoon, Sask.
Carss, Gordon Ewen, 336-6th Ave., North, Saskatoon, Sask.
Drabinsky, Ralph, 639 Ave. I So., Saskatoon, Sask.
Marshall, Douglas Hamilton, 509-12th St., Saskatoon, Sask.
Monaghan, Bernard Michael, 1718 - 22nd St., W., Saskatoon, Sask.
Moyer, Robert Lloyd, St. Andrew's College, Saskatoon, Sask.
Powell, David Allen, 806 - 8th Ave., N., Saskatoon, Sask.
Robinson, James Allen Law, St. Andrew's College, Saskatoon, Sask.
Shakotko, Leon, 209 - 29th St., W., Saskatoon, Sask.
Thompson, Francis Rex, Y.M.C.A., Saskatoon, Sask.
Uruski, Tony J. 209 Albert Ave., Saskatoon, Sask.
Westberg, Harold Arnason, 301 Bottomley Ave., Saskatoon, Sask.

Student to Junior

Clarke, Gerald Wallbridge, B.Sc., (Mech.), (Sask.), demonstrator, Univ. of Saskatchewan, Saskatoon, Sask.
Larmour, Donald Arthur, B.Sc., (Civil), (Sask.), resident engr., Department of Highways, Regina, Sask.
Loucks, George Irvin, B.Sc., (Mech.), (Sask.), demonstrator, mech. engr., Univ. of Saskatchewan, Saskatoon, Sask.
Pearson, Roderick Frank, B.Sc., (Engrg. Physics), (Sask.), power line constrn., R. J. MacRae, Saskatoon, Sask.
Spencer, Henry Anderson, B.Sc., (Mech.), (Sask.), instructor in mech. engrg. Univ. of Saskatchewan, Saskatoon, Sask.

Alberta

Members

Smith, David Athelstan Grove, B.Sc., (Mining & Met.), (Queen's), mine mgr., International Uranium Mining Co., Ltd., Contact Lake, via Yellowknife, N.W.T.
Stephenson, Robert John, resident engr., Water Supply & Sewerage, Dominion Government, Edmonton, Alta.

Junior

MacDonald, Donald Lyon, B.Sc., (Elect.), (Alberta), dftsman & asst. elect. engr., City of Edmonton Street Rly., Edmonton, Alta.

Junior to Member

Dale, John Clapham, B.Sc., (Elect.), (Alberta), asst. to constrn. supt., Canadian Utilities Ltd., Calgary, Alta.
Mitchell, Maurice Stephen, B.Sc., (Civil), (Alberta), sessional instructor, Civil Engrg. Dept., Univ. of Alberta, Edmonton, Alta.

Student to Junior

Walker, Lloyd Arthur, B.Sc., (Civil), (Alberta), jr. engr., Engineering & Construction Service, Dept. Mines & Resources, Banff, Alta.

New Brunswick

Member

Hughson, Horace Gifford, B.Sc., (Civil), (New Brunswick), resident engr., Department of Transport, Moncton, N.B.

Quebec

Members

Bourne, Obre Brabazon, Diploma, Civil Engrg., (Toronto), 5503 Trans-Island, Montreal, Que.
Bromley, George, B.Sc., (Elect.), (Manitoba), consulting engr., Montreal, Que.
McInnis, John Francis, B. Eng., (N.S. Tech.), constrn. & mtce. engr., Brown Corporation, La Tuque, Que.

Personals

Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.

Dr. Charles Camsell, M.E.I.C., retiring deputy minister of mines and resources, has been honoured by the Professional Institute of the Civil Service of Canada with a special award of its medal. The award, made at that institute's annual meeting in April, is in recognition of his outstanding contribution to science and administration during his forty years in the public service.

Dr. Camsell is a past-president of the Engineering Institute.

Dr. K. M. Cameron, M.E.I.C., past-president of the Institute, has retired as chief engineer of the Department of Public Works of Canada at Ottawa. He joined the department in 1908, serving first in the offices at London, Ont., and later as district engineer at Sherbrooke, Que. In 1912 he was transferred to Ottawa as senior assistant in the dredging branch of the department. Six years later he became assistant chief engineer and in 1923 was appointed chief engineer of the department.

Works of major interest completed while Mr. Cameron has been chief engineer include three large drydocks, namely, the Saint John Drydock at Saint John, N.B., the Champlain Drydock, Quebec Harbour, and the Esquimalt Drydock at Esquimalt, B.C.

E. O. Turner, M.E.I.C., of the faculty of the University of New Brunswick, Fredericton, N.B., has been re-appointed to the Council of the Institute representing the Association of Professional Engineers of New Brunswick.

Major-General Howard Kennedy, M.E.I.C., has been appointed to the Ontario Royal Commission on Forestry at Long Branch, Ont. Formerly quartermaster general of the Canadian Army at Ottawa, General Kennedy has held the position of vice-president in charge of woods, Ontario Paper Company Limited and Quebec North Shore Paper Company for the past two years. He is chairman of the Rehabilitation Committee of the Institute.

Dr. G. M. Furnival, M.E.I.C., has recently resigned his position as field superintendent for California Standard Company in Alberta to take the appointment of director of mines, Manitoba Department of Mines and Natural Resources, Winnipeg.

H. A. Cooch, M.E.I.C., vice-president of the Canadian Westinghouse Company Limited, Hamilton, Ont., has been elected a director of the company. A graduate in electrical engineering of the University of Toronto, he has just completed 35 years with Westinghouse.

Dr. E. A. Cleveland, M.E.I.C., chief commissioner of the Greater Vancouver Water District, and past-president of the Institute, has been named by the Canadian Section of the American Water Works Association to receive its Fuller Award.

News of the Personal Activities of members of the Institute

Colonel G. W. Beecroft, M.E.I.C., has recently retired from the Canadian Army and returned to Imperial Oil Limited and International Petroleum Company Limited in Toronto.

He has served since the beginning of the war, in 1940 and 1941 in command of the No. 2 Army Field Workshop, R.C.O.C., and in 1942 with the W.G.O. Branch, Ottawa. The same year he was appointed military adviser to the Wartime Bureau of Technical Personnel at Ottawa, and in 1944 and 1945 he was overseas rehabilitation officer for the Department of Veterans Affairs, located in London, England.

He was overseas with the C.E.F. 1915-1919.

Lieutenant-Colonel W. A. Capelle, M.E.I.C., was awarded the Croix de Guerre avec palme in January. The award was made in recognition of the excellent work performed by the 2nd Bn. R.C.E. in the rapid construction of an urgently required by-pass around the bombed-out city of Caen, France, in August 1944.

Maurice Gérin, M.E.I.C., of the Canadian Fairbanks-Morse Company Limited, Montreal, has been appointed manager of the diesel sales and engineering division for the company throughout Canada. Mr. Gérin has spent his whole business life with the Canadian Fairbanks-Morse Company, starting in 1922, after having graduated from the Ecole Polytechnique as civil engineer in 1920, and with a master's degree from the Massachusetts Institute of Technology in 1921. Mr. Gérin acted as sales engineer with the company from 1925-1931, handling municipal water works equipment, diesel generating plants, quarry and mining equipment, etc. In 1931 he was appointed manager of the diesel engine department in Montreal, and in 1933 took over the electrical and pump sales as well.

Maurice Gérin, M.E.I.C.

On the declaration of war, Mr. Gérin was put in charge of the installation of diesel engines purchased by the Department of Munitions and Supply for the British Admiralty Technical Mission, which were installed in minesweepers built at Quebec, Meteghan, Shelburne, and St. John's, Newfoundland. In 1943 Mr. Gérin was put in complete charge of the shipbuilding plant of the Canadian Fairbanks-Morse Company at Shelburne, N.S., where many 126 ft. minesweepers were built for the British Admiralty.

H. R. Younger, M.E.I.C., district engineer of the Canadian Pacific Railway, Calgary, has been elected chairman of the Calgary Branch of the Institute. A graduate in civil engineering of McGill University in 1910, Mr. Younger was first employed by the Canadian Pacific during vacations, and upon graduation permanently joined its staff. Stages of his career included two years as instrumentman on construction, and two as resident engineer on construction, all at the Kootenay Central Branch. He has been division engineer at Nelson, B.C., and superintendent of the Kettle Valley Division located at Penticton, B.C., being appointed to his present position at Calgary in 1941.

Mr. Younger joined the institute as an Associate Member in 1913, becoming a Member in 1940.

A. W. Peters, M.E.I.C., has been elected chairman of the St. Maurice Valley Branch of the Institute. Born at Fredericton, N.B., he graduated in 1923 from McGill University with a B.Sc. degree. Becoming associated with the Shawinigan Water and Power Company, Three Rivers, Que., he has been with that company or a subsidiary since 1923, first as power house draughtsman, being transferred in 1924 to the operating department at the head office. In 1927 Mr. Peters engaged in general electrical distribution engineering for the North Shore Power Company and in 1930 was appointed distribution engineer for the Shawinigan Water and Power Company. He joined the Institute as a Member in 1943.

Stewart Young, M.E.I.C., was recently appointed councillor of the Institute representing the Association of Professional Engineers of Saskatchewan. Born in Owen Sound, Ont., he received the degree of B.A.Sc. from the University of Toronto in 1912.

He joined the Department of Public Works of Saskatchewan as assistant surveyor in 1912, subsequently becoming district surveyor and resident engineer. In 1924 he was appointed director of town planning in the department of municipal affairs of the Province of Saskatchewan and was later director of technical services in that department. He became director of the division of municipal planning for the government of the Province of Saskatchewan and in 1945 was named director of community planning.

Mr. Young became an Associate Member of the Institute in 1917, transferring to Member in 1935. For several years he was registrar of the Association of Professional Engineers of Saskatchewan, as well as secretary-treasurer of the Saskatchewan Branch of the Institute.

S. C. Montgomery, M.E.I.C., was recently appointed councillor of the Institute, representing the new Kootenay Branch. He was born at Winnipeg, Man., and 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.

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., in their construction office, where he is still situated.

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.

G. H. Wood, M.E.I.C., senior assistant engineer, Dominion Water and Power Bureau, Department of Mines and Resources, who has been stationed at Niagara Falls for many years, has been transferred to Ottawa following a recent promotion. Mr. Wood took an active part in the affairs of the Niagara Peninsula Branch of the Institute and is a past-chairman of the Branch.

Group-Captain C. A. Davidson, M.E.I.C., was the recipient of the Legion of Merit, Degree of Officer, from the Ambassador from the United States, at an investiture, in Ottawa in March, in recognition of services performed in western Canada and in the Yukon from 1942 to 1944. Group Captain Davidson is now at Maintenance Command, Uplands, Ont.

W. H. Stuart, M.E.I.C., has been transferred from the position of deputy minister, Department of Highways and Public Works, Nova Scotia Government, to that of deputy minister, Department of Industry and Publicity.

E. L. Cousins, M.E.I.C., was presented with a silver cigar box and an illuminated address from the City of Halifax in recognition of his services toward the war effort there and on behalf of the people of that city. Mr. Cousins, Wartime Administrator of Canadian Atlantic Ports, was previously general manager of the Toronto Harbour Commission.

E. A. Cross, M.E.I.C., is the newly elected chairman of the Toronto Branch of the Institute. Born in Petersfield, Hants, England, he attended Birmingham University, graduating in 1909 with the degree of B.Sc. (civil engineering). In 1910 he became associated with Birmingham Canal Navigations, England, as assistant engineer, and in 1917, after two years with the Royal Engineers in France, he became research engineer at the Royal Arsenal, Woolwich England. He returned to Birmingham Canal Navigations as Chief Assistant Engineer in 1919, remaining until 1920.

E. A. Cross, M.E.I.C.

In the United States, in the subsequent two years Mr. Cross was superintendent of construction for W. L. Stoddart, architect, New York City, on such projects as the Mica Insulating Factory, Schenectady, N.Y., Hotel Sheraton, High Point, N.C., and the Lycoming Hotel, Williamsport, Pa. He then accepted the position of structural engineer for Albert Kahn, Detroit, Mich., remaining until 1927, when he associated himself with Chapman and Oxley, Toronto, as structural engineer. In 1930 Mr. Cross established his private practice as consulting structural engineer in Toronto.

Joining the Institute as an Associate Member in 1925, he transferred to Member in 1935.

E. M. Van Koughnet, M.E.I.C., has been appointed secretary-treasurer of the Montreal Branch of the Institute. Born at Buffalo, N.Y., he attended Royal Military College, Kingston, Ont., and McGill University, Montreal, and in 1923-24 was employed by the Steel Company of Canada at Hamilton, Ont. Subsequently connected with the Bell Telephone Company, Montreal, Caron Brothers, Montreal, Shawinigan Water and Power Company, Three Rivers, Canadian and General Finance Company Limited, Toronto, he went to Brazil in 1929 for the Sao Paulo Tramway, Light and Power Company Limited.

Later he associated himself with Frederick B. Brown, consulting engineer, Montreal, with the Montreal Light, Heat and Power Company, and with Messrs. Crane and Company, Montreal, stockbrokers. In 1935 he was secretary of the League for National Government. In 1936 he became engineer for the Quebec Provincial Electricity Board, at Montreal, and returned to the board in 1946 after five years with the R.C.E., from which he was released with the rank of major.

Mr. Van Koughnet joined the Institute as a Student in 1922, transferring to Junior in 1928. He became an Associate member in 1936 and a Member in 1940.

W. D. Hurst, M.E.I.C., city engineer of Winnipeg, Man., has been named by the Minnesota Section of the American Water Works Association to receive its Fuller Award. The citation of the award refers to his work on water works schools, his work in cementing relations between the Minnesota and Canadian Sections of the association, and to his literary contributions.

A. G. Moore, M.E.I.C., is now in private practice as a consulting engineer (mechanical, electrical) in the Town of Mount Royal, Que. After graduating from the Nova Scotia Technical College with a B.Sc. in electrical engineering in 1925, he spent two years with Westinghouse Electrical Manufacturing Company, East Pittsburgh, Pa., on the students' test course. He returned to Canada in 1927 and spent one year with the Asbestos Corporation at Thetford Mines, Que. In the following year he joined the engineering staff of the Electric Service Corporation, Shawinigan Falls. In 1930 he entered the employ of the Montreal Light Heat and Power Company as engineer on the electric overhead and underground distribution and construction department. Eight years later he became resident engineer with the Compagnie Immobilière de Ste. Marguerite, Lake Masson, Que. When war broke out he joined the engineering staff of Defence Industries Limited as assistant to the senior electrical engineer on design and construction of war plants. He resigned this position in March of this year.

W. A. Rush, M.E.I.C., controller of radio, Department of Transport, Ottawa, has been awarded a medal by the Professional Institute of the Civil Service of Canada. The award is in recognition of work done in the application and development of radio and radar in furtherance of the conduct of war.

F. I. Ker, M.E.I.C., publisher of the *Hamilton Spectator*, was elected president of The Canadian Press. He was general chairman of the Canadian Publishers War Finance Committee 1940-45. He is a director of the Canadian Daily Newspapers Association and the American Newspaper Publishers Association and of the Southam Company. Born in Dunham, Que., he was educated at McGill, entered newspaper work in 1921, and became editor and managing director of the *Spectator* in 1930. He was a delegate to the Imperial Press Conference in 1930 and will attend the sixth Imperial Press Conference to be held in London this year.

G. H. Burbidge, M.E.I.C., acting district engineer for the Department of Public Works, Port Arthur, Ont., since 1942, has been appointed district engineer of the department. A graduate of McGill University in civil engineering, he has been connected with the department since 1921.

D. M. Vye, M.E.I.C., has been appointed to the New Brunswick Resources Development Board staff as development engineer. Mr. Vye served with the maintenance and construction section of the R.C.A.F. from July, 1942, until his discharge with the rank of squadron leader just prior to his recent appointment. His engineering career prior to the war was with the Erie Railroad Company, Cleveland, Ohio, and in engineering and construction work in Canada.

G. W. Rowe, M.E.I.C., has been appointed district engineer for the Department of Public Works, Winnipeg, Man. Mr. Rowe served with the R.C.A.F. during the war on construction work at Carberry and Newfoundland. Prior to the war he spent a year and a half at Churchill, Man., where he was port engineer.

J. W. Ussher, M.E.I.C., is at present employed by the Canadian Pacific Railway as supervisor of water treatment for western lines with headquarters at Winnipeg, Man. He was formerly assistant superintendent in charge of production, St. Maurice Chemicals Limited, Shawinigan Falls, Que.

W. A. Wheten, M.E.I.C., has accepted the position of irrigation engineer with the Government of Ceylon. Prior to serving in the R.C.A.F., he was associated with the Prairie Farm Rehabilitation Administration at Saskatoon. For the past two years he has been with the Department of National Defence at Ottawa on the inspection of explosives.

H. B. Dickens, M.E.I.C., supervising engineer of the Department of Public Works of Canada at Ottawa, has had two oil paintings accepted for exhibition in the spring show of the Art Association of Montreal.

Walter L. Rice, M.E.I.C., has been released from the R.C.A.F. with the rank of flight lieutenant and has returned to the City of Toronto, works department, water works section, as assistant engineer of water distribution. He has been on leave of absence for war service for five and one-half years, the latter four of which he served as waterworks and sanitation engineer officer for No. 3 Training Command, Montreal, and No. 1 Air Command, Trenton.

A. J. S. Taunton, M.E.I.C., was recently named deputy city engineer of the City of Winnipeg. On his release from the R.C.A.F. with the rank of group captain early in 1945 he was appointed welfare officer with the Department of Veterans Affairs at M.D. 10, Winnipeg, Man., and was the City of Winnipeg representative on the Civic Wage Survey Board.

J. G. Belle-Isle, M.E.I.C., now released from the R.C.A.F., has returned to his former position as plant engineer with the Bell Telephone Company of Canada at Montreal. He served four years with the R.C.A.F., most of which time was spent at Air Force Headquarters (Directorate of Intelligence) in the publication of four technical volumes.

W. H. S. Bird, M.E.I.C., has joined the engineering department of Trans-Canada Airlines at Winnipeg, Man. He was formerly in the office of technical administrator at Canadair Limited, Montreal, Que.

J. E. Clark, M.E.I.C., of the Bell Telephone Company of Canada, has been transferred from the outside plant and transmission division, chief engineer's office, eastern area, at Montreal, Que., to the Laurentian district as district plant engineer.

W. A. Dawson, M.E.I.C., who resigned his position as master mechanic of the DeHavilland Aircraft of Canada Limited on the termination of the Mosquito contract, is now associated with the F. F. Barber Machinery Company, Toronto, as manager of their branch office at Hamilton, Ont.

T. B. Harrison, M.E.I.C., is now employed as plant engineer with the Ontario and Minnesota Pulp and Paper Company at Fort Frances, Ont. He was formerly on the staff of the fuel department of Atlas Steels Limited, Welland, Ont.

Jean Paul Lecavalier, M.E.I.C., formerly on the engineering staff of the drainage bureau, Department of Agriculture of the Province of Quebec, at Montreal, is now in private practice at Montreal.

W. G. Reekie, M.E.I.C., is now employed by Bloedel, Stewart and Welch, Vancouver, B.C., as assistant engineer in charge of the design and construction of the sulphate pulp mill which is being erected at Port Alberni, B.C.

Lawrence H. Burpee, M.E.I.C., has joined the staff of Morrison-Knudsen Company Inc., Seattle, Washington. He was previously associated with the Foundation Company of Canada Limited, Montreal.

Gilbert Proulx, M.E.I.C., was recently promoted to the position of superintendent of the Saguenay Electric Company at Chicoutimi, Que. A graduate in civil engineering of the Ecole Polytechnique in 1941, he was employed for a time by Dominion Bridge Company Limited, Lachine, Que. In 1942 he joined the staff of the Saguenay Electric Company as assistant to the superintendent.

J. Stewart Ball, M.E.I.C., has been appointed refinery engineer of the Shell Oil Company of British Columbia Limited. He was formerly mechanical and maintenance engineer with the Shell Oil Company in Montreal.

M. L. Zirul, Jr.E.I.C., is at present connected with the Water Rights Branch at Nelson, B.C. For the past two years he was employed on structural design work with the Powell River Company, Powell River, B.C., prior to which he was associated with the British Columbia branch of the Dominion Water and Power Bureau.

W. M. Tkacz, Jr.E.I.C., was discharged from the Royal Canadian Navy in February last with the rank of lieutenant (E). He is now employed as time study engineer at Canadian Vickers Limited, Montreal.

Maurice Saint-Jacques, Jr.E.I.C., is now employed in Montreal, Que., as distribution engineer with the Quebec Hydro-Electric Commission. He was previously with Canadian General Electric Company Limited, Toronto.

G. L. Archambault, Jr.E.I.C., has severed his connection with the Aluminum Company of Canada Limited, where he has been employed since 1942. He has accepted the position of sales manager with Les Produits en Aluminium et Acier Inoxydable L'Hoir Inc., at Levis, Que.

W. C. Brown, S.E.I.C., recently released from the army with the rank of captain, has joined the engineering staff of Electronic Devices Company Limited, Toronto. He was employed by the army as design engineer on army radar equipment, associated in that capacity since 1942 with the radio section of the National Research Council and with Research Enterprises Limited.

Obituaries

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

Bertram P. Richardson, M.E.I.C., died suddenly at his residence in Montreal on March 11th.

Born at Lee, Kent County, England, on May 5th, 1872, he was educated at preparatory and public schools and served five years apprenticeship with Jos. Thompson & Sons Ltd., engineers and shipbuilders, London and Sunderland, England.

Early he travelled to India and to Australia where he joined the New South Wales Mounted Police. In Western Australia he participated in a 900-mile prospecting trek to the Coolgardie Goldfields. At Perth, Western Australia, in 1897, he joined the engineering department of the Western Australian Government Railway, remaining until 1900 when he returned to England. With General Baden-Powell's South African Constabulary in South Africa from 1900 to 1902 he was superintendent of military works for the Orange Free State. He was engaged then by the Kroonstad Breweries Limited as resident engineer and in 1905 was contractor in connection with a 90-mile railway being built by the Natal Government Railways from Bethlehem to Kroonstad. From 1906 to 1911 he was designer and construction engineer for the Consolidated Goldfields Limited, H. Ekstein and Company and The Premier Diamond Mines Ltd. in South Africa, was connected with La Compagnie Générale d'Electricité de Laurenco Marques, Portuguese East Africa, and was elected a member of the Transvaal Institute of Mechanical Engineers.

Coming to Canada in 1912 he was associated with J. A. Morrison, Montreal, and with Ross & Macdonald, Montreal, as resident engineers. In World War I Mr. Richardson was five years in France and Belgium with the railway construction corps of the Canadian Army. On his return in 1919 he became resident engineer for Lockwood, Greene and Company of Canada Limited, Montreal, and later associated himself with the department of buildings of the Protestant Board of School Commissioners in Montreal. In 1935 he established private practice as consulting engineer in Montreal.

Mr. Richardson joined the Institute as a member in 1921, and became a life member in 1939.

Altheod Tremblay, M.E.I.C.

Walter G. Hunt, M.E.I.C.

J. W. LeB. Ross, M.E.I.C.

Altheod Tremblay, M.E.I.C., a member of the Institute for over forty years, died at his home in Quebec, Que., on March 1st, 1946. Born in Montreal in 1877, he studied with the Marist Brothers and entered the employ of J. P. B. Casgrain, land surveyor, in 1891 as an assistant. In 1901 he was admitted as a member of the association of land surveyors of the Province of Quebec, and was employed as assistant engineer on the construction of the Soulanges Canal. On his return in 1903 from a surveying expedition in Western Canada he entered the construction department of the Canadian Pacific Railway as draughtsman. In 1909 he became a Dominion Land Surveyor, and on the inauguration of its school of surveying and forestry Laval University requested him to lecture there.

From 1919 to 1927 Mr. Tremblay carried on the surveying of Quebec City and its suburbs, and of the municipalities of Giffard, Ste. Anne de Beaupre and Sillery. He was connected with the construction of the waterworks at Quebec-West and Charlesbourg. Laval University conferred on him the degree of Master of Arts in 1923.

Mr. Tremblay joined the Institute as a Student in 1903, transferring to Associate Member in 1906 and to Member in 1940.

Walter G. Hunt, M.E.I.C., president and founder of the Walter G. Hunt Company Limited, general contractors, Montreal, died on April 6th in Montreal.

Born at Bury, Que., he was educated at McGill University where he graduated in 1917. For several years he was associated with the firm of Ross-Meagher Company, engineers and general contractors, Ottawa, as engineer and later as general superintendent. In 1926 he came to Montreal and two years later formed the firm of which he was president. Projects undertaken by the firm included the construction of the Sir Arthur Currie memorial gymnasium and armoury for McGill University, extensions to tank shops for the Canadian Pacific Railway and construction work at the St. Hubert and Dorval airports, near Montreal. Mr. Hunt was a director of the Stanstead and Sherbrooke Fire Insurance Company and a past-president of the Builders Exchange, Incorporated.

Joining the Institute as a Student in 1916, he transferred to Junior in 1919. He became an Associate Member in 1922 and a Member in 1932. He served on the executive committee of the Montreal Branch for several years and was councillor of the Institute in 1941-42-43.

Charles William Dingman, M.E.I.C., pioneer oil man and petroleum engineer, died suddenly on March 14th following a brief illness. Born in Toronto in 1888, he received his education at Picton, Ont., and at Western Canada College, Calgary.

He was associated with his uncle, the late A. W. Dingman, in the Calgary Petroleum Products Company at the time of the famous "Dingman Discovery" in 1914 which started the historic Turner Valley oil boom.

From 1920 to 1931 Mr. Dingman served with the federal government as inspector of gas wells. In 1932 he was associated with the old Turner Valley conservation board and was then in private practice as a petroleum engineer until 1935.

Named director of the petroleum and natural gas division of lands and mines that year, he received the appointment of deputy chairman of the petroleum and natural gas conservation board in 1938, later becoming chairman and remaining on the board until 1941. Since that year he has been chief petroleum engineer with the Home Oil Company.

Mr. Dingman became a Member of the Institute in 1945.

John W. LeB. Ross, M.E.I.C., died in Ottawa on April 1st in his eightieth year. Born in Ottawa, April 27th, 1866, he joined the Department of Railways and Canals in 1884, starting in a junior capacity on the staff employed in the improvement of the St. Lawrence Waterway, his activities consisting until 1891 of level and transit work. He was then promoted and in 1892 was appointed assistant engineer, remaining until 1893, when he accepted a position with the Ottawa, Arnprior and Parry Sound Railway serving consecutively as leveller, topographer, transitman and assistant engineeer.

Returning to the Department of Railways and Canals in 1897 he was overseer of the Williamsburg canals and resident engineer in connection with obstructions in other parts of the St. Lawrence Waterway, and in 1907 was appointed superintending engineer of the Sault Ste. Marie Canal, which position he held until his retirement in 1936.

Mr. Ross joined the Institute as an Associate Member in 1897, transferring to Member in 1901. He was made a life member in 1936.

Albert Raiguel Bingham, M.E.I.C., died at his residence in Massena, New York, on January 4th. He was born in Philadelphia, Pa., in 1878 and studied electrical engineering at the Drexel Institute in that city, graduating in 1900.

His early career was with J. M. Race, Housatonic, Mass., the Berkshire Street Railway, Pittsfield, Mass., the Hudson River Electric Power Corporation at Utica, N.Y., and the Hydro Plant, Spier Falls, N.Y.

He then spent four years with the Aluminum Company of America in their power plant at Massena, N.Y., and in 1913 became assistant superintendent for the Canadian Light and Power Company at their power plant at St. Timothée, Que., in charge of the power plant at Beauharnois Canal. He later became general superintendent of the plant, retiring in 1930.

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

Noel Faure Harrison, M.E.I.C., died on February 9th after a few days illness, in Bri Cualann, County Wicklow, Ireland. Born in Dromore, County Down, Ireland, on December 25th, 1884, he attended the Dublin Technical School, graduating in 1902. He spent two years in the office of Sir Thomas Drew, President of the Royal Hybernian Academy, studying architectural drawing and building construction, and three years with Messrs. Norman Robinson and Brunker, electrical engineers.

In Canada, in 1906, he was assistant to H. Ross, electrical contractor, Winnipeg, Man., and in 1907 and 1908 was draughtsman with J. R. Royce, consulting mechanical engineer, Toronto, Ont. He was later with J. P. Farrelly Excavating Machine Company, Toronto, as draughtsman, and in 1909 became assistant to the late Roderick J. Parke, consulting electrical engineer, Toronto.

With Canadian Northern Railway, Winnipeg, Man., he was assistant to the architect until 1919, when he entered the office of the chief engineer, Winnipeg River Power Company, Winnipeg, in 1920 associating himself with the Manitoba Power Company Limited, Winnipeg.

Mr. Harrison paid a visit to Ireland two years later, being interested in the development of peat gas power, and in 1924 returned to Ireland where he was engaged in building activities in connection with a housing scheme there, and remained to established private practice as a consulting engineer at Bray, County Wicklow.

Mr. Harrison joined the Institute as an Associate Member in 1922, becoming a Member in 1940.

Flight Lieutenant Thomas B. Akin, R.C.A.F., M.E.I.C., was killed in an airplane crash on May 16th, 1945, in Alberta. Born in Calgary, Alta., he resided at Windsor, N.S., and attended the Nova Scotia Technical College, graduating in 1932 with the degree of B.Sc. in civil engineering.

That year be came associated with the Minas Basin Pulp and Power Company Limited, Hantsport, N.S., and in 1935 became superintendent of Candian Keyes Fibre Co. Ltd., in the same city, being appointed manager in 1937.

In 1941, he joined the R.C.A.F. as pilot officer, being stationed at the School of Aeronautical Engineering in Montreal, later transferring to No. 15 S.F.T.S., at Claresholm, Alta. Since 1943 he had been at No. 2 F.I.S., at Pearce, Alta.

Joining the Institute as a Student in 1932, he transferred to Member in 1941.

Joseph Harold Melville Rombaugh, Jr.E.I.C., died at his home in Toronto on January 17th. Born at Smiths Falls, Ont., on July 28th, 1908, he graduated from Queens University, Kingston, Ont., in 1931 with a B.Sc. in civil engineering.

In 1931-32 he was assistant city engineer at Sudbury, Ont., and was in the tapping department of Fittings Limited, Oshawa, Ont., until he entered the employ of McColl-Frontenac Oil Company Limited at Montreal East, Que., in 1937. In that company he was draughtsman, engineer, clerk to the superintendent of construction and maintenance, and finally draughtsman for the marketing department at their Toronto office.

Mr. Rombaugh joined the Institute as a Student in 1928 and transferred to Junior in 1937.

News of the Branches

Because of the paper supply situation it has been necessary to reduce considerably the amount of space usually devoted to News of the Branches. We beg the indulgence of the branch news editors if they find that we have made liberal use of the blue pencil on their reports.—Editor.

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

EDMONTON BRANCH

W. W. Preston, M.E.I.C. - *Secretary-Treasurer*

Technical features of **Mulberry**, the floating port designed by British engineers for the invasion of Normandy, were described by Col. V. C. Steer-Webster, O.B.E., in an address to a joint meeting of the Edmonton Branch E.I.C., the Association of Professional Engineers of Alberta, and the Canadian Institute of Mining and Metallurgy at their dinner on March 29th in the Macdonald Hotel. Col. Steer-Webster, who had headed the Mulberry project is now supervising the exhibition of models of Mulberry across Canada.

The speaker said that the war office began planning Mulberry when the allies left Dunkirk in 1940. He paid tribute to the Canadians for their attack at Dieppe, and emphasized the success of their efforts as preparation for the Normandy invasion.

The Colonel claimed there were no technical difficulties in building the port, but added that the design was governed by the shortage of materials, the scarcity of construction sites, the allowable sizes of shipping units (limited by narrow gauge railway, tunnel heights and bridge capacities) and the fact that 40 per cent of the manufacturing was to be done by women.

Col. Steer-Webster outlined the scope of the project and described the engineering features of various units comprising the port. Their flexibility in transit and during erection, and their protection from damage and how they stood up in service were also explained in the paper.

Chairman of the meeting was J. McMillan, president of the A.P.E.A. Head table guests included Hon. J. C. Bowen, Lieutenant-Governor of Alberta; Hon. N. E. Tanner, Minister of Lands and Mines; F. Mitchell, Deputy-Mayor of Edmonton, F. R. Burfield, chairman of the Edmonton Branch, E.I.C., E. O. Lilge, C.I.M.M., and Col. Steer-Webster who was introduced by Mr. Burfield.

At the conclusion of Col. Steer-Webster's address, which was heartily applauded, the members, numbering one hundred and fourteen, had the privilege of inspecting the Mulberry model at the Prince of Wales Armouries. The film "A Harbour Goes to France," was shown privately to the engineers.

HALIFAX BRANCH

J. D. Kline, M.E.I.C. - *Secretary-Treasurer*
S. W. Gray, M.E.I.C. - *Branch News Editor*

On April 15th, 1946, the regular monthly meeting of the Halifax Branch was held in the Nova Scotian Hotel. The attendance was 190, including some of the members of the Nova Scotia Technical College who were guests of the Branch.

Other guests at the head table included Air Vice-Marshal Morfee, Air Force; Brig. J. C. Stewart, Army; and Capt. Porteous, Navy; Prof. Hayes representing the Nova Scotia Institute of Science. The guest speaker of the evening was Dr. G. C. Laurence, chief of the technical physics division of the National Research Council's Chalk River Laboratory. He was introduced to the meeting by the chairman C. D. Martin.

Dr. Laurence delivered a very interesting and instructive address on **Atomic Energy,** reviewing the history of this research right up until the discovery of the atomic bomb.

Dr. Laurence, who was born in Charlottetown, P.E.I., and is a graduate of Dalhousie University, initiated the Canadian uranium fission research in Ottawa in 1940, and the interest with which his address was received is well born out by the above attendance, which was the largest attendance at a regular monthly meeting in the history of this Branch.

A vote of thanks to the speaker was moved by G. J. Currie and was seconded by Prof. J. V. Douglas of Dalhousie University.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - *Secretary-Treasurer*
I. M. Macdonald, Jr.E.I.C. - *Branch News Editor*

The regular monthly meeting of the Hamilton Branch was held on Thursday, March 28th, 1946, at McMaster University, with Chairman A. R. Hannaford presiding.

Over 100 member of the Branch and members of the Association of Professional Engineers of the Province of Ontario gathered to hear the speaker of the evening, Dr. G. Ross Lord, president of the Professional Association of Ontario. Dr. Lord, introduced by W. J. W. Reed, is associate professor of mechanical engineering at the University of Toronto. His subject for the evening was **The Association of Professional Engineers—Its Accomplishments and Objectives.**

Some of the objectives of the organization listed by Dr. Lord included such things as job evaluation to set the standard of remuneration according to work requirements, educational standards, assistance to students and young engineers, and dealing with infractions of the Professional Engineers Act. Other activities are the licensing of foreign engineers, and the raising of salaries of low-paid engineers to the standard for their work.

The affairs of the Association are managed by an active council of 18 members, who appoint committees to report on routine and special matters. Matters of interest before the council at present are revisions to the Professional Engineers Act of Ontario, and plans for standard professional engineering requirements in all Canadian provinces.

At the conclusion of Dr. Lord's talk, Col. Tom Medland, public relations director of the Association, spoke briefly and outlined some unusual experiences encountered in his work.

A vote of thanks was tendered Dr. Lord by E. G. Wychoff, after which the meeting was adjourned for customary refreshments.

LETHBRIDGE BRANCH

T. O. Neumann, M.E.I.C. - *Secretary-Treasurer*
H. T. Miard, M.E.I.C. - - *Branch News Editor*

Mr. Don Livingstone of Lethbridge spoke on the **Bailey Bridge** at the monthly dinner meeting of the Lethbridge Branch held in the Marquis Hotel on Friday, February 22nd.

The speaker was introduced by Mr. G. S. Brown, who said Mr. Livingstone's father had been one of the most active members of the Branch. After graduating in mining engineering from the University of Alberta in 1939, Mr. Livingstone worked for a time with the Lethbridge Collieries. He was an officer in the reserve Field Park Company, and joined the army when the unit was mobilized, going overseas with the Sixth Field Park Squadron. For some time he was field engineer, and later adjutant, of the Fourth Division Engineers, with the rank of captain. Lately Mr. Livingstone has resumed his position as engineer with the Lethbridge Collieries.

Mr. Livingstone is an accomplished speaker, and his dry humour was appreciated by the audience as he gave a rapid, comprehensive, and clear description of the Bailey Bridge, and the procedure at a bridgehead during assault.

At the beginning of the Second World War, the British and Canadian Armies found their pontoon bridges too light, and their dry gap bridges either too light or too long in construction.

A structure capable of carrying a seventy-ton load and which could be erected in a few hours was urgently required. Professor D. C. Bailey, a structural engineer at the School of Military Engineering, designed the famous bridge which bears his name. His was probably the greatest single contribution to modern Army equipment. The bridge came into general use early in 1942.

The Bailey is a through type, the roadway being carried between two main girders which are composed of a series of interchangeable ten-foot panels.

The Bailey can be adapted to many uses: single spans up to 190 ft. for tanks, or 240 ft. for trucks; multiple spans resting on piers built of Bailey components or of piling, floating bridges on pontoons, draw bridges, lift bridges, structures on tidal waters, and tank rafts. It can be assembled away from the site if there is a comparatively straight wide road leading to the bridgehead.

For most efficient work on spans up to 120 ft. in length, one man per linear foot of bridge is required. This enables all operations to be carried on simultaneously—mine clearing, construction of approach roads, off-loading of parts, and bridge erection. Bridge sites were usually covered with the wreckage of previous structures, and the time necessary to remove the debris, or build an approach to an adjoining site, was greater than that required for actual bridge construction.

The fastest time in training for construction of a class 40 pontoon bridge, 285 ft. long, was two hours seventeen minutes. A class 40 single span, forty feet long, with twenty-foot ramps was constructed in fourteen and one-half minutes.

Mr. Livingstone believed the record time in action was the construction in seven hours fifteen minutes of two 120-ft. spans by the Fourth Division Engineers. These were built over canals in the Scheldt Estuary, with the enemy only 250 yards away.

A bridge crew can learn to assemble the bridge in two or three hours, they would become proficient in a week, but they might require months or years to reach maximum efficiency.

Mr. Livingstone illustrated a bridgehead on a diagram, and described the crossing in five phases.

A film depicting the erection of a Bailey Bridge was shown, and Mr. Livingstone added some comments.

Mr. Ritchie of Macleod expressed the meeting's pleasure and thanks.

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In honour of Mr. C. S. Donaldson, who is retiring as general manager of the Lethbridge Collieries, and Mrs. Donaldson, the Lethbridge Branch held a dinner meeting in the Marquis Hotel on Thursday, April 4th.

During the dinner, a trio—Mrs. George Brown, Mr. Brown and Mr. Henderson—furnished a delightful musical background. The sing-song, led by R. S. Lawrence, was devoted to favourites of Mr. and Mrs. Donaldson.

Miss Dawn Purkis sang two charming solos, accompanied by Miss Margaret Brown at the piano.

Chairman P. E. Kirkpatrick quoting from "The Faith of an Engineer" expressed the Branch's admiration of Mr. Donaldson's success in the mining field, his observance of the ethics of the profession, and the respect in which he is held by his fellow-members. In honour of the occasion, Mr. Kirkpatrick presented to Mr. Donaldson a gold lapel pin of the crest of The Engineering Institute of Canada. Mrs. Donaldson was presented with a large bouquet of spring flowers. Those present joined in singing "For He's a Jolly Good Fellow."

In replying, Mr. Donaldson said we all wonder at times if our efforts were worth while, and he assured the meeting that the kindness of his friends and his many associates on the occasion of his retirement, has proved to him that one's efforts were appreciated. He also introduced Mr. J. M. Davidson, his successor at the Lethbridge Collieries, and Mrs. Davidson.

The next part of the programme consisted of bright Scotch dances by Miss Jean Gauld and her pupils. Accompaniment on the piano was by Mrs. Dawson and on the bagpipes by "Scotty" Patterson, who also favoured with a solo.

Mr. Lawrence expressed the Branch's pleasure in having George Brown, Jr. home from the war safe and sound. Mr. Brown's fine baritone voice was enthusiastically received by the audience as he sang three selections.

C. Clendening introduced Mr. Ralph Thrall, who presented a paper on **Lime, Its Manufacture, and Some of Its Uses.**

Mr. Thrall explained there are two types of limestone: "high calcium" and "high magnesium" or dolomite. The quarry at Sentinel consists of high calcium limestone running 90 to 97 per cent of $CaCO_3$, and dolomite is considered an impurity. He confined his discussion to the treatment of the high calcium type.

Limestone occurs in every province of Canada, except possibly Saskatchewan, and in all but two states of the United States.

Limestone, besides its use in the manufacture of lime, is used for building stone. The local stone is not suitable due to the type of formation.

Sugar factories burn limestone with coke to produce quicklime and carbon dioxide. The molasses product still contains a large per cent of sugar. This is recovered by the "Steffenhouse" process of desugarization. Quicklime is added to the molasses producing a precipitate, which is filtered off. This is put into solution, and carbon dioxide is introduced, unites with the lime, and releases the sugar. Limestone required for beet sugar factories equals six per cent of the tonnage of the beet crop.

Glass manufacture requires lime, and the company at Redcliff orders limestone, as the natural gas fuel there enables them to produce lime economically.

Powdered limestone is used for dusting the walls of coal mines.

Lime is used in the ceramic industry, in cleaning coal by the sink and float process, in hog feeds, and in agriculture. The local soils do not require it, as they are partly decomposed limestone.

Mr. Thrall demonstrated the affinity of the pure lime or "quicklime" for water.

Hydrated lime is one of the main products of lime. This consists of the product obtained by adding just enough water to the lime to complete the chemical reaction. The chemical constituents are definitely known, while quickline may contain a varying per cent of combined water. The chemical industry and the building trades require large quantities.

Lime is also used in water-softening, in flotation processes for base metals, in gold processing, in paper mills, nickel manufacture, oil refineries, and with coke it is used to manufacture carbide.

Mr. Thrall said this district has two valuable assets for industry —lime and coal, but the location and transportation costs are drawbacks.

A. L. H. Somerville thanked the speaker.

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. - }

A Students' Night was held by the Montreal Branch on February 14th, 1946. Léo Scharry, S.E.I.C., was chairman of the meeting. The following students presented papers:

Roger P. Langlois, Fifth Year Ecole Polytechnique, on **Development of a Special Cathode-Ray Tube.** Mr. Langlois explained that for measurements of lengthy time-duration, such as for the study of slow electrical transient conditions, it was often desirable to increase the horizontal sweep of the luminous spot on the screen of a common cathode-ray tube. Such a sweep could be more than trippled by having the usual conical side wall of the tube made cylindrical and used as a circular screen for a suitably deflected cathode-ray beam. Slides were projected, showing the experimental set-up made at the electronics laboratory of the Ecole Polytechnique, under the direction of Professor J. C. Bernier.

Experiments permitted conclusions as to the proper shape of electrodes and magnetic fields to be used in order to deflect the beam without distortion. Realization of a practical tube based on these principles is being furthered at Polytechnique, and is expected to be of interesting use for various laboratory applications.

D. W. McLimont, Third Year McGill University, on **Wash Borings.** With the employment of simple apparatus and few men, wash boring affords a method of determining the nature of ground in depth. Boring proceeds as water pumped down a hollow steel drill rod escapes at a terminal cutting bit in the ground, washes soil up a steel casing around the drill, and voids it at the top.

A record is made of the type of material washed up at any particular depth as the bore hole descends. This information, together with geological data if available, is plotted and tabulated, and permits conclusions to be drawn regarding the composition, elevation and lie of soil strata, the existence of boulders, hardpan and bedrock.

Ground consisting of silt, clay, sandy clay, sand, fine gravel and loam may be explored by wash boring. The principal pieces of apparatus are: drill rod, casing, force pump, derrick, and winch. The operation may be carried out with a four or five-man crew.

The apparatus is mounted on a chassis with wheels or skids for boring on land; on a marine scow for subaqueous boring; or on sleds for under water borings made through ice.

Roger Simard, Fourth Year Ecole Polytechnique, on **Petroleum By-Products in the Plastic and Rubber Industries.**

This talk, which was of a general nature, was the survey of recent progress in the field of chemical synthesis starting from the cracked petroleum gases, the olefin hydrocarbons. After a brief outline of the cracking process, Mr. Simard explained, from a projected diagram, the various derivatives obtained from methane, ethylene, acetylene and butylene. From this he proceeded to describe the products obtained, mainly the phenolic and vinyl resins, Buna-N, neoprene and polystrene. As a practical application, there was described in detail the processing of Buna-S rubber as done at the Sarnia plant of the Polymer Corporation. This was accompanied by a projected diagram of the flow sheet drawn from data obligingly furnished by the rubber laboratory of the N.R.C. where Mr. Simard had worked the last two summers. A summary of the technical and economical possibilities of this new field of chemical synthesis was given in conclusion.

L. E. Neil Carr, Fourth Year McGill, gave an interesting talk on **Automatic Control in the Oil Refining Industry.**

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Leon A. Duchastel, retiring secretary-treasurer of the Montreal Branch was presented with a pair of silver candlesticks and two silver ash-trays at the regular meeting of the Branch, on March 11, 1946. The presentation was made by Dr. J. M. R. Fairbairn, on behalf of friends with whom Mr. Duchastel had worked on various committees. Thanking his friends for the gifts the former secretary-treasurer mentioned that he was glad of the opportunity to have worked with them.

Dr. W. E. Wickenden, was the speaker of the evening and his subject was **Engineers and Public Policy.** He covered a good deal of the world situation and its effect on engineers and laid some stress on the fact that nature's supply of raw materials might become exhausted before many years had passed. He also pointed out that the labour situation was such that some control had to be exercised to ensure that unreasonable demands were not made upon the ultimate consumer. Dr. Wickenden thought that engineers were in a position to help the world to solve its problems.

The meeting was very well attended and F. L. Lawton was in the chair.

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Mr. George P. Haynes, chief engineer, combustion division of Todd Shipyards Corp., New York, read a paper entitled **Fuel Oil Burning as Applied to Commercial Boilers for Industrial Service,** before the Montreal Branch on Thursday evening, March 28th, 1946.

The two outstanding types of petroleum are the paraffin base and the asphalt base; the latter is the one mostly used for fuel in industry. There are four general classes of oil atomizers for using this fuel. (a) The straight pressure or mechanical atomizer. (b) same as (a) but with a return flow system which provides for bleeding of oil from the discharge orifice to increase the capacity range. (c) Rotary-spinning cup atomizer and (d) the steam atomizer.

The straight pressure atomizer is the simplest to operate because it has only one moving part—the pump. It is ideal for a steady uniform load and variation of pressure will only allow a 2 to 1 range of operation for a given size sprayer plate. The addition of a " return flow system " allows the pressure to remain constant and the amount of bleed off to be varied. This gives very satisfactory atomizing conditions and allows an operating range of 6 to 1 with a given sprayer plate. The oil is delivered to the boiler at about 300 p.s.i.

The rotary spinning cup type is used where operating pressures are below 15 p.s.i. because it can atomize oil at a higher viscosity than either of the pressure types. While the pressure type burner needs oil at 150 SSU, the rotary cup type can handle oil at 375 SSU; this means that preheaters are not required. This burner has a wide capacity range and may be under fully automatic control with gas or electric ignition. One of the drawbacks is the likelihood of mechanical failure because each of the burners is individually motor driven.

The steam atomizer is used where sludges, and heavy tars are to be burned, the viscosity of which is usually above 375 SSU. Large port areas are needed to prevent clogging and similar difficulties. Supply pressure runs around 100 p.s.i. One of the chief drawbacks is a constant steam demand.

In the discussion period which followed, Mr. Haynes mentioned that he was not particularly worried about the supply of fuel oil being exhausted. It was also pointed out that recent tests in England have proved the straight pressure atomizer to be more efficient than the steam type atomizer.

A. L. Stewart thanked the speaker. W. L. Yack was chairman of the meeting.

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 on March 22 at the National Museum Lecture Hall, Col. J. P. Carriere, of Ottawa, presented an illustrated paper on **An Outline of Pre-Stressed Concrete Design.** This talk dealt with an outline of the basis for the design of prestressed concrete structural members based on researches and works carried out in Europe and included illustrations of its application.

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At a noon luncheon on April 5, the Ottawa Branch heard an address on **The Engineer and His Relation to Human Progress** by A. P. Young, O.B.E., of London, England. Mr. Young, a well known British engineer, inventor, industrial manager and educationalist, was in Canada on a tour under the auspices of the United Kingdom Information Office. During a major portion of his career, he has dealt with human relationships, with particular reference to the engineer's part in them.

Engineers should be interested not only in material improvements but also in the people that make use of them, declared Mr. Young. The engineering mind is called to a great task in our progress toward an industrial democracy. It will have to do its share in engendering in people an internal willingness to co-operate in all problems for the good of humanity. This should achieve far greater things than can possibly be achieved under the whip of external compulsion, which is the basis of dictatorship.

The idea of the brotherhood of man has been reverberating throughout the world for 2,000 years, said Mr. Young. Now it has become something more than an idealistic issue. The engineering mind, through its discovery of atomic power, has precipitated a crisis that demands instant attention. We shall have to go into international co-operation or most surely civilization will crash into the abyss. We shall live as one family or we shall not live at all.

Regarding those engineers who have helped to develop atomic power, the speaker remarked that they are now the blue-eyed boys of the engineering world but we must see to it that we do not all get black eyes from their engineering vigor.

Chairman J. H. Irvine presided.

PETERBOROUGH BRANCH

E. Whiteley, m.e.i.c. - *Secretary-Treasurer*
J. C. Allan, m.e.i.c. - *Branch News Editor*

On March 14th Mr. J. P. Sesia of the Faircraft Industries Limited, Longueuil, P.Q., addressed 95 members and visitors of the Peterborough Branch on **The Faircraft Factory Built House.**

Mr. Sesia introduced the subject with a description of four distinct systems used in the manufacture of prefabricated houses.

The first is a system of pre-cutting all pieces to size. These pieces are then shipped to the site, and the house is built. There is a substantial economy of material effected in that waste is reduced to a minimum. Against this must be set the difficulties which untrained workmen experience in sorting out the pieces and finding out just where they go. The success of this system is entirely dependent on the quality of the lumber.

The second method of prefabrication carries the process one step further, in that the wood members are cut in the factory and assembled into panels. These panels are then shipped to the site. When all these panels are bolted together the work proceeds in the conventional manner. Faircraft concluded that this system has greater economies than the first, because more work is done in the factory under efficient working conditions. Speed of erection at the site is far greater than by conventional methods. However, a survey indicated that when the cost of transportation is considered, the net saving in cost over the conventional site building methods was not very great.

Under the third system the house is built in two or three complete sections. Each section is fully wired, and the plumbing is installed. After shipment to the site, the several pieces are bolted together. This system approaches more nearly to the logical ideal in that the work on the site is far less than in either of the first two methods. Transportation costs are the only serious drawback. Usually one house requires three trucks or three flat cars.

The fourth system is used in the Faircraft House. It involves construction of the entire house at the factory. Instead of sectionalizing the house for shipment it is folded into a space small enough for one trailer truck or one flat car, and shipped in one package. Mr. Sesia considered that only the absence of a system of wide roads throughout the country had prevented the adoption of such a system years ago.

The speaker then described the Faircraft house and the methods of manufacture at Longueuil, P.Q.

With one exception, the house is built of conventional materials. The exception is the use of aluminum for the outside wall covering.

Following a description of walls, floors, ceilings, roofing, methods of manufacture and erection, the speaker concluded with some comments on the place of prefabrication in the present strained housing situation. The completion of a Faircraft house is a matter of days. The completion of a site built house is a matter of weeks or months. In the Faircraft factory, the complete manufacturing cycle of each house takes place inside of two weeks. It takes perhaps longer to dig the foundation than it does to build the house.

Mr. Sesia concluded with the statement that " We have created—if you will—a machine which is capable of producing more cubic feet of living space in less time and with greater economy than can be produced in any other way under existing conditions today."

QUEBEC BRANCH

Roger Desjardins, m.e.i.c. - *Secretary-Treasurer*

On February the 25th, the Quebec Branch heard an address by Lt. Col. E. D. Gray Donald entitled **Some Notes on Engineers and Engineering.**

To the engineer wanting success, the speaker said, fundamental professional knowledge of course is pre-requisite, but beyond that he must interest himself in economics, administration, accounting, law, merchandising, psychology, sociology, and a dozen other branches of knowledge—even, very occasionally of course, politics. Nearly every engineering problem is at the same time an economic problem. Construction work requires knowledge of organization, handling men, and some accounting.

Indispensable to success are balance, accuracy and clarity of thought and of verbal expression, and precision. To read well is important. Magazine articles have illustrated that few people read properly, and have given suggestions as to how reading can be improved. Most people read too slowly and carelessly, and assimilate little. Practice in reading well results in a saving of time, more understanding, and more pleasure from reading.

Speaking then about the "yes-man" and the "no-man", Mr. Gray Donald said that there is a happy medium between the two,—the man who will agree or disagree if he knows enough about the subject to be able to form an intelligent opinion. If he has no definite ideas, he will either keep quiet or ask time to think things over. If he has a better idea he says so, but makes sure that it is a better idea, and not just a different one.

The engineer must possess the ability to sell his ideas to others. An idea often does not find favour either because it is badly presented or it is no good. There is no room for passivity or negation in the engineering profession. Every engineer must be constructive, progressive and optimistic. The speaker said that whenever anything new comes up the passive attitude is to say 'Why', but the progressive fellows says 'Why not'.

Mr. Gray Donald concluded with an excellent summary of the qualities making for success. Good habits give balance; balance gives stability; stability gives strength; and strength gives the power to carry on under all circumstances, avoiding panic, discouragement, or faint-heartedness, but contributing strength and confidence.

Jean St-Jacques of the Quebec Power thanked the speaker on behalf of the audience.

Following the address Léo Roy, former secretary-treasurer of the Branch was offered a send-off on the occasion of his departure for Montreal where he has accepted an important situation with Hydro-Quebec.

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On April 4th, the Quebec Branch had the opportunity of hearing an address on **Radar.** The speaker was Mr. W. A. Laurie, public information representative of the Bell Telephone Company of Canada, and, in the chair, C. H. Boisvert, vice-chairman of the Branch. The speaker was introduced by Gilles Sarrault, professor of the Faculty of Sciences of Laval and thanked by U. Archambault of the Provincial Transportation Board.

Reviewing briefly the history of radio location, as radar is also called, Mr. Laurie pointed out that both British and American scientists participated in its discovery and application to war purposes.

A former radar technician in the R.C.A.F., Mr. Laurie was able to give a first-hand account of the development of radio detection and ranging, and using actual radar equipment he demonstrated how it works.

Mr. Laurie explained how very short radio waves, transmitted at high power, are reflected back from various objects. Picked up by a very sensitive receiver, the reflections reveal themselves on a fluorescent screen, showing up in various ways depending on the use to which the information is to be put.

Radar ground stations enabled the R.A.F. to win the Battle of Britain, Mr. Laurie said, and radar carried by British interceptors licked German night bombing. The results of fire-control radar so terrified the Italians that after the Battle of Cape Matapan their fleet never again came out of hiding. Radar was the means of tracking down the *Bismarck*. It licked the U-boat menace and the V-1 robomb blitz. It contributed to the success of Allied landings in North Africa, and France. It made airborne invasions possible. Radar might have saved Pearl Harbour if its warning had been heeded. In the Pacific, it enabled the *U.S.S. South Dakota* to bring down 32 enemy aircraft in one engagement. Aided by radar, the *South Dakota* and the *Washington* alone sank three Jap cruisers and one or two battleships in the Battle of Savo Island. Radar completely neutralized Jap air superiority in the India-Burma theatre, and kept open the supply lines of the British 14th Army. Close to three out of every four bombs dropped by heavy bombers on both German and Jap targets in the last year of war were guided by the radar bombsight.

In peacetime, radar can be used for airdrome traffic control, permitting safe landings even in fog, Mr. Laurie stated. It enables a ship to detect icebergs and other vessels in its path at night or in fog. It is already providing data for weather forecasts.

"Yet radar," the speaker concluded, "is still an infant."

SAGUENAY BRANCH

H. R. Fee, M.E.I.C. - - - - - *Secretary-Treasurer*

Mr. R. W. Herzer of Aluminum Company of Canada, Limited, Montreal, Que., addressed the Saguenay Branch of the Institute on 29th March 1946 on the subject **Canadian Technical Investigator Tours Western Europe After V-J Day.**

Mr. Herzer was one of a three-man technical investigating committee sent to Europe by the Aluminum Company of Canada, Limited, and his paper gave his impression of conditions in Europe as he saw them.

Most of the travelling was over fairly long distances and was done by air, but occasionally other methods of transport were used and these were found to be slow and unreliable, even in England. In Italy rail transport was particularly disrupted because of damage to bridges and railway stations, while in Germany a number of bridges had been destroyed by the retreating army, regardless of military significance. The canal system had also been badly sabotaged and was practically paralyzed. The chief method of transport was by road, and in this respect the speaker paid tribute to the "Bailey" bridges installed by the army Engineers. Even highway traffic was limited by the shortage of fuel, which had to be imported.

The speaker stated that business is in a complete state of turmoil. Some concerns have had their facilities completely destroyed, while others are shut down for want of raw materials, and still others are closed by military orders.

With respect to food, the speaker stated that the army rations were passable, and that throughout Europe extensive black markets existed, with prices unusually high, and therefore available only to a limited number. He expressed the opinion that England had made a greater sacrifice than any other country to relieve the situation in Europe.

Discussing physical damage, Mr. Herzer stated that England had not suffered as much as the continent, since the blitz was made during the period before the use of large bombs. In Italy the bombing had been particularly accurate and was aimed chiefly at railway stations. He stated that in general churches suffered most from bomb damage, with houses second and industry third, which was probably the reverse order of the efficiency of the fire control organization.

Mr. Herzer gave a very graphic picture of an approach to a bombed city, assuming that city to be Montreal. He described the extent of damage, the difficulties encountered in the movement of traffic and in securing accommodations, and told of the use made of the remaining buildings.

In closing, the speaker stated that the moral damage was more serious than the physical damage, and recommended that we, as Canadians, teach democracy by example in our support of world democratic organizations, and that in future our immigration policy should be based on the contribution the individual had made to the democratic way of living, rather than on background and financial standing.

The meeting was chaired by B. E. Bauman, and F. T. Boutilier moved a vote of thanks to the speaker.

ST. MAURICE VALLEY BRANCH

W. R. Mackay, M.E.I.C. - *Secretary-Treasurer*

The annual meeting of the St. Maurice Valley Branch was held in the Jacques Cartier Room of the Chateau de Blois in the form of a luncheon meeting at 1.30 p.m. on Saturday, April 13th. The guest speaker for the occasion was Dr. P. L. Pratley, prominent Montreal consulting engineer, who discussed the problems of the engineer on large bridge-building projects and how these problems vary widely under the various conditions encountered. Bridges may be privately or publicly owned and may be located so as to be under the jurisdiction of city, provincial or federal government or a combination of these. In some cases, they cross an international boundary, with resultant problems peculiar to this condition. Dr. Pratley used as examples a number of large bridges built during the past twenty years, with which he was personally familiar.

A. W. Peters expressed the thanks of the meeting to Dr. Pratley for his informative address.

J. A. Lalonde then spoke to the meeting about the current appeal to engineers for the Harry F. Bennett Educational Fund. It was stated that the drive in this Branch was organized and well under way.

H. K. Wyman, chairman, who presided at the meeting, then introduced the incoming chairman and executive to the meeting.

W. R. Mackay was appointed secretary-treasurer.

The attendance at the meeting was 81, which included several guests from Montreal and from the Chamber of Commerce.

SARNIA BRANCH

F. F. Dyer, M.E.I.C. - *Secretary-Treasurer*
C. E. Leon, M.E.I.C. - *Branch News Editor*

On Thursday, April 4th, the Sarnia Branch of the Engineering Institute held a dinner meeting at the Sarnia Golf Club. The speaker for the evening was Mr. T. J. Halme of the Industrial Electronics Department of Canadian General Electric Company, Toronto, his subject being **Industrial Electronics—Today and Tomorrow.** Mr. Halme graduated in electrical engineering from Queen's University, Kingston and upon graduation joined the Canadian General Electric Company in Peterborough where he took their industrial training course.

Industrial Engineers had no occasion to think about electronics until only a few years ago. At this time they awoke to the realization that electronics had become a valuable tool for doing things that formerly had never been imagined possible. However, electronics must be considered on merits only and not as a simple "cure-all" for every unsolved problem. In the application of electronics, Mr. Halme emphasized that they are as easy to apply as ordinary relays, transformers, and other electrical tools.

Mr. Halme reviewed some of the categories in which electronics are used today. By means of electronic measurement and inspection, an accuracy is possible that is 50 times greater than ever before. Electronic profile gauges give contour inspection to tolerances of one-ten-thousandth of an inch.

Time interval meters are used to time high speed camera shutters. It is possible to measure thickness continuously by passing X-rays through moving strips of materials and recording with a photo-tube the intensity with which these rays strike a fluorescent screen, thus giving accurate control on innumerable processes. Qualitative analysis such as ash content of coals is possible without the destruction of the analysed sample.

Mr. Halme described at some length an electronic motor control that varied the speed of the loading induction motor in the pendulum type textile testing machine.

In the field of light control, using photo-electric cells, Mr. Halme mentioned a few of the applications such as scanning devices to detect pinholes in rapidly moving tin sheets and foil; stroboscopes to detect faulty patterns on rapidly moving strips of material, and a new development in photo-tubes in which photo-electric beams can be transmitted over distances of 1,000 feet and more by the use of pulsating light.

In the field of electronic timing, the widest application is in controlled resistance welding. In the field of high frequency electronic heating, Mr. Halme pointed out that there were two distinct types of electronic heating—induction heating which is used for materials that are good electrical conductors, and where the area of heating must be closely confined, and di-electric heating, which is used for non-conductors and where heating is required throughout the entire mass.

In conclusion, Mr. Halme again stressed that electronics have made possible things that were impossible to accomplish a few years ago. The characteristics of electronics that make such things possible are fast operation, amplification, precise and quiet control. However, it is very necessary to realize that the future of electronics depends upon the active interest of engineers, their keeping abreast of electronic development and conceiving new ideas for applications. Electronics issue a challenge to the ingenuity of engineers in the future and it is to such men as ourselves that we must look for the further use of electronics.

VANCOUVER BRANCH

A. M. Eyre, S.E.I.C. - - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - *Branch News Editor*

On Thursday, March 21st, N. O. Paquette, M.E.I.C., addressed the Vancouver Branch on **Job Evaluation Methods.** Mr. Paquette, chief engineer of Stevenson and Kellogg Limited, industrial management engineers, was introduced by J. P. Fraser.

The speaker outlined the history of scientific job evaluation and the value of the subject to management for satisfactory labour relations.

The major steps in job evaluation were presented. First there is the collection of all data related to each job under various factors, such as complexity, education needed, initiative, etc Second, a point rating is assigned each factor for the different jobs in an organization. Third, the point rating is converted to dollars, and graphs are drawn to determine the relation of jobs and dollars. From the graphs so developed wage adjustments, new job ratings and wage trends may be determined.

The speaker stressed the by-products of job evaluation study, such as the thorough picture of activities and relationships of the various jobs in an organization. Promotion and training programmes may also be developed from scientific job evaluation study.

A spirited discussion followed the address. R. Walkem expressed the appreciation of those present for the informative and interesting presentation.

Appromixately fifty members and friends attended.

R. C. Pybus was Chairman of the meeting.

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Tuesday, April 16th, 1946 was the annual ladies' night at the Vancouver Branch. A special showing of the large-scale model of **Operation Mulberry** was presented at the Hudson's Bay Company for members and friends.

R. C. Pybus, acting as chairman of the meeting, introduced L. Austin Wright, general secretary of the Institute, who made a few opening remarks and turned the showing over to Colonel V. C. Steer-Webster of the British War Office.

Colonel Steer-Webster advised the gathering of the proper way to view the model and outlined the important features of the display. A fifteen minute film of the actual operation was presented at intervals throughout the evening. Many interesting questions and engineering problems were discussed by Colonel Steer-Webster.

Members of the Association of Professional Engineers of the Province of British Columbia were also invited to this special showing, which proved to be one of the most successful ladies' evenings in the history of the Institute.

A buffet supper was arranged by the Hudson's Bay Company.

NOTICE TO STUDENTS

Student members of the Institute who have left 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.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Business Journalism; Its Function and Future:
Julien Elfenbein. N.Y., Lond., Harper, c1945. 8¾ x 66¼ in., 341 pp., illus., cloth.

Engineer in Society:
John Mills. N.Y., Van Nostrand, 1946. 8¼ x 5¾ in., 196 pp., cloth.

Engineering Catalogue . . . 12th Annual ed., 1945-1946:
Montreal, Canadian Engineering Publications, c1945. 11¼ x 8½ in., 507 pp., illus., fabrikoid.

High Vacuum Technique; Theory, Practice, Industrial Applications and Properties of Materials; 2d. ed., rev.:
J. Yarwood. N.Y., Wiley, Lond., Chapman & Hall, 1945. 9¼ x 6 in., 140 pp., illus., cloth.

How to Find a Short and Other Automobile Wiring Troubles:
Jack Steele. N.Y., Norman W. Henley, 1946. 7¾ x 5¼ in., 209 pp., illus., cloth.

Manual of Instructions on Proper Firing Methods; in the Interest of Fuel Combustion and Conservation, Air Polution, Smoke Elimination:
Chicago, Smoke Preventions Association of America, 1945. 10¾ x 8½ in., 72 pp., illus., paper.

Notes on Writing for Students in Engineering:
R. DeL. French. Montreal, McGill University, 1945. 9 x 6 in., 80 pp., illus., paper.

Paint Manual; with Particular Reference to Federal Specifications:
Percy H. Walker and Eugene F. Hickson. (National Bureau of Standards. Building Materials and Structures. Report BMS 105). Wash., G.P.O., 1945. 8 x 5¼ in., 165 pp., illus., cloth.

Statistical Method in Quality Control; (Engineering Data Book, Section 29):
P. C. Clarke. Lansdale, Pa., Hunter Pressed Steel Co., 1944. 11½ x 9 in., 118 pp., illus., fabrikoid.

Teletransmissions par Ondes Porteuses dans Les Réseaux de Transport d'Energie à Haute Tension:
André Chevallier. Paris, Dunod, 1946. 10 x 6½ in., 111 pp., illus., paper.

World of Numbers:
Herbert McKay. Cambridge, Univ., Pr., 1946. 7¾ x 5½ in., 198 pp., illus., cloth.

PROCEEDINGS, TRANSACTIONS, ETC.

American Society for Testing Materials:
1945 Supplement to A.S.T.M. Standards including Tentatives; Part I —Metals.

American-Soviet Building Conference:
Proceedings, 1945. N.Y., Architects Committee, National Council of American-Soviet Friendship.

Institution of Naval Architects:
Transactions, vol. 87, 1945.

Iron and Steel Institute:
Journal, Vol. 150, No. 2, 1944.

Junior Institution of Engineers:
Journal and Record of Transactions, vol. 55 for the 64th Session, 1944-45.

TECHNICAL BULLETINS, ETC.

American Institute of Electrical Engineers—Standards:
No. 45, 1945—Recommended Practice for Electric Installations on Shipboard.
. . . No. 47, 1945—Expulsion Type Distribution Lightning Arresters. (Proposed AIEE Standard for Trial Use).
. . . No. 503, 1945—AIEE Test Code for Synchronous Machines. (Prepared under the Auspices of Committee on Electric Machinery).
. . . Nos. 601 and 602, 1945—Preferred Standards for Large 3,600-Rpm, 3-Phase, 60-Cycle Condensing Steam Turbine-Generators (Larger than 10,000-KW Rated Capacity). (Prepared by Joint AIEE-ASME Committee on Steam Turbine-Generators). And Standard Specification Date for Generators for Large 3,600-Rpm, 3-Phase, 60-Cycle Condensing Steam Turbine-Generators (Larger than 10,000-KW Rated Capacity). (Prepared by AIEE Group of Joint AIEE-ASME Committee on Steam Turbine-Generators).

American Standards Association:
Catalog of Standards, March 1, 1946.
. . . **Standards:**—*ASA — C37.2-1945 — American Standard for Automatic Station Control, Supervisory, and Telemetering Equipments. Sponsored by Electrical Standards Committee.) Approved December 11, 1945.*
. . . ASA—C37.4-1945 through C37.9-1945—American Standards for Alternating-Current Power Circuit Breakers. (Sponsored by Electrical Standards Committee.) Approved May 16, 1945.

American Welding Society:
Recommended Practices for Resistance Welding (Tentative). Prepared by A.W.S. Resistance Welding Committee. Approved December 6, 1945.

British Standards Institution—British Standards:
BS 497: 1945—Cast Manhole Covers, Road Gully Gratings, And Frames.
. . . BS 832: 1945—Bell Transformers excluding Transformers for Use in Mines.
. . . BS 1290: 1946—Wire Rope Slings and Sling Legs.
. . . BS 1296: 1946—Shapes of Butt-Welded Lathe and Planer Tools. (Emergency Standard.)

Codes of Practice Committee—British Standard Code of Practice:
CP (B) 527—Concrete Laid Jointless on a Concrete Base.—CP (B) 528—Composition Block Flooring.—CP (B) 529—Calcium Sulphate Flooring (Tentative).—CP (B) 530—Linoleum and Cork Carpet.—CP (B) 531—Provision of Electricity Service Cables for Small Houses. —CP (B) 532—Consumer's Electricity Supply Controls for Small Dwellings.—CP (B) 533—Lightning Protection.

Edison Electric Institute:
Boilers and Combustion, 1944; a Report of the Boilers and Combustion Subcommittee of the Prime Movers Committee. (Publication No. M4.)
. . . Boiler Auxiliaries, 1944-1945; a Report of the Boiler Auxiliaries Subcommittee of the Prime Movers Committee. (Publication No. M6.)

Electrochemical Society:
Preprints:—*89-10—Scandium in the Stars by Arthur S. King.—89-11—Production of Beryllium Compounds, Metal and Alloys by Henry C. Kawecki.—89-12—"Elkem" Rotating Arc Furnace for Electrothermic Process by Tonnes Ellefsen.—89-13—Thermodynamic Studies of Dilute Solutions in Molten Binary Alloys by John A. Yanko, A. E. Drake and Frank Hovorka.*

Institution of Mechanical Engineers—Advance Papers:
Evolution of a Tank Transmission by H. E. Merritt.
. . . Loop Scavenge Diesel Engine by H. Desmond Carter.
. . . Tuned and Damped Gyrostatic Vibration Absorber by R. N. Arnold.

North-East Coast Institution of Engineers and Shipbuilders—Advance Papers:
Electricity Supply of the North East Coast; a Survey of Recent Development, by S. E. Monkhouse.
. . . Marine Propeller Blade Vibrations: Full Scale Tests, by L. C. Burrill.
. . . Some Comments on Engines and Engineers, by C. C. Pounder.
. . . Some Researches on Internal Combustion Prime Movers, by James Calderwood.

REPORTS, YEARBOOKS, ETC.

Canada. Department of Mines and Resources:
Annual Report, 1945. Ottawa, King's Printer, 1946.
. . . Coal Mines in Canada, 1945.

Engineering Foundation:
Annual Report, 1944-1945.

Institution of Structural Engineers:
Year Book and List of Members, 1945.

PAMPHLETS, ETC.

Measurement and Guidance Project in Engineering Education:
Kenneth W. Vaughn. N.Y., Engineers' Council for Professional Development, 1945.

Research, Invention and Patents:
Andrey A. Potter. N.Y., Industrial Research Institute, 1945.

Timber Seasoning in South Africa:

M. H. Scott. (Union of South Africa. Department of Agriculture & Forestry. Forestry Series No. 11.) Pretoria, Government Printer, 1945.

Traffic Congestion:

R. N. Watt. Montreal, Montreal Tramways Company, 1946. (Address delivered before the Rotary Club of Montreal, March 19th, 1946.)

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

British Standard Specification for Lathe and Planer Tools (B.S. 1290—1946):

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

A new standard relating to the shapes of butt-welded lathe and planer tools prepared by collaboration between the Ministry of Supply and the Welded and Brazed High Speed Tool Trade Association. The standard establishes a standard series of 15 shank sections for lathe and planer tools together with a series of 31 diagrams illustrating the shapes of the tool points, and relates each shape of tool to the various shank sections in which it is customarily manufactured. Each tool shape is given a standard reference number for convenience in ordering.

Recommended Practices for Resistance Welding:

N.Y., American Welding Society, 1946. 47 pp., 50c.

This is a compilation of recommended practices for the spot and seam welding of low-carbon, stainless and hardenable steels, nickel, monel and inconel; the projection welding of low-carbon and stainless steels; flash-butt welding low and medium forging strength steels; and standard methods for testing resistance welds. Each recommended practice comprises a table of machine settings for current, voltage, time, pressure, and other factors, which will produce welds of specified strength in various thicknesses of materials. Included is a section of standard methods for testing resistance welds; with a complete description of the test specimens, equipment to be used, and procedure to be followed.

Scarce Materials; and When You Can Get Them:

N.Y., Journal of Commerce, 1946. 12 pp., 25c.

A new supply table indicating when the end of current shortages may be expected. Supplies of copper, sugar, rubber, lead tin, building materials, steel, paper, and many other materials are indicated. The factors influencing the supply situation in 21 basic raw materials are brought up to date. The probable end of acute scarcities, and the eventual date when supply and demand will be balanced is also spotlighted in the timetable.

Selection of Steel for Welding:

Samuel L. Hoyt. N.Y., American Welding Society, 1946. 10 pp., 50c.

This article explains why steel selected for welding should be chosen for "welding quality". It cites several typical examples of welded construction and explains the problem involved in the selection of steel for each. Also discussed are three-dimensional stress systems created by welded fabrication, as compared to stress conditions in riveted assemblies, and the need for "cohesive strength" in steels used for welded construction, to eliminate possibility of brittle failures.

Solid Phase Welding:

Augustus B. Kinzel. N.Y., American Welding Society, 1946. 22 pp., 50c.

An analysis of the principles and theory of pressure welding and solid phase bonding, this pamphlet covers the fundamental mechanism of bonding, including the theories of metallic cohesion, atomic bonding and film diffusion. The relative effect of temperature, time, and pressure in solid phase welding are also explained.

Wear Resistance Tests on Concrete Floors and Methods of Dust Prevention:

By Georg Wastlund and Anders Eriksson. Svenska Forskningsinstitutet for Cement och Betong vid Kungl Tekniska Hogskolan I Stockholm—Handlingar N: R 5 (e), 1945 (Swedish Cement and Concrete Research Institute—Proceedings) (in English).

This paper presents a description of tests made on concrete floor specimens of various types in order to determine their resistance to wear and to investigate the character of deterioration of concrete floor surfaces due to traffic. The results of these tests show that concrete floors provided with finish courses containing coarse aggregate up to about 9 mm. in size and an excess of pea gravel are definitely superior to concrete floors with a finish course containing fine sand only. The latter are common in Sweden at the present time. The investigation has helped to elucidate the causes of dusting of concrete floors, which if often very intense and detrimental in many respects. The surface skin of concrete floors is, as a rule, of poor quality, and as it is readily worn off, dust is liable to form. Dusting can be considerably reduced if the poor surface skin is removed by machine grinding, provided that the concrete below the skin is of first-rate quality. The paper concluded by proposing a detailed tentative specification for concrete floor finish which differs in essentials from current Swedish practice.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

METAL WORKING AND HEAT-TREATMENT, Vol. I

By F. Johnson. Paul Elek (Publishers) Ltd., Diamond House, 36-38 Hatton Garden, London, E.C.1. 204 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, 17s. 6d.

This first volume of a series of four deals extensively with the characteristics and heat-treatment of carbon steels. It covers the influence of composition and treatment on structures and properties; describes practical operations such as forging, annealing, tempering, machining, etc.; devotes two chapters to hardenability; and discusses mechanical properties and their testing. There is a supplementary chapter on the heat-treatment of tool steel. Successive volumes are planned as follows: Vol. II, Alloy steels, cast iron and non-ferrous alloys; Vol. III, Surface-hardening; Vol. IV, Furnaces and pyrometry.

OPTICAL INSTRUMENTS IN ENGINEERING

By S. H. Hemsley. Paul Elek (Publishers) Ltd., Diamond House, 36-38 Hatton Garden, London, E.C.1, 1945. 80 pp., diagrs., tables, 8¾ x 5½ in., cloth, 7s. 6d.

This book outlines the construction and scope of some of the more important optical instruments now obtainable for workshop purposes, and briefly describes the principles upon which they work. No details of operation are given, but their general capabilities are surveyed to indicate ways in which they might be used in specific cases. The electron microscope is described in principle although not, strictly speaking, an optical instrument.

SCIENTIFIC SOCIETIES IN THE UNITED STATES:

By. R. S. Bates. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 246 pp., tables, 8¾ x 5½ in., cloth, $3.50.

The history and the influence of the scientific societies of the United States are the themes dealt with in this book. Beginning with the first small, short-lived organizations prior to the American Revolution, the author traces the development of this grouping together for scientific advancement down to the present-day multitude of national, state and local societies. These developments are effectively related to other aspects of the growth of the United States. A thirty-page bibliography provides further material on all phases of the subject.

PRELIMINARY NOTICE

(*Continued from page 333*)

FOWLER—CHARLES ALLISON EUGENE, of Halifax, N.S. Born at Halifax, N.S., Jan. 24th, 1921. Educ.: B.Eng., (Mech.), McGill, 1944; 1941-42, (summers), machine shop, Halifax Shipyards Ltd.; dftsman., Dartmouth Marine Slips; 1943-46, Lieut., R.C.E.M.E.; 1946, (6 mos.), mech. engr. & arch. dftsman., C. A. Fowler & Co., Halifax, N.S., (consultg. engrs. & architects); returning to Univ. of Manitoba (study architecture). (St. 1943).

References: W. H. Noonan, I. P. MacNab, J. B. Hayes, C. A. Fowler.

GORDON—JOHN ABRAHAM, 276 John St., Peterboro, Ont. Born at Bay Roberts, N'fld., July 10th, 1918. Educ.: B.Eng., McGill, 1941, jr. engr., Canadian General Electric Co.; 1941-45, R.C.E.M.E., Officer Commanding A Unit; and at present, training as part of personal rehabilitation program, Canadian General Electric Co., Peterboro, Ont. (St. 1941).

References: H. R. Theakston, C. V. Christie, G. R. Langley, R. H. Hodgson, A. Malby.

HUGHES—GERALD FRANCIS GEORGE, Glasgow, Scotland. Born at Sayabec-Que., March 10th, 1919. Educ.: B.Sc., (Elect. Engrg.), New Brunswick, 1940; 1940-41, test engrg. course, Canadian General Electric Co., Ltd., Toronto & Peterboro, Ont.; 1941-45, R.C.N.V.R., Liaison Officer between R.C.N. & Dir. Elect. Engrg., Admiralty, London & Bath; and at present, Asst., Canadian Government Trade Commissioner, Glasgow, Scotland. (St. 1940).

References: C. E. Olive, E. G. Cullwick, F. H. Palmer, W. H. Eastlake, A. F. Baird.

WALKER—HOWARD JAMES, Cap de la Madeleine, Que. Born at Montreal, Que., May 8th, 1917. Educ.: B.Sc., (Elect.), McGill, 1940; 1940-41, Shawinigan Water & Power Co., Victoriaville, Que.; 1941-45, R.C.A.F. Overseas, with rank of S/L. (Engrg. Officer); and at present, distribution engr., Shawinigan Water & Power Co., Three Rivers, Que. (St. 1940).

References: R. H. Mather, C. V. Christie, C. Thomson, A. C. Abbott, A. W. Peters.

WILKINS—ERNEST BERTRAM, of Lethbridge, Alta. Born at Lethbridge, Alta., April 21st, 1921. Educ.: B.Sc., (Civil), Alberta, 1943; 1941-42, (summers), rodman, instru'tman., Dept. of Transport; 1943-46, R.C.E., with rank of Lieutenant. (St. 1943).

References: R. S. L. Wilson, I. F. Morrison, R. H. Hardy, A. L. H. Somerville, T. H. Miard.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

April 30th, 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 June meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

A Member shall be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thrity-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, 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 attainment 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

ANDERSON—SAMUEL CHARLES, 56 Leinster Ave., S., Hamilton, Ont. Born at Belfast, Ireland, Aug. 31st, 1896. Educ.: B.Sc., (Eng.), London Univ., England, 1922; with T. Lyons & Co., Ltd., London, as follows: 1922-23, in factory & drawing off., 1923-25, i/c plant at Coventry; with Anglo-Persian Oil Co., as follows: 1925-26, asst. engr. on pipe lines, 1926-28, personal asst. to field mgr.; 192932 Agricultural Genl. Engrg. Ltd., Aldwych House, London (dissolved in 1932), during period, factory representative in Canada, (Peacock Bros., Montreal); with Sawyer-Massey Ltd., Hamilton, Ont., as follows: 1941-45,chief dftsman., 1945 to date, sales engr.

References: T. S. Glover, W. A. T. Gilmour, S. R. Job, R. E. Butt, E. T. W Bailey.

ANDREWS—SAMUEL WARREN, of Niagara Falls, Ont. Born at Lead, South Dakota, Sept. 24th, 1890. Educ.: Mech. Engr., Cornell, 1912, (accredited E.C.P.D.); M., A.I.E.E.; M., A.S.M.E.; R.P.E., Ontario; 1912-13, dftsman, Portland (Ore.) Rly., L. & P. Co.; 1913, dftsman, inspectr. & res. engr., railway electrification, Southern Pacific Co.; 1917-18, H.E.P.C. of Ontario, transmission dept.; Queenston-Chippawa Development, as follows: 1918-20, asst. plant engr., 1920-24, plant engr.; with H. G. Acres & Co., Niagara Falls, Ont., as follows: 1924-34, mech. engr., 1934-45, chief engr., and at present, president.

References: J. G. Hall, R. L. Hearn, F. W. Bradshaw, A. W. F. McQueen, H. E. Barnett

BROOKING—DONALD CHARLES, 249 Mandeville St., Winnipeg, Man. Born at Winnipeg,Man., June 5th, 1910. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1933; with Canadian General Electric, as follows: 1934-36, test course, 1936-38, air conditioning engr., responsible for engrg. of indus., commercial & domestic air conditioning systems, calculation of cooling, heating requirements, etc., design of electrical control & dust systems, etc., 1938-41, mgr., air conditioning divn., Winnipeg, as above, and in addition sale & supervision of installn. of systems, engrg. of indus. & commercial refrigeration systems, etc., 1941-43, distribution engr., Winnipeg divn.; 1943-45, Elect. Lieut., R.C.N.; and at present, distribution engr., Canadian General Electric Co., Ltd., Winnipeg, Man.

References: E. P. Fetherstonhaugh, L. G. Scott, D. M. Stephens, T. E. Storey, J. W. Greenlaw, W. A. Trott.

CAMPBELL—DONALD WILLIAM, 137 Wolseley Ave., Montreal 28, Que. Born at Fort William, Ont., Feb. 17th, 1912. Educ.: B.Sc., (Mech.), Queen's, 1942; 1935-36, (summer), mechanic, Lake Shore Mine; 1936-37, (summer), mechanic, Falconbridge Nickel Mine; 1940, (summer), instru'tman., Dept. of National Defence; 1941-46, R.C.E.M.E., Canadian Army, Workshops Officer; and at present, sales engr., T. C. Chown Ltd., (power house equipt.), Montreal.

References: L. T. Rutledge, R. A. Low, N. C. Sherman, R. L. Franklin, K. H. McKibbin, D. S. Ellis.

CAMPBELL—JAMES DOUGLAS, of Woodstock, Ont. Born at Pelly, Sask., Dec. 31st, 1916. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1939; with Steel Co. of Canada, Ltd., Hamilton, Ont., as follows: 1941-42, asst. foreman open hearth dept., 1942-44, scrap yard foreman, open hearth dept., 1944-45, asst. foreman; 1945 to date, Chemical Lime Limited, Beachville, Ont., as manager.

References: J. A. Vance, A. L. Furanna, D. D. C. McGeachy, W. E. Brown, D. S. Ellis.

COOKE—DONALD NORRY, of London, Ont. Born at Tilbury, Ont., Sept. 18th, 1913. Educ.: B.A.Sc., (Elect.), Toronto, 1935; R.P.E., Ontario; 1935-36, elect. constrn., motor & control apparatus repair & instaln., Johnson-Turner Repair & Engrg., Windsor, Ont.; 1936-39, illuminating engr., The Holophane Co. of Can., Ltd., Toronto, Ont.; 1939-40, i/c sales engrg. & instln. work for London district, Johnson-Turner Electric Repair & Engrg. Co., London, Ont.; enlisted Aug., 1940, on active service overseas from Dec. 1940 to Sept. 1945 with R.C.E.M.E., last two appointments, Deputy Director Mech. Engrg., 2nd Cdn. Corps and O/C Cdn. Base Workshop with full rank of Colonel; at present, genl. mgr. & secretary, Soft Water Supply Ltd., London, Ont.

References: H. G. Thompson, W. L. Thompson, E. V. Buchanan, V. A. McKillop, L. S. McGregor.

COOMBES—ROBERT ARTHUR, of St. Catharines, Ont. Born at North Devon, N.B., Sept. 8th, 1914. Educ.: B.Sc., (Elect.), New Brunswick, 1942; 1941, (summer), switchgear engr., Canadian Westinghouse Co.; 1942-45, R.C.N.V.R., Naval Engrg., 1½ yrs. i/c machinery ships at sea; 1946 to date, switchgear engr., English Electric Co., Ltd., St. Catharines, Ont.

References: J. B. Eldridge, A. F. Baird, E. O. Turner, J. H. Moore, E. M. Nason.

DAVIES—CLIFFORD LORNE, of Selkirk, Man. Born at Selkirk, Man., April 3rd, 1920. Educ.: B.Sc., (Civil), Manitoba, 1943; 1941-42, (summers), Manitoba Rolling Mills Co., Ltd.; 1943-45, R.C.A.F., Overseas; 1945 to date, tech. officer, reconstrn., Public Works of Canada, Winnipeg, Man.

References: P. E. Doncaster, J. E. Kellett, W. A. Capelle, E. V. Gilbert, N. M. Hall.

DAVISON—WILLIAM ERIC, 861 Victoria Ave., St. Lambert, Que. Born at Wolfville, N.S., Dec. 14th, 1899. Educ.: B.Sc., (Elect.), N.S. Tech., 1924; 1916-17, Canadian Car & Foundry; 1917-19, R.C.E., Signal Corps; 1924-25, Shawinigan Water & Power Co.; 1925-35, Shawinigan Engrg. Co., Montreal; with Shawinigan Water & Power Co., as follows: 1935-38, supt., terminal stns., 1945 to date, asst. supt., substn. divn., Montreal, Que.

References: A. L. Hough, W. R. Way, R. E. Heartz, C. R. Lindsey, L. A. Duchastel, R. B. Roach.

GROSVENOR—FRANK, of Toronto, Ont. Born at Toronto, Ont., Jan., 18th, 1908. Educ.: B.A.Sc., Toronto, 1930; R.P.E., Ontario; 1929-32, dftsman, H.E.P.C. of Ontario; 1933, jr. engr., Imperial Oil Ltd.; with H.E.P.C. of Ontario, 1936-39, designing engr., 1940-43, supervising engr., 1944, asst. engr., (mechanical), 1945 to date, asst. engr., (section head), Toronto, Ont.

References: O. Holden, J. R. Montague, S. W. B. Black, J. A. Aeberil, G. R. Lord, E. G. Tallman.

HARTWICK—ELBERT FREDERICK, of Arvida, Que. Born at Ottawa, Ont. Jan. 8th, 1917. Educ.: B.Eng., (Chem.), McGill, 1938; with Aluminum Co. of Canada, as follows: 1938-40, apprentice, reduction plant & fabrication, Arvida, Toronto & Shawinigan Falls, 1940-42, supvr., aluminum paste & powder plant, 1942-45, asst. supt., electrode plant & alum. powder plant, and at present, engr., pilot plant operations, Arvida, Que.

References: B. E. Bauman, T. A. Carter, J. W. Ward, G. M. Mason, F. T. Boutilier.

HAWKINS—LEONARD K., of Edmonton, Alta. Born at Brighton, Eng., August, 1890. Educ.: private study; 1908, rodman, instru'man., Sumas Reclamation Co.; 1909-10, instru'man., Gordon Sweatman, Vancouver, B.C.; 1910-11, dftsman, Kettle Valley Rly.; 1911-12, dftsman, Vancouver, Victoria & Eastern Rly.; 1913-14, topo. survey townsite nr. Prince Rupert for English syndicate; 1914-15, asst. J. H. Kennedy, chief engr., Vancouver, Victoria & Eastern Rly.; 1916-18, asst. supt., J. R. Cahill Inc., San Francisco, constrn. engrs., Red Mountain Mining Co., i/c constrn. factory for British & American war supplies; 1918-19, in B.C., estimating jobs; 1920-31 in business on own a/c; 1933-38, computing quantities, etc., Dept. Public Works, B.C.; with the Dept. Transport, as follows: 1939, res. engr., Vancouver Airport, 1940, paving inspectr., Calgary Airport, 1941 to date, res. engr., (Civil Aviation Br.), mtce. Mackenzie River airfields, Edmonton, Alta.

References: A. L. H. Somerville, H. Keith, E. Smith, J. W. S. Chappelle, T. O. Neumann, H. T. Miard.

LIBBEY—A. MOULTON, of Saint John, N.B. Born at Brockway, N.B., Nov. 29th, 1901. Educ.: I.C.S.; Military Coll. of Science, Eng., (1 yr.); 1918-24, machi apprentice, C.N.R.; 1925-26, mech. dftsman, Baldwin Loco. Works, Philadelphia; 1928-33, mach. & dftsman.; 1933-39, Armament Artificer Dept. National Defence; with R.C.E.M.E., as follows: 1939-44, Officer I/C Machine Shop, 1944 to date, Officer I/C Workshops.

References: H. A. Stephenson, W. B. Akerley, H. R. McQueen.

LITTLE—DONALD CAMERON, of Windsor, Ont. Born at Saskatoon, Sask., July 4th, 1918. Educ.: B.Sc., (Mech. Engrg.), Sask., 1942; 1942-46, Capt., R.C.E.M.E.; and at present, jr. engr., Kelsey Wheel Co., Ltd., Windsor, Ont.

References: N. B. Hutcheon, R. A. Spencer, E. K. Phillips.

MacDONALD—RODERICK EDWARD, of Sydney, N.S. Born at Florence, N.S., May 15th, 1917. Educ. B.Sc., Acadia Univ., 1939; 1939-46, R.C.E., as Army Engineer Officer; and at present, student engr., Dominion Iron & Steel Co., Sydney, N.S.

References: W. E. Bown, Y. C. Barrington, M. W. Booth, A. J. Kerry, C. M. Anson.

MacKAY—WILLIAM NELSON, 333 No. John St., Fort William, Ont. Born at Fort William, Dec. 16th, 1915. Educ.: B. Aero Engrg., Univ. Minnesota, 1939, (accredited E.C.P.D.); 1939-40, jr. engr., Canadian Car & Foundry, A/C Divn.; with R.C.A.F., as follows: 1940-42, Deputy Dir. Mtce. Divn., 1942, (10 mos.), O/C Airframe Repair Sect. No. 10 Repair Depot, Calgary, 1942-43, Chief Engr., No. 2 Wireless School, I/C Aircraft Mtce., 1943-44, O/C Repair Sq. No. 3 Service, Flying Training School, 1944-45, Chief Engineer, and at present, O/C Genl. Engrg. Section, No. 10 Repair Depot, Calgary, Alta., with the rank of Squadron Leader, (awaiting retirement).

References: D. G. Tapley, P. Peele, W. J. Grey, K. W. Mitchell, H. J. Stephens.

McLACHLAN—ROBERT ANGUS, 747—East Ninth St., N., Vancouver, B.C. Born, Vancouver, B.C., Sept. 9th, 1898. Educ.: S.B., (Naval Arch. & Marine Engrg.), M.I.T., 1926 (accredited E.C.P.D.); R.P.E., B.C.; 1919-22, with T. Halliday, naval arch., Vancouver; 1923-24, dftsman., B.C. Telephone Co. Vancouver; 1926-27, Federal Drydock & Shipbuilding Co., Kearney, N.J.; 1927-28, Vulcan Iron Works, Vancouver; with Dominion Bridge Co., Vancouver, as follows: 1929-37, detailer, checker, 1937 to date, chief dftsman.

References: A. S. Gentles, J. Robertson, W. O. C. Scott, W. H. Powell, A. Peebles.

MEYER—CARL RUDOLF, of 1108 Elgin Terrace, Montreal. Born at Berlin, Germany, Oct. 22nd, 1912. Educ.: B.Sc., (Eng.), Univ. of London, 1937; 1930-32, practical shop experience as engrg. student with Siemens & Schuckert, Berlin, Germany; 1937-38, teaching engrg. subjects, British Institute of Engrg. Technology, London, Eng.; 1938-40, asst. development engr., design & testing of mech. handling equipt., development work on new type fuel injection pump for diesel engines, New Conveyor Co., Ltd., Oldbury, Eng.; 1941-43, chief dftsman., i/c drawing office for jigs, tools, & special machinery design & plant mtce., tooling of gun & aircraft parts, preparation of flow sheets, etc. for Sorel Industries Ltd., Dominion Engrg. Works Ltd., etc.; with Industrial Steel & Fibre Ltd., Terrebonne, Que., as follows: 1943-44, asst. prod. mgr., 1944 to date, prod. mgr., i/c factory.

References: J. S. Walsh, J. L. Beiler, L. Asselin.

MONTGOMERY—KENNETH HUGH, of Suffield, Alta. Born at Fredericton, N.B., May 9th, 1893. Educ.: Civil engrg., I.C.S.; with Canadian Northern Rly., as follows: 1911-14, (1 yr.), res. engr., constrn.; 1915-19, Cdn. Engr. Corps., Army; 1920-27, farming, Alta.; with Calgary Power Co., as follows: 1928-29, res. engr., i/c survey party, Ghost Dam to Edmonton, 1929-31, res. engr., constrn., (1), Camrose Dam filtrating Plant, (2), Magrath—water & sewage system including pumping stn., sewage disposal plant & concrete storage tank, considerable experience with quicksand during constrn.; 1931-32, concrete inspector, Glenmore Dam, City of Calgary; 1932-40, town engr. & supt. utilities, Town of Macleod, Alta.; 1940 to date, Canadian Army, A/Adjutant, Home War Establishment Adm. Officer, Experimental Stn. Suffield, Alta.

References: H. B. Sherman, G. S. Brown, T. Pascoe, J. W. Young.

RATTENBURY—DAVID JAMES, 3756 W. 3rd Ave., Vancouver, B.C. Born at Kelowna, B.C., March 5th, 1918. Educ.: B.A.Sc., (Mech. Engrg.), B.C., 1941; 1941-44, Aeronautical Inspection Directorate, worked as A.I.D. inspector in three Boeing plants, finally at C. P. Airlines repair plant at New Westminster, B.C.; with Canadian Sumner Iron Works, Vancouver, B.C., as follows: 1944-45, dftsman., 1945 to date, chief dftsman.

References: J. N. Finlayson, H. J. MacLeod, P. N. Bland, G. W. Allan, A. Peebles, H. N. MacPherson.

SCRIMES—WALTER ROBERT, of 204 Oak St., Winnipeg, Man. Born at Winnipeg, Man., Aug. 24th, 1917. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1940; 1940, (3 mos.), apprentice engr., Canadian Westinghouse Co.; 1940-45, Officer, Royal Canadian Corps Signals; 1945 to date, asst. engr., Winnipeg Electric Co., distribution dept., Winnipeg, Man.

References: E. P. Fetherstonhaugh, E. V. Caton, N. M. Hall, A. E. Macdonald, W. F. Riddell.

SHEPHERD—HERBERT LAWRENCE, Ajax, Ont. Born at Toronto, Ont. May 13th, 1914. Educ.: B.A.Sc., (Elect. Engrg.), Toronto, 1934; 1935-41, H.S. teacher, dfting., maths., electricity, etc.; 1942-45, R.C.N.V.R., Elect Officer, mtce. of anti-sub. equipt., Elect. Instructor, H.M.C. Anti-Submarine School; 1945, (7 mos.), counsellor to ex-service applicants for engrg. courses, Faculty Applied Science & Engrg., Univ. of Toronto, and at present, asst. to director of studies, Ajax.

References: C. R. Young, W. J. T. Wright, W. S. Wilson, T. R. Loudon, D. O. D. Ramsdale.

SIMMONS—DWIGHT SYLVESTER, 425 N. Christina St., Sarnia, Ont. Born at Sarnia, Ont., Sept. 19th, 1908. Educ.: B.Sc., (Mech. Engrg.), Queen's, 1932; R.P.E., Ontario; 1924-25, (summers), Imperial Oil, Sarnia; Shawinigan Engrg., Rapide Blanc; Hudson Motor Car, Detroit; Holmes Foundry, Port Huron, Mich.; with Imperial Oil Limited, as follows: 1932-34, dftsman., genl., engrg., design of special steel structures, pressure vessels, etc., 1934-42, process design, responsibility of units costing several million dollars, training by lectures & practical demonstration, operators for those units, and responsible for bringing units into operation; with St. Clair Processing Corp., Ltd., (rubber plant), as follows: 1943-45, tech. supt., 1945 to date, asst. mgr., directing laboratories, tech. dept., genl. responsibility for all operations.

References: G. L. Macpherson, T. Montgomery, R. L. Dunsmore, C. E. Carson, R. W. Dunlop, C. P. Warkentin, E. K. Lewis, W. E. Taylor.

STEPHANSON—BARNEY THORVARDUR, of Edmonton, Alta. Born at Elfros, Sask., Aug. 16th, 1918. Educ.: B.Sc., (Agric. Engrg.), Sask., 1944; 1944 to date, extension agricultural engr., Provincial, Dept. of Agriculture, Edmonton, Alta.

References: N. B. Hutcheon, R. A. Spencer, F. R. Burfield.

TARBOX—JOHN WILLIAM, 344—17th Ave., East, Vancouver, B.C. Born at London, Eng., Jan. 2nd, 1917. Educ.: B.A.Sc., B.C., 1942; 1940-41, jr. engr., tool & jig design and parts processing, Boeing Aircraft; 1942 to date, Captain, R.C.E.M.E. (awaiting discharge).

References: J. N. Finalyson, I. F. Morrison, A. O. Monk, H. J. MacLeod, G. W. Allan.

TUCK—ALBERT EDWARD, 283 Tuxedo Ave., S., Hamilton, Ont. Born at Burlington, Ont., March 23rd, 1902. Educ.: B.A.Sc., Toronto, 1926; R.P.E., Ontario; with Steel Co. of Canada, Hamilton, Ont., as follows: 1926-28, elect. dftsman., 1928-46, elect. test engr., i/c elect. testing of motors, power systems, protective relaying & metering, during this period elect. engr., responsible for design of sub-stn. bldgs., underground power dist. systems, conduit layouts, mill bldg. & office lighting systems, and at present elect. test engr.

References: C. J. Porter, E. T. W. Bailey, E. G. Wyckoff, J. R. Dunbar, R. E. Butt, W. J. W. Reid.

WALDOCK—DONALD ALBERT GEORGE, of Ottawa, Ont. Born at Ramsgate, Eng., Aug. 30th, 1915. Educ.: B.Sc., London Univ., 1936; R.P.E., Quebec; with B.B.C., England, as follows: 1936-38, student apprentice, 1938-39, broadcast transmitter engr.; 1940-45, H.Q. Scottish Command, Major, War Office, England, (Radar), and finally Lt.-Colonel, GSO 1, (Radar), British Army Staff, Washington, D.C.; 1945-46, (4 mos.) telephone transmission engr., Northern Electric Co., Montreal; and at present, Radar Development Officer, N.D.H.Q., (D.A.D. 5), with rank of Major, Ottawa, Ont.

References: J. W. Fagan, E. H. Hayes, C. A. Manson, L. G. Eon, J. E. Breeze, F. F. Fulton.

WEBSTER—GORDON WILLIAM, Millarville, Alta. Born at Edmonton, Alta., Sept. 27th, 1913. Educ.: B.Sc., (Chem. Engrg.), Alberta, 1935; R.P.E., Alberta; 1935-37, jr. chemist, lab., Imperial Oil Co., Ltd. Calgary, Alta.; 1937-40, acidizing engr., oil wells, Turner Valley, Dowell Inc. Calgary; 1940 to date, prod. engr., Home Oil Co., Ltd., Calgary, Alta.

References: J F Langston, A. B. Geddes, S. G. Coultis, H. E. Denton, J. N. Ford, J. J. Hanna, W D. Suitor.

WELCH—DONALD HERBERT, 280 Savoy St., Sarnia, Ont. Born at Peterboro, Ont., March 20th, 1917. Educ.: B.A.Sc., (Chem. Engrg.), Toronto, 1940; R.P.E., Ontario; 1940-41, mech. engrg., machine shop & pipefitters shop, boiler house & steam plant, Colgate Palmolive Peet, Toronto; 1941-42, asst. plant supvr., starting up following units: neutralizing plant, dicyandinide plant, etc.; 1942-43, Imperial Oil Limited, training for rubber plant; 1943 to date, asst. supvr. on butadene plant, St. Clair Processing Corp., Ltd.

References: E. K. Lewis, E. W. Dill.

YUILL—EDWARD STANFIELD, of Montreal, Que. Born at Montreal, Feb. 14th, 1920. Educ.: B.A.Sc., Toronto, 1944; 1939-41, (summers), radio aviation section operation, C.B.C., Sackville, N.B.; 1941-42, full time physics instructor, Mt. Allison Univ.; 1944-46, Radar Officer with R.N.; and at present, engr. in lab., wire & cable division, Northern Electric Co., Ltd., Montreal, Que.

References: H. W. McKeil, H. Miller, N. L. Dann, W. G. Tyler, R. A. Kerr.

FOR TRANSFER FROM JUNIOR

ANGEL—JOHN BARTLETT, of St. John's, N'fld. Born at St. John's, N'fld., June 12th, 1913. Educ.: B.Eng. (Met.), McGill, 1935; with United Nail & Foundry Co., Ltd., St. John's, N'fld., as follows: 1936-37, metallurgist, 1937-38, genl. supt., and 1938 to date, managing-director. (Jr. 1939).

References: E. A. Ryan, A. J. C. Raine, H. M. Jaquays, J. W. Morris, C. B. Archibald.

BRIDGEWATER—ALBERT WILLIAM, of Montreal, Que. Born at Saskatoon, Sask., Oct. 7th, 1914. Educ.: B.Sc., M.Sc., (Civil Engrg.), Sask., 1935, 1936, respectively; 1937, dftsman., Dominion Bridge Co., Ltd., Winnipeg; 1937-39, structl. designer, structl steel & reinforced concrete M. M Dillon, consultg. structl. engr., London, Ont.; 1939-40, res. engr., constrn. Alkali plant, Canadian Industries Limited Shawinigan Falls, Que.; 1940-41, structl. designer, Defence Industries Ltd., Montreal; 1941-45, Capt., R.C.E., Overseas; 1945 to date, structl. designer & dftsman., office chief engr., Canadian Pacific Railway Co., Montreal, Que. (Jr. 1941).

References: R B. Jones, L.H. Laffoley, G. E. Shaw, J. G. Sutherland, A. L.Martin, W. R Mitchell, J. E. Armstrong.

DUTTON—WILLIAM LAWRASON, of Chatham, Ont. Born at Ingersoll, Ont., Aug. 5th, 1907. Educ.: B.A.Sc., (Civil), Toronto, 1931; 1931-40, Union Gas Co., Ltd., Chatham, Ont., survey, mapping, pipe-line, gas measurements by orifice meter, pressure regulations, regulation and compressor stn. design and constrn., underground storage, etc.; 1940-46, R.M.C., Overseas, with rank of Lt.-Colonel, O.B.E., E.D.; and at present, asst. to chief engr., Union Gas Co. of Canada, Ltd., Chatham, Ont. (Jr. 1935.)

References: J. A. Baird, G. A. McCubbin, T. M. S. Kingston, R. L. Dobbin, R. G. C. Armstrong.

LINGLEY—HAROLD PERCY, of Saint John, N.B. Born at Saint John, N.B., Nov. 8th, 1906. Educ.: B.Sc., (Civil), New Brunswick, 1930; 1930-31, dftsman., C.N.R.; with West Saint John Harbour Reconstrn. Project, D.P.W., as follows: 1931-32, dftsman., 1932-34, engr. inspectr., rock drills & dredges, 1934-36, temporary jr. engr., 1936-37, instru'man. on highway grading & paving project, 1937, (5 mos.), temporary asst. engr., 1937-43, jr. engr., and at present permanent asst. engr., Saint John, N.B. (Jr. 1936).

References: G. M. Brown, C. D. McAllister, J. M. Lamb, A. R. Crookshank, F. A. Patriquen.

ROUE—JOHN EDWARD. 244 Spring Garden Road, Halifax, N.S. Born at Halifax, N.S., Aug. 25th, 1916. Educ. B.Eng., (Elect.), N.S. Tech., 1939; with Imperial Oil Limited, Halifax, as follows: 1939-40, engrg. dept., i/c dfting. office, 1940, (6 mos) process control dept.,mtce of indicating recording & control instruments, etc. 1940 to date, R.C.N.V.R., with rank of A/Lieut. Cdr. (L), Chief Radio Engineer Officer, i/c Radio Engr. Dept. H.M.C., Dockyard, Halfax, N.S. (Jr. 1944).

References: W. H. G. Roger, F. H. Sexton, J. R. Kaye, C. Scrymgeour, S. Ball, P. A. Lovett.

SOMMERVILLE—DONALD BARTON, of St. Catharines, Ont. Born at Toronto, Ont., Jan. 7th, 1914. Educ.: B.A.Sc., Toronto, 1935; R.P.E., Ontario; 1936-37, design engr., Canadian Comstock Co., Ltd.; 1937-38, field engr., International Petroleum Co., Peru, S.A.; 1938-43, Canadian Comstock Co., Ltd., mining dept., design engr., mgr., mining dept.; 1943-45, Comstock Shipbuilding Co., Saint John, N.B., asst. to genl. mgr. and genl. mgr.; 1945-46, dist. mgr., also director Canadian Comstock Co., Ltd., Toronto; 1946 to date, vice-pres. & genl. mgr., St. Catharines Steel Products Ltd., and director of Canadian Comstock Co., Ltd. (Jr. 1937).

References: C. R. Young, A. Wilson, M. M. Dillon, G. E. Humphries, C. F.Morrison.

TIMMS—REGINALD HAROLD, of Fonthill, Ont. Born at Welland, Ont., July 11th, 1916. Educ.: B.A.Sc., (Civil), Toronto, 1942; R.P.E., Ontario; 1941-45, R.C.N.V.R., with rank of Lieut.; 1945 to date, vice-pres. & asst. mgr., i/c all field engrg. & constrn., R. Timms Construction, Welland, Ont. (Jr. 1944).

References: R. F. Legget, W. D. Brownlee, H. Weaver, J. C. Street, E. M. Proctor.

FOR TRANSFER FROM STUDENT

ANDERSON—JAMES DOUGLAS, of Lunenburg, N.S. Born at Halifax, N.S., August 15th, 1920. Educ.: B.Eng., (Mech.), McGill, 1943; 1940-41, (summers). Shawinigan Engrg. Corp. Ltd., constrn transmission line; Canadian Car & Foundry, genl. foundry practice; Combustion Engrg. Corp. Ltd., genl. service & erection of steam generating equipt.; 1942 to date, R.C.N. (R), with rank of Lieut. (E), awaiting discharge. (St. 1941).

References: J. J. O'Neill, A. R. Roberts, R. DeL. French, T. Fife, H. M. Esdaile, H. G. Moseley.

CAMPION—WILLIAM KINGSLEY, 102 Queen St., St. Catharines, Ont. Born at St. Catharines, Ont., Feb. 4th, 1922. Educ.: B.Sc., (Mech. Engrg.), Queen's 1944; R.P.E., Ontario; 1941-43, (summers), dftsman., English Electric Co. (Can.) Ltd.; machinist, St. Catharines Steel Products Ltd.; machinist, Thompson Products (Can.) Ltd.; 1944 to date, Lieut. I/C No. 1 (H.Q.) Coy., R.C.E.M.E., L.A.D., M.D.I., London, Ont. (St. 1944).

References: M. H. Jones, C. G. Moon, G. F. Vollmer, E. Grummitt, A. L. McPhail,

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THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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 ENGINEERS for junior engineering positions in production control department are required by a corporation in Southern Ontario. Candidates may be 1946 graduates. Preference to ex-service men. Apply to File No. 3344-V.

CHEMICAL ENGINEER or chemist, for junior position in patent department of a large chemical company in Quebec. Apply to File No. 3469-V.

CHEMICAL ENGINEER with some pulp and paper experience required for the technical department of a paper mill in Lake St. John area. Apply to File No. 3470-V.

CIVIL

JUNIOR ENGINEER, young graduate in civil with some experience in structural and municipal work, also overseas experience in the armed forces, age 35 or under, is required by a city in Ontario. Apply to File No. 3203-V.

CIVIL ENGINEER, young graduate preferred, with some experience on building layouts and piping work is required as draughtsman for an oil company in the Montreal area. Apply to File No. 3345-V.

CIVIL ENGINEERS with construction experience for field work on contracts with a firm of Montreal contractors. Salary open. Apply to File No. 3437-V.

CIVIL ENGINEER, as township engineer, responsible for construction and maintenance of roads, municipal drainage etc. Must be qualified O.L.S. Required for Central Ontario. Salary $250 per month. Local private practice allowed. Apply to File No. 3441-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in the Montreal area. Apply to File No. 3446-V.

CIVIL ENGINEER with experience on foundations, steel work and erection of plant. Preferably R.P.E. in B C. Required for construction work on B.C. coast. Salary according to qualifications. Apply to File No. 3448-V.

CIVIL ENGINEERS with construction experience, age 25 up, preference R.C.E. personnel, required by building contractors in Montreal, to take charge of jobs as superintendent or office engineer. Salary from $300 according to qualifications. Apply to File No. 3458-V.

ELECTRICAL

ELECTRICAL GRADUATE, with considerable experience in electronics and aircraft instruments and some sales ability, age 30 to 40, required for firm handling aircraft equipment in Montreal area. Salary open. Apply to File No. 3434-V.

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

MECHANICAL

YOUNG MECHANICAL ENGINEERS, recent graduates, preferably ex-service men, as assistants to plant engineer on mechanical supervision and maintenance of a cement plant in S.A. Knowledge of French useful. Apply to File No. 3218-W.

MECHANICAL ENGINEER, fluently bilingual, is required for the province of Quebec to represent a company engaged in the manufacture of bakers' machinery and candy making machinery, etc. Apply to File No. 3268-V.

SALES ENGINEER, high calibre, graduate mechanical with metallurgical knowledge, for large industrial organization in Quebec, preferably bilingual, salary according to experience. Apply to File No. 3433-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, recent graduate, preferably bilingual, required for mechanical department in a paper mill in St. Maurice Valley, to be trained in a supervisory capacity. Apply to File No. 3452-V.

MECHANICAL ENGINEER with over ten years experience required for responsible position with an American mining corporation. Salary from $400 according to qualifications. Apply to File No. 3453-V.

ASSISTANT MECHANICAL SUPERINTENDENT to train for a senior position in a large paper mill in the St. Maurice Valley area. Must have paper or mining experience. Veteran preferred. Salary from $300 according to experience. Apply to File No. 3462-V.

MECHANICAL ENGINEER, age 35 to 45, preferably married, with good background of shop training and experience in the manufacture of farm machinery. Salary from $350 according to qualifications. Apply to File No. 3463-V.

MECHANICAL ENGINEERS with varying experience in tool engineering and machine shop practices. Positions involve supervision of tool designers and draughtsmen for design and ordering of jigs, fixtures, gauges, tools etc., for the production of precision equipment. Montreal area. Salary from $200 to $400 Apply to File No. 3464-V.

MECHANICAL ENGINEERS, recent graduates, for training as industrial engineers, required by a paper manufacturer in Eastern Ontario. Apply to File No. 3465-V.

MECHANICAL ENGINEER with experience in machine and tool design for design work on packaging machinery, required by a manufacturing concern in Western Ontario. Salary from $275. Apply to File No. 3466-V.

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 considerable experience in plumbing, heating ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

METALLURGICAL

METALLURGICAL ENGINEER with some practical experience and desirous of entering the steel business is required to work for a large corporation in Eastern Canada. Apply to File No. 3314-V.

MISCELLANEOUS

ARCHITECTURAL DRAUGHTSMAN with enough experience to develop new types of windows, doors, trusses, steel sections etc., is required by a manufacturer in Montreal. Salary would be about $300. Apply to File No. 3212-V.

ENGINEER SALESMAN, preferably returned man under 40 with some road-building experience, is wanted by a firm engaged in the manufacture of emulsions. Apply to File No. 3250-V.

ARCHITECT is wanted to undertake responsibility along general lines, such as class of work which comes under jurisdiction of a provincial Dept. of Public Works. Desirable age not exceeding forty. Apply to File No. 3301-V.

INSTRUMENTS ENGINEER with five years experience in aircraft construction and installation design, of which at least 2 years should have been specialized as above, is required to act as design group leader for a company in the Montreal area. Apply to File No. 3316-V.

CIVIL AND ELECTRICAL ENGINEERS, age 30 to 40, 5 to 10 years experience, for estimating, design and general engineering for large public utility in Toronto area. Apply to File No. 3429-V.

CHIEF DRAUGHTSMAN to take charge of engineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

CHIEF DRAUGHTSMAN, over 25 years of age, with intimate knowledge of construction mechanical details, piping, to take charge of about 15 draughtsmen in an industrial plant. Salary dependent on qualifications. Apply to File No. 3435-V.

QUALIFIED DRAUGHTSMAN, thoroughly capable in design and layout of industrial piping, steam, water, air etc. Salary open. Apply to File No. 3435-V.

TWO CIVIL OR MECHANICAL ENGINEERS, recent graduates, preferably ex-service men, are required by a pulp and paper company in the Province of Quebec, to be trained as logging engineers and woods operations supervisors. Previous experience in the woods an asset but not essential. Salary $200 to $225 with board and lodgings. Apply to File No. 3442-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. 3443-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 AND ELECTRICAL SUPERINTENDENT with experience in maintenance of mine equipment and in design and construction. Replies should outline experience and salary desired. Apply to File No. 3453-V.

GENERAL PLANT SUPERINTENDENT, or manager in complete charge, to organize and operate a shipbuilding plant in the Maritimes, with knowledge of both hulls and engines, mainly for repairs and revisions. Salary from $5,000. Apply to File No. 3454-V.

GRADUATE ENGINEERS IN CIVIL, MECHANICAL, ELECTRICAL OR CHEMICAL, from recent graduates up with 2 to 5 years general experience (including overseas service) required for petroleum refinery engineering. Salary according to qualifications. Apply to File No. 3455-V.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

SALES ENGINEER of ability, preferably graduate mechanical, with some experience in marine engineering and sales, to develop sales and applications for a heavy outboard propelling unit for use on heavy inland water transport. Salary from $300 depending on qualifications. Apply to File No. 3457-V.

FORESTRY ENGINEER graduate 25 to 35, preferably bilingual Veteran, is required by a newsprint manufacturer in the St. Maurice Valley. Apply to File No. 3462-V.

SALES ENGINEER, preferably mechanical graduate, required by a firm dealing in heavy machinery for sales activities in Eastern Canada with headquarters in Montreal. Salary from $250 according to qualifications. Apply to File No. 3467-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

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

CIVIL

CIVIL OR MECHANICAL ENGINEER, not necessarily a graduate, age 24-30, some experience in concrete and steel draughting, some sales ability, required to work with a consulting engineer and contractor in Montreal. Salary open. Apply to Box No. 3339-V.

SEVERAL CIVIL ENGINEERS, two with two or three years' experience in road construction and two recent graduates, are required for road building work in northern Quebec. Salary $2400. to $3000 a year. Apply to Box. No. 3351-V.

GRADUATE CIVIL ENGINEER, three or four years out of college, is required for surveying in bush in the Ottawa district, able to take charge of survey and do some plotting, make studies, etc. at office. Salary about $250. a month. Preference to veterans. Apply to Box. No. 3357-V.

CIVIL ENGINEER graduate with a good background of experience is required to act as superintendent or project manager for a large company in the Montreal area. Experience in heavy building construction essential. Age 40-50. Salary open. Apply to Box No. 3358-V.

TWO CIVIL ENGINEERS, preferably but not necessarily graduates, are required to act as structural steel draughtsmen or checkers for a company engaged in this sort of work in Alberta. All applications should indicate education, experience and salary expected. Apply to Box No. 3365-V.

CIVIL OR MECHANICAL ENGINEER with four or five years experience in a pulp and paper company is required by a company engaged in this work in eastern Ontario. Apply to Box No. 3367-V.

CIVIL OR MECHANICAL ENGINEER is required for design works by a paper company in the St. Maurice Valley. Some mining experience helpful. Salary $275. a month. Apply to Box No. 3381-V.

CIVIL ENGINEER, graduate age 30 to 40 years, is required for supervision of construction on 2½ million dollar project near Montreal. Salary $300 plus expenses. Apply to Box No. 3383-V.

CIVIL ENGINEER is required to act as assistant to city engineer, some knowledge of town services such as, water works, sewage, building inspection, parks, lighting an asset. Location Montreal. Salary open. Apply to Box No. 3385-V.

CIVIL ENGINEER with five to ten years experience in reinforced concrete design is required by a firm of consulting engineers in Montreal. Salary open. Apply to Box No. 3387-V.

TWO CIVIL ENGINEERS are required to act as senior and junior structural designer respectively with a steel company in southern Ontario. Salary open. Apply to Box No. 3389-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to Box No. 3394-V.

RESIDENT ENGINEER graduate, preferably but not necessarily bilingual with several years' experience in building construction is required for a housing project in Montreal. Several civil engineers from recent graduates up are also required. Salary open. Apply to Box No. 3402-V.

CIVIL ENGINEER recent graduate is required by a pulp and paper company in the province of Quebec to understudy logging engineer on road-building, dam construction, etc. Candidates should be bilingual. Salary $200 a month. Apply to Box No. 3405-V.

SEVERAL CIVIL ENGINEERS with experience in the design of structural steel and reinforced concrete, or who are interested in testing and research work in connection with concrete and soils are required in the engineering department of a large organization in Toronto. Salary open. Apply to Box No. 3409-V.

CIVIL ENGINEER graduate with several years experience in construction work, preferably bilingual is required by a construction company in Montreal to take charge of a project as resident engineer in Quebec. Salary open. Apply to Box No. 3421-V.

CIVIL OR MECHANICAL ENGINEER graduate, with experience in construction and truck equipment, age 35 to 40, is required by an oil company to take charge of operations in Montreal area. Apply to Box No. 3427-V.

ELECTRICAL

ELECTRICAL ENGINEER with some experience with machinery and/or electrical installation work, with ability to get along with people, and interested in investing some capital, is required for executive work with a small company on the west coast for work in connection with the electrical machinery requirements and installation of lighting and power plants in the province. Salary open. Apply to Box No. 3352-V.

TWO ELECTRICAL ENGINEERS with a minimum of four years' experience with commercial radio equipment are required by a firm in Montreal. Applicants must have good personality and ability to meet public. Please do not apply unless qualified. Salary open. Apply to Box No. 3395-V.

ELECTRICAL ENGINEER with experience in marine electrification is required by a consulting firm in the Montreal area. Salary open. Apply in writing to Box No. 3398-V.

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 Box No. 3415-V.

ELECTRICAL ENGINEER 5 to 10 years experience on general electrical design wiring of buildings, industrial plants and sub-stations, preferably a graduate, is wanted by a firm of consulting engineers in Montreal. Salary $250-$400 a month. Apply to Box No. 3420-V.

ELECTRICAL ENGINEERS from recent graduates up, if possible with experience in maintenance and repair of A.C. and D.C. motors, or in power plant work, are required by a mining corporation in South America. Salary $275 up. Apply to Box No. 3425-V.

MECHANICAL

MECHANICAL ENGINEER, recent graduate, preferably ex-service man is required by a company in the Toronto area for work in salt processing, steam heating evaporators, power plant etc. Age 25-27. Salary $200. to $300. a month depending on qualifications. Apply to Box No. 3308-V.

MECHANICAL ENGINEER, age about 35-40 with experience in thermo-dynamics, mechanical and chemical work is required to be chief engineer of a company in the Toronto area. Preference to ex-service man. Salary about $400-$600. a month. Apply to Box No. 3308-V.

MECHANICAL ENGINEER, with 4 or 5 years industrial experience since graduation, with knowledge of and interest in steam as applied to industrial equipment, and preferably some experience in ventilation work and in pulp and paper mills, is required by a company in southern Ontario. Salary $3600. per year. Apply to Box No. 3333-V.

MECHANICAL ENGINEER, preferably graduate, with some experience in general lines of contractors' equipment including tractors, shovels, diesel engines, concrete machinery, etc., is required to act as manager of machinery department head office of a large machinery house in the maritimes. Salary excellent. Apply to Box. No. 3353-V

MECHANICAL ENGINEER, graduate, with some experience in the sale of marine engines, is required to head up the marine department of a large machinery house in the maritimes. Remuneration would depend entirely on the ability and efforts of successful candidate. Apply to Box No. 3355-V.

EIGHT MECHANICAL ENGINEERS or senior draughtsmen are required for design on a large plant extension project near Montreal. Salary $200. a month and good room and board available. Apply to Box No. 3360-V.

MECHANICAL ENGINEER, senior man is required for responsible position in a pulp and paper mill in the province of Quebec. Salary open according to qualifications. Apply to Box No. 3361-V.

MECHANICAL OR ELECTRICAL ENGINEER, preferably but not necessarily with some experience on design of tools and small parts is required by a company in the Montreal area. Salary: open. Apply to Box No. 3374-V.

TWO OR THREE MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

MECHANICAL ENGINEER is required to act as assistant mechanical superintendent of a paper mill in the St. Maurice Valley. Salary $350 a month. Apply to Box No. 3381-V.

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

THREE MECHANICAL ENGINEERS with one or two years experience in draughting and design are required for a paper company on the east coast. Work will involve draughting, design of new equipment and alterations to existing plant and equipment. Salary open. Apply to Box No. 3397-V.

MECHANICAL DRAUGHTSMAN is required by a paper company in Ontario. Must have industrial plant experience including conveyors, piping and machinery layouts. Salary $200-$225 a month. Apply to Box No. 3399-V.

MECHANICAL ENGINEER with paper mill experience is required to act as assistant mechanical superintendent of a large paper mill located in a city in western Quebec. Salary open. Apply to Box No. 3400-V.

JUNIOR MECHANICAL ENGINEER AND SENIOR MECHANICAL DRAUGHTSMAN, not necessarily graduates, but must have some experience of mechanical design problems. Preference will be given to ex-servicemen. Salary $1,800 to $2,700 depending on experience. Possibility of permanent employment located in Quebec City. Apply to Box No. 3401-V.

MECHANICAL ENGINEER, recent graduate, is required by a pulp and paper company in the province of Quebec, to learn woods operations with a view to mechanization. Candidates should be bilingual. Salary $200 a month. Apply to Box No. 3405-V.

CHIEF ENGINEER, age 35 to 40, preferably graduate mechanical, with experience in shop and production planning, running drafting office, etc., and ability to get along with people, is required by a factory in Sherbrooke ,Quebec. Salary $5,000 to $6,000 a year. Apply to Box No. 3410-V.

MECHANICAL ENGINEER with considerable practical experience is required for general plant maintenance of production equipment for large out of town metal processing plant. Salary open. Apply in writing to Box No. 3417-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-V.

METALLURGICAL

RECENT GRADUATES in metallurgical or chemical engineering are wanted for quantitative non-ferrous chemical analysis by a mining corporation in South America. Salary open. Apply to Box No. 3425-V.

MINING ENGINEERS

MINING ENGINEER, with good experience, is required by a company in Brazil, South America, engaged in the mining and smelting of lead. Successful candidate would have complete authority to operate mine: and in addition to salary would have house accommodation provided. Salary open. Apply to Box No. 3321-V.

MINING ENGINEERS, necessarily with some experience in mining work, capable of becoming shift bosses, are wanted for work with a corporation in South America engaged in the production of coal and copper. Salary $275 to $400 a month. Apply to Box No. 3425-V.

MINING ENGINEER graduate experienced and capable of doing underground survey work, estimating tonnage extraction, etc., is wanted by a company in South America. Salary open. Apply to Box No. 3425-V.

MISCELLANEOUS

SERVICE REPRESENTATIVE is required by a firm in Toronto to sell automotive, electrical and fuel system parts, and to train automotive mechanics. Position would be in Ontario and salary is open according to qualifications. Apply to Box No. 3295-V.

ARCHITECT, graduate, preferably, but with some reasonable experience, with good background and personality is required by a firm in Montreal. Interested in someone willing to start at the bottom with prospects of eventually becoming a partner in the firm. Apply to Box No. 3298-V.

DRAUGHTSMAN, preferably someone experienced in process piping work in food industries is required by a firm in the Montreal area engaged in consulting work. Apply to Box No. 3299-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of high grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose photograph to Box No. 3303-V.

DESIGNING ENGINEER with four or five years experience in designing and detailing is required for work with consulting engineer in Vancouver. Salary is open according to qualifications. Apply to Box No. 3325-V.

TWO DRAUGHTSMEN with a minimum of three years draughting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V

GRADUATE ENGINEER, age 25-35, preferably married wth five to 10 years experience in the design of complicated machines to be trained in the designing of shoe machinery. Starting wage will range from $60. to $75. a week for five-day week. Apply to Box No. 3330-V.

TWO ARCHITECTURAL DESIGNERS AND DRAUGHTSMEN, or architects with some experience in modern materials and design are required by a young progressive firm of architectural designers and engineers in Alberta. Salary will be commensurate with ability. Apply to Box No. 3331-V.

MECHANICAL, ELECTRICAL OR CIVIL ENGINEER, recent graduate who must have fluent knowledge of Spanish, preferably under 30, is required by a firm in the Montreal area for technical work in connection with production. Some travelling. Salary open according to qualifications. Apply to Box No. 3373-V.

DRAUGHTSMAN familiar with reinforced concrete and structural steel is required by a consulting firm in Montreal. Salary open. Apply to Box No. 3387-V.

DESIGN ENGINEER not necessarily a graduate but with mechanical or structural experience in the paper industry is required by a firm in the St. Maurice Valley of Quebec. Salary $250 to $300 a month. Apply to Box No 3388-V.

CHIEF INSTRUCTOR completely bilingual, veteran, not necessarily an engineer, is required by a pulp and paper company in the province of Quebec to instruct in labour relations, etc., and to understudy personnel manager. Salary $150 a month. Apply to Box No. 3405-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Salary open. Apply to Box No. 3406-V.

GRADUATE ENGINEER with experience in structural design and detailing is required for work in bridge department of large transport company. Apply to Box No. 3407-V giving all particulars including salary expected.

ENGINEERING SALESMAN with pleasing personality, bilingual, 25 to 35 years old, not necessarily a graduate, but with some engineering background and if possible some knowledge of lubrication is required by a large company in Montreal. Salary open. Apply to Box No. 3422-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

MAINTENANCE ENGINEER

Pulp and Paper Mill

•

Graduate Engineer, preferably mechanical, experienced in pulp and paper mill maintenance. Salary commensurate with ability and experience. Apply to personnel manager, The E. B. Eddy Company, Hull, Que.

PLANT ENGINEER

Modern boiler plant, hydro electric plant, refrigeration plants, electric, water, gas, sewer services, building construction, maintenance, repair, fire protection, numerous buildings. Eastern Ontario. Experienced graduate engineer. Salary $4,000-5,000. Reply listing qualifications.

SHOP SUPERINTENDENT

Supervise several shops engaged on jobbing work on precision instruments, machines and equipment. Graduate engineer experienced in tools, machine, pattern, sheet metal, cabinet shops, design, production. Eastern Ontario. Salary $3,600-4,200. Reply listing qualifications.

APPLY TO FILE No. 3468-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, 1946. 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.

Situations Wanted

SENIOR REINFORCED CONCRETE DESIGNER and civil engineer, R.P.E. (Ont.). experienced field and office, various countries, seeks first class opening. Apply to Box No. 107-W.

CIVIL ENGINEER, M.E.I.C., P.E.Q., age 39, married, B.Sc., U.N.B., widespread experience in construction with experience in plant maintenance both in civilian and Air Force capacities. Interested in responsible position involving plant maintenance. Apply to Box No. 225-W.

CIVIL ENGINEER, age 40, McGill '29, B.Sc., married, experienced surveyor and field engineer, two years on inspection of airfield construction, location immaterial, available on short notice. Apply to File No. 741-W.

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 Box No. 1527-W.

PLANT ENGINEER, graduate, M.E.I.C., age 42, qualified to take responsible charge of layout of plant and equipment, structural and mechanical design and organization of plant maintenance. Wide experience with chemical processes. Have successfully handled skilled and unskilled labour on construction, maintenance and plant operation. Prefer location in Ontario. Minimum salary $5000. per year. Apply to File No. 1621-W.

GRADUATE ENGINEER, B.Sc. (Mech) M.E.I.C., age 45, married. Three years experience in time and job study, factory methods and cost accounting. Fifteen years experience in construction and building maintenance; considerable experience in shop layouts and maintenance. Five years sales promotion and technical field work in plastics. Capable of handling personnel and planning. Seeks an executive position in industrial business or will assume complete administration of medium sized business in any part of Canada. Available on short notice. Apply to File No. 1642-W.

ELECTRICAL ENGINEER, M.E.I.C., R.P.E. (Ont). interested in mechanical design and production; experienced in hydro-electric station design, transformer and machine layouts and in development and design of radar equipment. Services available immediately. Location preferred: Toronto or Hamilton. Apply to Box No. 1693-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 37, 12 years experience in pulp and paper industry, both technical and production, also three years research in paper containers during war. Bilingual; would like to return to paper industry. Available at a month's notice. Apply to Box No. 1768-W.

CIVIL ENGINEER, age 32, married, B.Sc. in Civil Engineering U.N.B. 1938, M.Sc. U.N.B. 1944. Two years service with R.C.E. Six years experience in Canada and in tropics on construction of roads, airfields, wharves, drainage works, etc. Speaks English, some French and Spanish. Presently employed but wishes to change for a position more directly in charge of construction. Available on thirty days notice. Apply to File No. 1860-W.

GRADUATE ENGINEER, B.Sc. (Civil) M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to Box No. 2440-W.

CHEMICAL ENGINEER, young university graduate, previously engaged in war industry, desires permanent position. Available immediately. Apply to Box No. 2464-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 23, single degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy, Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

MECHANICAL ENGINEER, Jr.E.I.C., single, age 27, graduate Royal Naval Engineering College (Practical Engineering Prize) wishes work of practical nature, mainly outdoor. Interested in operation or construction of steam, hydro or internal combustion machinery. Eight years in R.C.N., including operational, overseeing and instructing. Medical discharge. Seven months on shipyard staff. Prefer to remain near Pacific Coast but would consider temperate climate like New Zealand, South Africa, southern England. Apply to Box No. 2589-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., with 18 years' experience in Canada and abroad in tool design, product design, shop and industrial engineering, labour relations. Successful organizer. Available due to closing of war plant. Apply to Box No. 2592-W.

ELECTRICAL GRADUATE '46, N.S.T.C., S.E.I.C., 23, single, available upon graduation anywhere in Canada. Interested in electronics, communications, industrial promotion and management. Experience in one of Canada's largest radio manufacturer's test department and electrical draughting. Apply to Box No. 2607-W.

GRADUATE MECHANICAL-ELECTRICAL ENGINEER, 53 years old, with broad background in U.S. and Canada would like position in small or medium-sized organization as assistant to manager in operations but with freedom to do research and development touching any phase of the business. Apply to Box No. 2608-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng. (Ont.), available with one month notice or less. Age 44, married, three children. Six months mining engineering experience, three years mechanical experience in large implement factory, supervision since 1940 for Inspection Board of U.K. and Canada of a large staff on inspection of electrical apparatus and equipment. Seeks position with considerable administrative responsibility based on electrical production or maintenance. Able to go anywhere on continent. Apply to Box No. 2614-W.

INDUSTRIAL ENGINEER, graduate in civil engineering, B.A.Sc., M.E.I.C., single, age 30, bilingual. Experience in industrial engineering work; plant layout, time and motion study, wage incentive, work simplification, job evaluation, material handling, cost and production control, cost reduction research available. prefer Montreal, highest references from former employers. Apply to Box No. 2616-W.

GRADUATE MECHANICAL ENGINEER, Prof. Eng. (Ont.) Jr.E.I.C., married, age 31. Experience covers machine shop apprentice, engineering design, chemical plant design, field engineer on construction work, plant operation and superintendent in large plants employing modern plant management methods. Past 8 years have been with present employer. Now wishes to make change to smaller company with opportunity of securing position of responsibility. Apply to Box No. 2629-W.

MECHANICAL ENGINEER, Jr. E.I.C., graduate Queen's 1937, age 33, married. Four years with a mechanical control company at design, customer contact, administration and shop liason work. One year with a beverage company at design, development and installation of special machinery and conveyor equipment. Four years with a steel plate fabricator on design, estimating and field work. Desire position as assistant to plant engineer in an established Ontario firm. Available now. Apply to File No. 2641-W.

MECHANICAL ENGINEER, M.E.I.C., with chemical engineering experience, interested in responsible position with expanding organisation. Experience covers design, development, maintenance and construction of plant equipment. Would consider association with consulting engineer or act as foreign representative. Apply to File No. 2642-W.

GRADUATE CHEMICAL ENGINEER, McGill 1946, available immediately. Plant or sales work, single, healthy and ambitious, will travel anywhere. Apply to File No. 2661-W.

GRADUATE MECHANICAL ENGINEER, (Sask. '45) age 24, married, Jr. member of The Society of Naval Architects and Marine Engineers. Experience with moulded plywood, one year general mechanical engineering in processing plant. Good knowledge of yacht design. Require position with a firm connected with the boating industry, plywood, engines, hardware, plastics, etc. Prefer Vancouver location, available August 1st. Apply to File No. 2662-W.

ENGINEER now employed seeks better position; thoroughly bilingual; had many years experience teaching chemistry, mineralogy and geology and demonstrating in connected laboratories. Acted as mining engineer in mineralogy laboratory, writing reports on samples examined and conducting prospectors' classes; also had municipal engineering experience. Age 49; seeks position as executive, town manager, construction superintendent, sales engineer. Veteran of both wars. Apply to File No. 2663-W.

STRUCTURAL ENGINEER competent to analyse stresses and to make or review designs in concrete, steel or timber; would undertake small assignments (not requiring full time services). Office in Montreal. Apply to File No. 2672-W.

THE ENGINEERING JOURNAL

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COVER PICTURE

The cover picture is the first in the series "Universities of Canada" which the *Journal* expects to print. The new buildings of the Université de Montréal which were completed in recent years rise on the northern slopes of Mount Royal. They house the faculties of law, medicine, arts, science, and the school of hygiene. The Ecole Polytechnique, which is the faculty of applied science of the Université de Montréal, houses in its own buildings on St. Denis Street.

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TECHNICAL ASPECTS OF THE FUTURE OF ALUMINUM

P. M. HAENNI

Director of Research, Aluminium Laboratories Limited, Kingston, Ont.

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Introduction

In the course of the last six years the annual production of aluminum ingot in Canada expanded from a pre-war level of 70,000 tons to no less than 500,000 tons. This phenomenal growth, though stimulated by the war, was the outcome of forty years of experience and planning, which culminated in the completion of Shipshaw power development in 1943. To-day, Canada is the world's second largest producer of the metal; and the Arvida smelter is the biggest in existence.

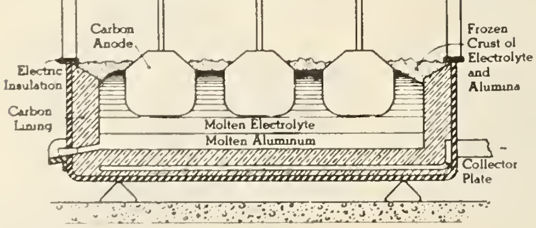
Before the war, only about 10,000 tons of ingot was consumed domestically, the majority of the output being used for heavy armament programmes abroad. Now, when the war is over; when the United States also is looking for outlets for its enormous production-facilities, and when other countries are becoming interested in setting up their own basic industries; it is reasonable to inquire whether any more than a small fraction of Canadian aluminum capacity can be utilized.

The aluminum industry has become a significant factor in Canadian economy, affecting both the employment of labour and the accumulation of foreign exchange. The question of its future is thus of more than ordinary interest.

Ingot Production

Aluminum, because of its great affinity for oxygen, is not found in a metallic state in nature; but combined with that and other elements, it is one of the most abundant and widely distributed ingredients of the earth's crust. It is found in innumerable forms, being present in precious stones such as ruby, sapphire, corundum, and topaz, as well as in mountainous masses of silicates and volcanic rocks, and in enormous alluvial deposits; it is found in natural waters, and occurs in numerous kinds of plant life. Practically all the aluminum produced commercially, however, is obtained from one single ore, an impure aluminum hydrate known as bauxite, the name of which is derived from the locale at Les Baux of a famous French deposit.

The extraction of metallic aluminum from bauxite involves two processes, the first being the chemical purification of the ore whereby anhydrous alumina (Al_2O_3) is obtained. The smelting operation proper consists in the electrolysis of alumina in molten cryolite, using carbon electrodes, the aluminum collecting on the cathodic bottom of the vessel: the electrolytic cell is shown diagrammatically in Fig. 1. The metal so obtained has a commercial purity ranging from 99.0 per cent upwards. To obtain still higher purities, the commercial product may be refined by further electrolysis, again using a solution of molten cryolite and fluorides: the molten purified aluminum is the cathode in this process, and a heavy aluminum-copper anode is employed. The purity of the aluminum so obtained compares with that of a typical commercial product in the manner shown in Table I.



HALL·HÉROULT

Electrolytic Cell

in which aluminum is produced

Fig. 1.

Table I

Typical Composition of Commercial Purity and Electrolytically Refined Aluminum

	Commercial %	Refined %
Al	99.6 +	99.99
Fe	.25	.003
Si	.15	.004
Ti	.010	.001
Cu	.005	.001
Mn	.002	.000
Na	.002	.000

+ By difference of Fe and Si

Although is has been found possible to produce alumina from clays and other common minerals, bauxite is likely to remain for a long time the most economical raw material for aluminum. And, although electrothermal methods such as carbo-thermal reduction are being investigated by various producers and are even being used commercially for the production of certain aluminum-silicon alloys, there is no immediate likelihood that the traditional smelting of alumina by electrolytic reduction will be abandoned: this is particularly true in Canada, where metal analysing up to 99.9 per cent purity can be produced directly. It is possible, however, that should the demand for metal of extreme purity reach sizeable proportions, new refining methods based on distillation of aluminum will attract the attention of the chemist. The precise influence of non-metallic impurities such as oxides, carbides, nitrates, phosphites, and sulfides, is not yet fully determined; and in the future considerable advantages may be found to accrue from their elimination.

Physical and Mechanical Properties

Of the several physical constants of aluminum that, in Table II, are compared with those of the other two structural metals, the following are the most significant:

The low density, which is responsible for the high strength-weight ratio of aluminum alloys and for their present and future importance in transportation and in moving parts from which dead load must be eliminated.

The low melting point, which permits of easy melting and founding.

The high thermal and electrical conductivities, by virtue of which aluminum is remarkably adapted for heat appliances and for electrical conductors.

The crystal structure, defined as face-centered cubic (the same type of structure possessed by copper and silver, and by iron at high temperatures): this structure accounts for ductility, formability, and for the conductivities mentioned above.

The low modulus of elasticity, which confers high resiliency but which renders necessary certain modifications in connection with the design of members subjected to flexural and compression stresses.

Table II

Physical Properties of Aluminum, Magnesium, and Iron

	Aluminum	Magnesium	Iron
Density (grams per cubic centimeter) at 20°C	2.70	1.74	7.87
Thermal Expansivity, 20° to 100°C	23.8×10^{-6}	25.8	11.9
Melting Point (°C)	660	651	1535
Boiling Point (°C)	1800	2130	2994
Thermal Conductivity (cal./cm.^{2}/cm./°C/sec.) 0 to 100°C	0.50	0.37	0.19
Latent Heat of Fusion (calories per gram)	93	88	65
Electrical Resistivity, Commercial Conductors, (microhms per cm.^{3}) at 20°C	2.83	4.46	9.8
Solidification Shrinkage (percentage)	6.6	4.3	
Electrode Potential (volts, at 25°C)	1.69	2.4	0.4
Crystal Structure	f.c.c.	c.p.h.	b.c.c.
Modulus of Elasticity (psi 10^6)	10	6.5	30

The non-metallic and non-sparking attributes, which render the metal suitable for certain special uses: and the high and sustained reflectivity of aluminum surfaces, rendering the metal of significant use in insulating media.

Aluminum and its alloy differ in many other physical and mechanical respects from steel (see Table III and Fig. 3), which until a few years ago stood as the only metal in the structural field. The ratio of shear strength to tensile strength, for instance, is different. Workability, hardness, impact-resistance, and fatigue-strength are important instances where aluminum does not compare favourably with certain steel, and of which particular account must be taken in structural design. That none of these is an insuperable obstacle to the use of the metal has, however, been very thoroughly established by its unexceptionable performance as the primary component of aircraft structures.

The designing engineer, by taking due account of these divergencies from the properties of familiar and long-used steel, will in his day-to-day work continue to make a most vital contribution to the future of aluminum in the many structural applications for which it is properly fitted.

Chemical Properties

Aluminum is chemically stable when placed in contact with any of a considerable range of commodities, particularly with organic compounds. It has, moreover, a high resistance to atmospheric corrosion, whether industrial, rural, or maritime. The pure metal, together with certain alloys, also withstands the attack of concentrated nitric acid and concentrated acetic acid: The high-purity metal is to a great extent resistant even to hydrochloric acid, as is shown in Fig. 2.

This chemical behaviour or aluminum is largely due to the presence of a continuous, compact, invisible oxide coating on its surface. This layer of oxide forms almost instantly upon exposure of the metal, and constitutes a barrier against further oxidation: it is difficult to remove. The film varies greatly in thickness, uniformity, hygroscopicity, and continuity, being influenced by factors among which may be cited temperature, metallurgical conditions, degree of polish and quantity of moisture present. It may be increased in thickness by chemical processes such as immersion in oxidizing solutions of dichromates or chlorates; or by the electro-chemical process of anodic oxidation in electrolytes such as sulphuric and chromic acids. The improvement in film thickness that is obtained by these processes presents a surface susceptible to the absorption of dyes: the metal may thus be commercially coloured by dyeing. In the future it may

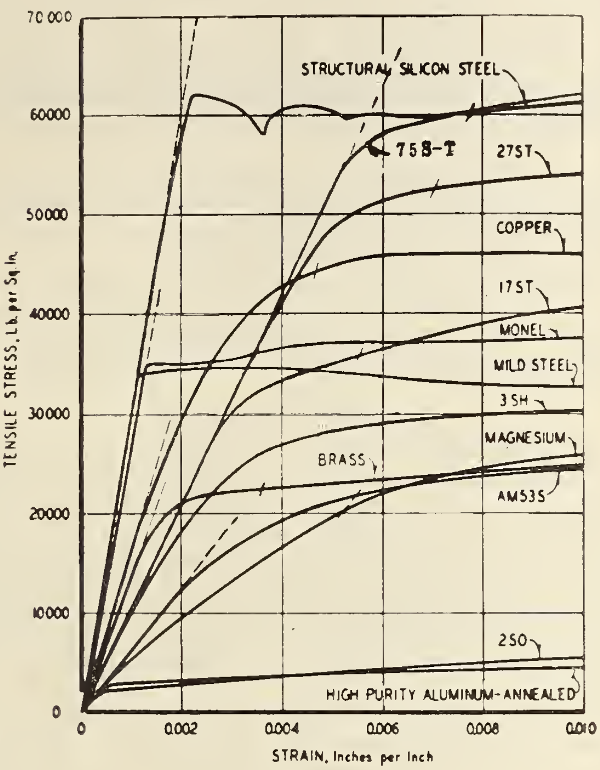


Fig. 3.

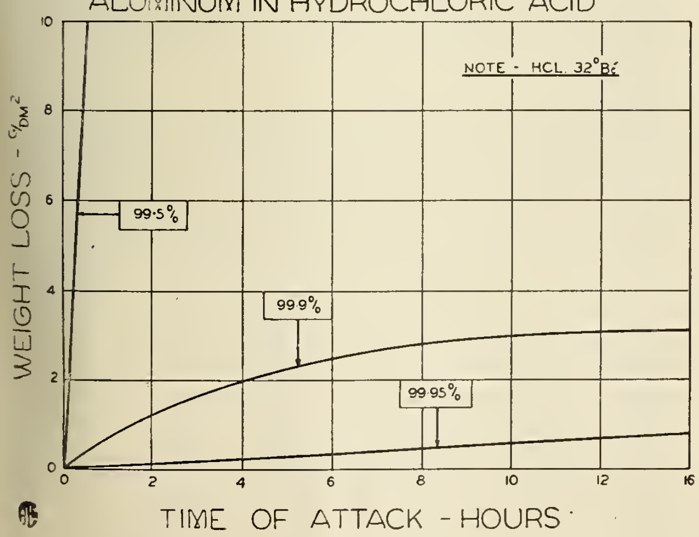


Fig. 2.

Table III

Typical Mechanical Properties—Structural Materials

Material	Specification	Tensile Strength psi.	Yield Strength psi.	Elongation on 2 in. %	E psi. x10^6
Wrought Alloys					
Mild Steel	ASTM A7-42	68,000	36,000	24	30
Nickel Steel	ASTM A8-39	95,000	60,000	21	30
AC. 17S Aluminum		62,000	40,000	22	10.5
AC. 26S Aluminum		70,000	62,000	11	10.5
XA. 75S Aluminum		82,000	70,000	12	10.5
ESD Aluminum		84,000	75,000	12	10.5
Cast Alloys					
Grey Iron	ASTM A48-41 (Class 30)	30,000	25,000	0.5	14
Cast Carbon Steel	ASTM A87-42 (Class A-2)	65,000	42,000	24	30
AC. 350 Aluminum		50,000	27,000	16	10.5
AC. 226-T26 Aluminum		41,000	33,000	6	10.5

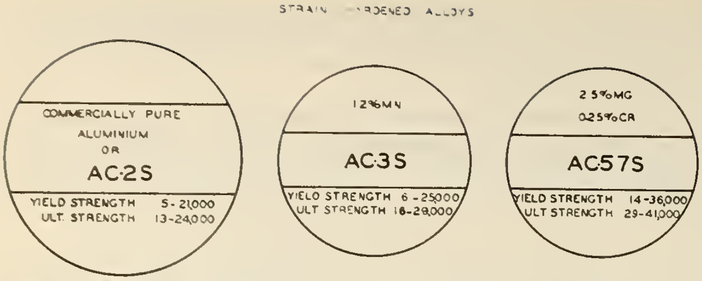


Fig. 4—Wrought alloys have the letter "S" as a suffix to differentiate them from casting alloys; the numbers indicating the various compositions, and the prefix letters "AC" that they are products of the Aluminum Company of Canada, Limited.

confidently be expected that there will be developed even more versatile oxide coatings, with improved appearance, greater hardness, better dye absorption and easier production chemically or by anodic means.

Aluminum is non-toxic, and is thus one of the few metals which can be used safely in contact with food. And, moreover, the fact that its compounds are colourless is of the greatest importance in chemical, architectural, and other applications.

Metallurgy

Pure aluminum is well known to be a soft material, with relatively low mechanical characteristics; but, upon alloying with small percentages of other metals in accordance with well established practice, tensile and other properties may be obtained which range well into the class of the better structural steels. Table III enumerates typical mechanical properties for certain wrought and cast alloys of steel and aluminum; and, in Fig. 3, are illustrated typical stress-strain curves for a variety of metals and alloys.

Aluminum alloys are divided into two general classes, namely, "non-heat-treatable" and "heat-treatable". Wrought alloys in the former category are termed "strain-hardened" or "common" alloys, and in the latter category, "strong alloys".

Strain-hardened alloys (Fig. 4), because of their excellent corrosion resistance and their formability, have a great variety of uses where high strength is not paramount. These alloys are available in a wide range of tempers, the harder tempers being produced by cold work.

The fact that aluminum alloys of certain chemical compositions, notably those containing copper and magnesium, are susceptible to heat-treatment whereby their mechanical properties are completely altered, has opened up applications in the structural field which otherwise would have been closed, and the simplicity of the essential treatment has greatly aided their adoption. The majority of heat-treatable aluminum alloys derive from the four main classes that are illustrated in Figs. 5, 6, 7, and 8.

AIRCRAFT ALLOY DEVELOPED FROM CLASSICAL DURALUMIN

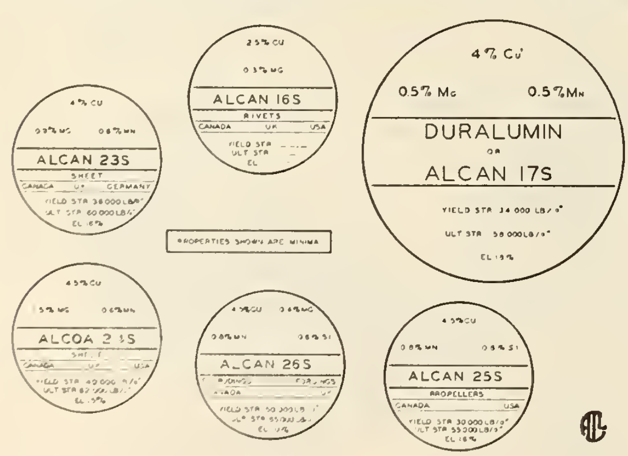


Fig. 5.

Has the last word been said in the production of new alloys?

The recent commercial development of wrought alloys giving tensile strength close to 100,000 lb. per sq. in. (in the extruded form), the recent appearance of self-hardening casting alloys, the potentialities offered by the production of alloys from high purity aluminum by the plating of still stronger alloy core with alloy coating, the production of alloys with controlled ingredients to produce a given effect such as a certain type of natural or anodic oxide film, a given type and degree of preferred orientation upon manufacturing, etc., all point to the fact that the future of aluminum will, to a considerable extent, be influenced by the development of new alloys and improved composite materials.

Fabrication

The versatility of aluminum and its alloys with regard to fabrication is indicated diagrammatically in Fig. 9. From that figure it will be noted that all the common methods of metal-founding, from simple sand-casting to

AIRCRAFT ALLOYS DEVELOPED FROM CLASSICAL ALCAN 160

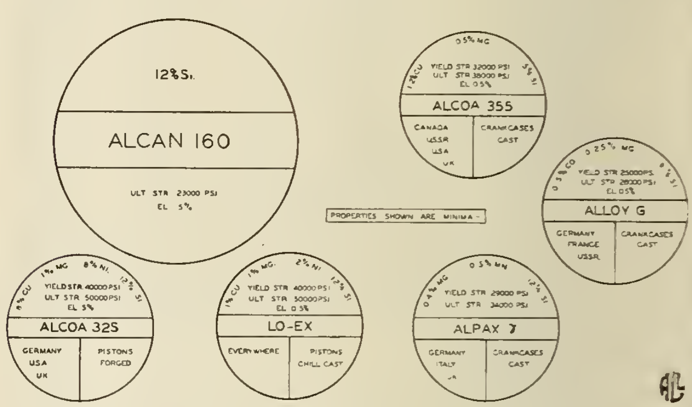


Fig. 6.

the more highly specialized centrifugal processes, are in ordinary commercial use.

With reference to the wrought alloys, it will be seen that these are currently being fabricated by hot and cold rolling, by drop forging, by pressing, and by upsetting. The latter techniques, involving the hot forming of solid metal, are exemplified in a notable manner by the extrusion process, whereby the metal is squeezed through an orifice in a manner similar to the pressing of toothpaste out of a collapsible tube. Aluminum alloys, which are among the most workable of metals, may also be readily spun on the lathe for cooking utensils or reflectors, drawn in the press into shells and containers, press or hammer formed into a great variety of shapes, and treated by stamping, coining, or embossing.

In addition to the finishes ordinarily used on metals, among which are listed mechanical finishes, electro-plated finishes, painting, and lacquering, it has already been pointed out that aluminum and its alloys may be treated by well-established methods in order to increase the thickness, and the chemical and mechanical resistance, of the natural oxide film; and that the processed film may furthermore be coloured by simple dyeing processes. There is no doubt that further improvements in surface-treatment, together with techniques involving dyeing, photography, plating, and highly reflective specular finishing, will play no small part in the future of aluminum.

The assembly of aluminum parts may be accomplished by all the usual methods of joining. Riveting, stapling, welding, brazing, and soldering are all now in commercial use to various extents; and there is considerable promise in bonding by means of newly-developed thermo-setting plastics and other adhesives. The several methods of

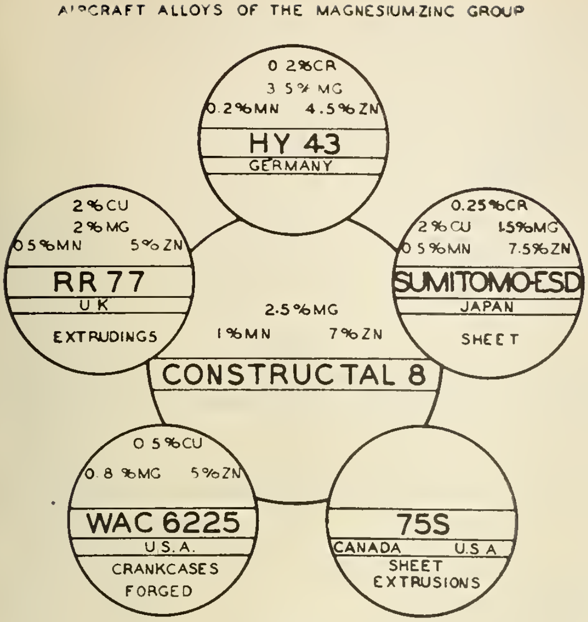


Fig. 7.

joining aluminum parts are becoming constantly more effective and more versatile as the processes are developed to greater degrees of perfection.

With regard to new manufacturing techniques, the main results to be looked for will be lower cost of fabrication, improved soundness and metallurgical structure, together with higher and more uniform mechanical properties. Improvements in the foundry will be essentially slow and evolutionary. In the manufacture of wrought alloys, the impossibility of producing large ingots of sound and homogeneous metal was, until recently, a cause of grave concern; but the development of the direct-chill or continuous casting process, in which the ingot is cooled directly by the impingement of water immediately upon solidification, has already opened a new field of rolled and forged products, of much larger size than was previously attainable. This process, in turn, will permit the production, by continuous rolling or extruding, of large-sized commodities, combined with the advantage of reduced cost of production.

In the field of powder metallurgy, the techniques for mass production of small aluminum alloy parts, with or without sintering, have been very thoroughly explored; and their commercial application is already to be noted in the increasing use of aluminum bearings.

Economics

The close of the nineteenth century was, generally speaking, a period of quantity production, while the present age will be recognized for its emphasis on quality; this applies to commodities in general and to metals in particular. Aluminum, which is substantially a twentieth-century product (its marked industrial development being a product of the first world war just as that of magnesium will be associated with the second world war), entered the metal market in the middle of this transition from quantity to quantity-plus-quality, and it has thus been forced to develop with respect to both of these parameters simultaneously.

Table IV

World Production of Metals as Compared with Aluminum
(On weight basis)

Years	Fe/Al	Cu/Al	Pb/Al	Zn/Al	Sn/Al
1900	4,200	20	33	25	4
1910	1,100	6	6	7	1
1920	500	2.3	1.6	2.1	0.36
1930	350	1.8	1.4	2	0.25
1940	135	2.2	1.5	1.4	0.14
1943	42	1	0.7	0.65	0.07

In the struggle for quantity, aluminum made notable progress during the war and its production on a volume basis became second only to that of steel; and on a weight basis almost to the same extent. This is shown in Table IV.

Achievements on the quality side are even more striking. Two examples may be cited. The new 75S-T alloy has a tensile strength of 76,000 lb. per sq. in., compared with the 13,000 lb. per sq. in., possessed by commercially-pure aluminum. Attention may also be drawn to the most effective combination of corrosion-resistance with high mechanical properties that has been obtained by the use of Alclad material, particularly in aircraft.

Developments such as those referred to have been due in a large measure to patient and systematic research. No fewer than fifteen research laboratories are at the present date devoted exclusively to the development and improvement of aluminum alloys and to methods for their fabrication; while in addition, more than two hundred laboratories are employing a large part of their facilities to the same ends.

Table V

Material and Power Required for the Production of

1 ton alumina		1 ton aluminum	
Bauxite	2.3 t.	Alumina	2.2 t.
Coal	0.2 t.		
Caustic Soda	0.15 t.	Electrode Carbon	0.8 t.
Lime	0.03 t.		
Water	6,000 gals.	Cryolite	0.08 t.
Steam	15,000 lbs.		
Power	180 KWH	Power	25,000 KWH

A question that has been asked in connection with increased production of aluminum is that of its effect upon the price of the metal. The answer to this is a matter of record: increased production has been accompanied by a lowering of the price. It may also be queried whether it will be possible to maintain the present high rate of production and whether lower prices can be achieved in the future. Table V lists the raw materials and power requirements for the production respectively of one ton of alumina and of one ton of aluminum; and Table VI shows the percentage partition of the cost of aluminum. From those figures it is obvious that production costs are primarily dependent on the costs of certain items, particularly bauxite and power. Labour and operating expenses also bear directly on the matter, and it seems clear that modern trends towards higher cost of labour will ultimately limit the extent to which increased production can be accompanied by a lower price.

Table VI

Cost Price of Aluminum in Percent

	%
Electrical Energy	20
Alumina	35
Electrodes	18
Cryolite	2
General Expenses & Operating	25

The future of a material can be predicted to some extent by the assessment of the degree of market-saturation that appears to have been reached in its case. Figures and curves of world production for aluminum, pig iron, petroleum, and copper, shows that actual saturation has not been reached for any of these products. Coal, iron, and copper are running almost parallel in production increase: petroleum shows a tendency to go on increasing quite rapidly, and, finally, aluminum shows a similar but even more marked tendency. In the latter connection it is of interest to note that, in countries such as Switzerland and Great Britain, production has not kept pace with that in other countries, especially in Canada, Germany, and the United States.

The most sensitive factor in the modification of curves of consumption and of saturation-levels is the price element, and the 25-per cent reduction in the price of aluminum during the last five years, combined with the development of notable improvements in mechanical properties and

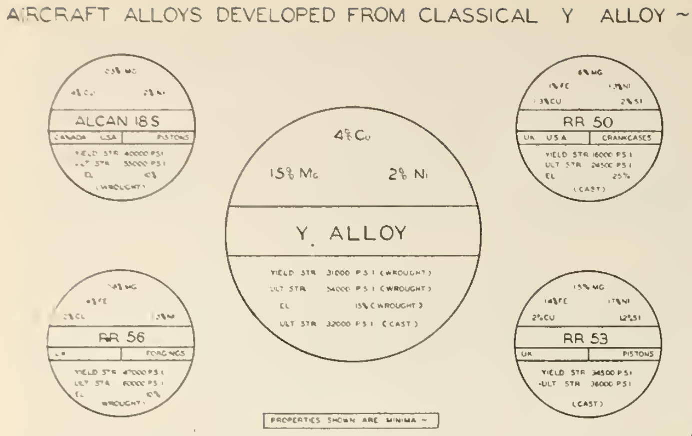


Fig. 8.

fabrication processes, will undoubtedly have a pronounced effect on the future consumption of this metal. In the past, aluminum was competitive in price with other non-ferrous metals such as copper, and to a much lesser degree with zinc, lead, and even tin: now aluminum is beginning to enter the price brackets of a number of special steels.

Table VII lists the percentages of total steel output when applied to the various fields of its application. In these various fields, aluminum will of course compete principally where lightness and resistance to corrosion are the main factors: two very important applications are those covered by transportation and by the food industry. This, it may be noted, does not represent a new departure, but simply a continuation of developments that were taking place prior to the war.

Table VII

Uses of Steel

	1937 %	1944 %
Agriculture	5.7	2.3
Aircraft		5.4
Automotive	18.9	
Construction	14.7	10.3
Containers	7.8	6.7
Machining Tools	4.4	5.1
Oil, Gas & Water Mining	7.4	3.0
Pressing, Forming, Shaping	3.6	4.4
Railroads	11.4	8.1
Shipbuilding	.9	20.7
Export	9.5	13.8
All Others	15.7	20.2

Table VIII gives an estimate of world production of aluminum for 1944; while Table IX tabulates the amount of aluminum used in the various fields of its pre-war application, together with a post-war estimate. The latter table

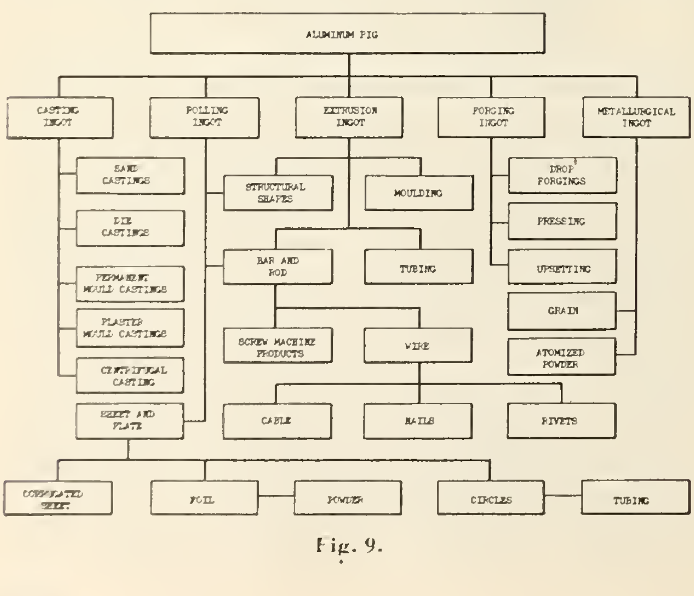


Fig. 9.

Table VIII

Estimated Production of Aluminum—1944

	%	Million Tons
Africa	—	—
Asia	6.5	.15
Australia	—	—
Europe	37.0	.90
France	2.6	.06
Great Britain	1.7	.04
Germany	1.5	.38
North America	56.5	1.35
U.S.A.	35.0	.8
Canada	22.0	.5
South America	—	—

indicates that the transportation industry will absorb an even greater proportion of the aluminum output than was the case before the war.

Table IX

World Consumption of Aluminum Divided as to Uses

	1925 to 1935 %	Post-War %
Aircraft, automobile, bus, railway, marine industry	30	35
Food industry, cooking utensils	15	14
Heavy and small machinery	15	15
Electrical industry: conductors, busbars, motors	10	9
Chemical industry	3	3
Building and construction	5	7
Ferrous and non-ferrous metallurgy	7	6
Miscellaneous	15	11

Practical Applications

The intrinsic properties of aluminum, including its high strength-to-weight ratio, its resistance to corrosion, the film-forming properties of its surface, its high affinity for oxygen, its alloying properties, its reflectivity and its conductivity both electrical and thermal, have each resulted in a special field of application for the metal. The various uses are grouped under a number of headings in Table X.

Table X

Properties and Uses of Aluminum

High Strength — Weight Ratio		
Transportation	*Aircraft*	Land & sea planes, engines
	Automotive	Cars, buses, trucks, tank trucks, body, frame
	Railroad	Street cars, hopper cars, box cars, passenger cars, locomotive parts, trucks, containers
	Marine Construction	Super-structure, bulkheads, lifeboats, davits, masts, canoes, fittings
	Miscellaneous Vehicles	Bicycles, motorcycles, wheelbarrows, carriages
Machinery	*Reciprocating & Rotating Parts*	Connecting rods, textile industry, propellers
	Portable Tools	Pneumatic tools, spray gun impeller, fire engine parts
	Handling Equipment	Conveyers, pulleys, worm gears, foundry patterns
	Engines	Blocks, heads, crankcases housing, bases of diesel, aircraft, automotive, marine engines, outboard motors, steam turbines
	Home Appliances	Washing machines, vacuum cleaners, refrigerators
Metallic Construction	*Structural Work*	Cranes, booms, bridges
	Mining	Cages, skips, pit car loaders, mine cars
	Tanks	Storage tanks, containers, gas tanks
Corrosion Resistance		
Culinary	*Cooking Utensils*	Pots, pans, pressure cookers, covers, kettles
	Processing	Dairy, brewery, gelatine, fruit press
	Canning	General line can. Food processed can: fish, meat

	Packaging	Collapsible tubes, packing foil (butter, tea, fruit, cheese, meat, coffee, chocolates), bottle caps
	Transportation	Milk truck tank, milk can, beer barrel, drums
Chemical	*Processing Equipment*	Kettles, pans, coils, condensers, storage tanks, crystallizers, moulds, coolers, pipes
	Fatty acid	Condensers
Industrial	*Oil Refinery*	Towers, trays, heat exchangers, tanks, lines
	Rayon Industry	Spinning buckets, bobbins, ducts, tanks
	Varnish Industry	Kettles
	Sewage Disposal	Plates, gates, troughs, screens
	Transportation	Tanks, gas cylinders, drums cans
Architectural	*Structural Parts*	Windows, doors, grille, hand-rails, partitions
	Roofing	Flat, corrugated, shingles, sky-light
	Plumbing	Lavatory fittings, bath, pipes
	Hardware	Handles, fittings, curtain accessories, hinges, reflectors, lighting fixtures
	Ornamental Parts	Spandrels, name plates, fountains, panels
	Furniture	Chairs, beds, ovens, refrigerators, airplane, car, bus seats
Film Forming Properties		
Electrical		Condensers
Metallurgical		Zinc electro-deposition Nickel electro-deposition
Architectural		Calorized parts Anodized parts
High Affinity for Oxygen		
Deoxidizing		Steel
Alumino-Thermy		Welding, Reduction
Explosives		
Pyrotechnics		
Cement Admixtures		Aerocrete, Anti-shrinkage addition
Reflectivity		
Reflectors		Light: Ultra-violet rays Mirrors: Telescope Heat: Stove reflectors
Insulating Material		Alfol. Oven linings

Alloying Properties	
Ferrous Metals	Heat resisting alloys. Nitriding steel Permanent Magnets (Alnicol)
Non-ferrous Metals	Aluminum, Bronze, Zinc die castings, Zinc galvanizing baths
Thermal Conductivity	Pistons Cylinder Heads (liquid & air cooled) Bearings
Electrical Conductivity and Diamagnetic Properties	
Heat Appliances	Stoves (Gas and Electric) Heat Exchangers (Home & Industry) Heating Elements (Radiators) Home Equipment (Flat irons, ironers)
Conductors	ACSR and Alloy Conductor Underground Cable Telephone wire Busbars
Conductor Accessories	Squirrel Cage Rotors
Motor Parts	Housing: Motor frames
Machinery	Welding Casings: Motor boxes, Switch boxes, Trolley Bows
Radio	Cabinets, miscellaneous parts

Conclusion

In the present brief survey, only some of the aspects controlling the long-term future of aluminum have been considered. Its short-term future will be governed by the current backlog of consumer goods, as indeed will the immediate future of most other materials.

In the case of aluminum, the greatly increased capacity of the reduction plants, especially in Canada, the availability of enormous amounts of aluminum scrap in all parts of the world, and a much-improved knowledge of fabrication methods consequent on the huge expansion of the aircraft industry during the war, will all play their parts in promoting developments over the coming years. Together with the downward trend of prices that is to be anticipated, they will assure for aluminum and its alloys an increasingly permanent place in the economy of the world.

INDUSTRIAL EARTHQUAKE HAZARDS IN EASTERN CANADA

ERNEST A. HODGSON, M.E.I.C.
Chief, Seismological Division, Dominion Observatory, Ottawa, Canada

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An interesting pastime, which is not quite as futile as might at first sight appear, is that of developing empirical formulae to express what might be called physico-psychological relationships. For example, one might evaluate the general public interest in earthquakes in terms of the various contributing factors. Evidently, it varies directly as the intensity of the severe shock immediately preceding; directly as, and possibly as the square of, the damage cost in dollars; and inversely as, say, the cube of the number of months which have elapsed since the last major earthquake.

Anyone meditating for awhile on the problem could readily discover other factors and might be inclined to disagree with the powers adopted in the simple formula above. But, in any case, the curve of Canadian public interest in earthquakes resembles the chart of a patient suffering from undulant fever. There are sharp peaks of intense interest, with long intervals during which the curve lies close to the zero axis. Such a graph for Japan, or even California, would exhibit a greater number of peaks but they would not stand out so strikingly, for there would be fewer long periods of low values.

As a result of this continued interest, the architects, contractors and electrical engineers of such countries as Japan have been stimulated to recognize and evaluate industrial earthquake hazards and to provide reasonably effective measures to guard against them.

At this time, when Canadian public interest has been stimulated by the recent Cornwall earthquake, quite a number of letters have been received from executives of industrial concerns, vitally interested, by the way, in extensive electrical services, asking when and where another severe earthquake may be expected and what precautions should be taken in repairing or extending their premises.

For nearly forty years, the Seismological Division of the Dominion Observatory has been quietly but steadily accumulating and indexing all available data, instrumental and historical, on the subject of earthquakes in Canada. The present would seem to be an opportune time to undertake a short analysis of this material. As most of it refers to earthquakes in Ontario and Quebec, the discussion is limited to an evaluation of " Industrial Earthquake Hazards in Eastern Canada."

To define the area more precisely, let us restrict the study to those parts of Ontario and Quebec lying in the watershed of the St. Lawrence and relatively close to its streams. Moreover, since earthquakes do not recognize political boundaries, it is necessary to consider also those adjacent parts of the United States which may be included in the drainage limits above.

Historical and Seismological Sources

The subject involves a consideration of the earthquake history of this territory from the earliest historical times to the present. The last four or five decades of this period are well covered by seismological records and studies, but the data for earlier years may be obtained only from written records, practically all of which were compiled by those who were not trained observers and who had no instruments to assist them[3]. Even reports by men such as the late Sir William Dawson[2], Mgr. Laflamme[1], and others are little more than carefully edited compilations of accounts given by earlier lay observers, except for Dawson's reports on the earthquakes of 1860, 1864, and 1870. Even these shocks he did not personally investigate in the field, relying mostly on newspaper accounts for his data. For part of the historical record, old newspaper files in both Canada and the United States have been consulted by members of the Observatory staff.

The first seismograph definitely known to have been operated in Canada was an old-style, Ewing instrument set up in the Physics Department of McGill University, According to a paper by C. H. McLeod and H. C. Callendar (" Our Record of Canadian Earthquakes," *Papers from the Department of Physics, McGill University*, Montreal, 1897) the first earthquake recorded by this equipment was that of March 23, 1897. Regular recording does not seem to have been attempted. No data are available today. There is some mention in early records of a " seismometer " operated at McGill previous to 1897 by Dr. Smallwood. The type of instrument is not known and no instrumental data have been preserved.

In 1897, an early-type, two-component, horizontal Milne seismograph was set up at Toronto. (In 1898 a similar pair of instruments was installed at Victoria, though this does not affect our present problem; nor do those of other types set up at Saskatoon and at Halifax, respectively, in 1915.) Recording and reporting of earthquakes as registered at Toronto began at once and were maintained regularly. In 1922, two horizontal-component Milne-Shaw seismographs replaced the earlier Milne instruments, both at Toronto and at Victoria.

In 1905, at the inception of the Dominion Observatory, Ottawa, the late Dr. Otto Klotz was in charge of the geophysical studies. A Bosch photograph seismograph (two horizontal components) was installed there soon

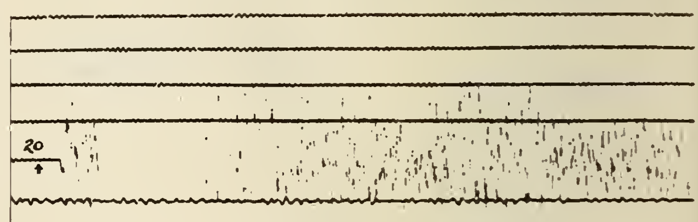

Fig. 1.—Seismograms of three major Canadian earthquakes. These seismograms show the relative amplitudes of the earlier registered phases of the earthquakes of 1925, 1935 and 1944 (St. Lawrence, Timiskaming and Cornwall). The records were all made on the same instrument (a Milne-Shaw seismograph). To compare relative intensities (at the foci), it is necessary to compensate for the reduction in amplitude due to distance from epicentre to station and for unequal scales used in the photographic reproduction. When these corrections are applied, it is found that the approximate relative intensities, at the foci, of the three shocks (St. Lawrence, Timiskaming, Cornwall) were, respectively, in the ratio—26:12:1. It is interesting to note that the ratio of estimated damage caused by these three quakes is—5:1:200.

afterwards. The first earthquake of any consequence to be recorded was the San Francisco shock of April 18, 1906. The Bosch was supplemented in March, 1912, by a Wiechert vertical (smoked-sheet) instrument. In 1922, two horizontal-component Milne-Shaws began operation; and in 1937 the Wiechert vertical was replaced by a modern photographic, short and long period, vertical Benioff. The present Ottawa instruments are the Milne-Shaw horizontals and the Benioff vertical, the Bosch horizontals having been moved to Halifax and the Wiechert vertical discontinued.

When the C.N.R. tunnel was being driven through Mount Royal, McGill University purchased and operated a single-component photographic Milne-Shaw seismograph. It was never used for regular seismological work, having been set up to determine the nature and magnitude of the disturbances caused by the tunnel. This instrument was purchased by the Dominion Observatory in 1925 and was installed, in 1927, at Seven Falls, Que. (about 7 miles north of Beaupré). At the same time, a Wood-Anderson, horizontal, torsion seismograph was installed at the same location and a similar Wood-Anderson was placed at Shawinigan Falls, Que. These two installations (vault, instruments, and services) were undertaken by the Shawinigan Water and Power Company and are still maintained by that organization. The work is under the direction of the Dominion Observatory and all seismograms are included in the records read and filed at Ottawa.

It thus appears that there has been a seismological service which would have recorded and noted any earthquakes of importance in the region with which we are concerned since 1897. The sensitivity of the equipment has been increased from time to time as has been noted. Since the installation of the Benioff vertical at Ottawa in June 1937, even relatively minor shocks, too small to be noted in the press, would be included in the reports. Installations of similar high class equipment at Burlington, Vt., Williamstown, Mass., Weston, Mass., and Harvard, Mass., permitted the formation of the North Eastern Seismological Association (NESA), which carries out special investigations leading to the detection and sometimes to the location by triangulation of the minor shocks in eastern Canada and New England. The records of this Association began to be published in June 1938 and are still being maintained.

The Record

The above-mentioned historical and seismological sources supply the basic data which must be used in any evaluation of earthquake hazards in eastern Canada. Let us select and examine, one by one, the reports of earthquakes of about magnitude V or greater on the Rossi-Forel scale[4] (the Cornwall earthquake would rank about VIII+). It may not be out of place to occasionally interject items reflecting what the reporters call "human interest" but, of necessity, most of the details must be limited to those which are later to be used in forming our conclusions. The total available earthquake records, within the above restrictions, are as follows:

1534—1536

There is mention in early records of an earthquake near Baie St. Paul, said to have occurred "between the two voyages of Jacques Cartier", which wrought noticeable changes in the topography. The name Les Eboulements was given by Cartier to a group of landslides caused by this earthquake,—a name still borne by a village in that vicinity. Tradition affirms that Isle-aux-Coudres, opposite the mouth of the river Gouffre (Baie St. Paul), was formed by these landslides, but this is not likely.

1663—Feb. 5

This was not one shock but a series of severe earthquakes, of which the first violent one occurred on Feb. 5. The epicentre was probably near Baie St. Paul, but the tremors were felt over a wide area. They are reported at length in the Jesuit Relations[1].

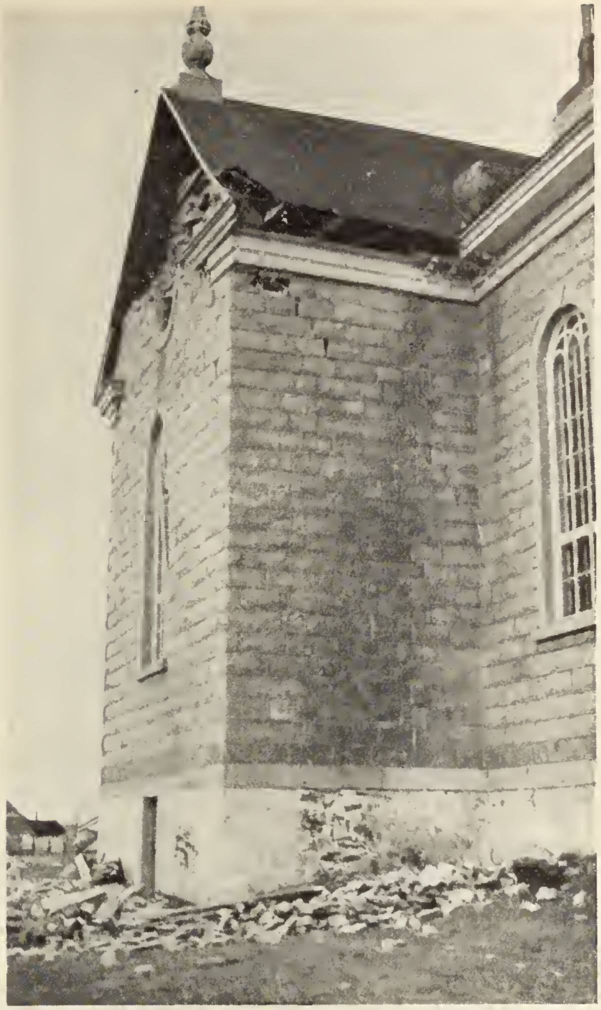

Fig. 2.—Rivière Ouelle church after the earthquake of February 28, 1925. This well constructed stone church stood on deep alluvium in the lowlands of Rivière Ouelle. It was jarred loose, stone from stone, so that it was necessary to tear it down and re-build.

We learn that: "An earthquake, extending over a region more than two hundred leagues in length and one hundred in breadth has shaken this whole country; mountains were swallowed up; forests were changed into great lakes; rivers disappeared; rocks were split and their fragments hurled to the tops of the tallest trees; etc." Mgr. Laflamme[3] comments: "Nous croyons qu'un bon nombre des faits rapportés à ce sujet par l'historien sont exagérés. L'épouvante est une mauvaise disposition d'esprit pour faire de bonnes observations scientifiques . . . Personne n'a été tué . . . Dans tous les cas, il est certain que les secousses ont été violentes et se sont répétées pendant plus de six mois, avec une intensité qui, *comme dans tous les tremblements de terre, a été diminuant jusqu'à la fin*." (The italics are our own.)

Several points are to be noted: Although a study of all accounts would lead to the conviction that the epicentre lay below Quebec[6], there are numerous stories[5] which show that landslides occurred at many places, notably in the valley of the St. Maurice. That river is said to have run white for three months, and other accounts say the St. Lawrence itself was "sulphurous" down to Tadoussac. A note in the Jesuit Relations says: "We noticed that in the more elevated places (which in that region are also invariably rocky) the motion was less than in the level country (which in that region is mostly deep alluvium)". (The brackets enclose our own interjected comments.) It is further to be noted that there were few structures which could have been damaged and that " personne n'a été tué ". Some heavy shocks were reported in 1664, 1665, and 1668, centered in the region of Baie St. Paul to Tadoussac. These were evidently aftershocks of the earthquake of 1663.

1732—Sept. 5

This earthquake seems to have had its epicentre near Montreal. Three hundred houses were damaged ③; many chimneys fell; people were hurt; one girl was killed; people slept in their gardens. " On fait des confessions générales de tous les côtés; les dames ont quitté leurs paniers (hoop skirts), les prêtres leur ont fait signer une promesse ".

(1755—Nov. 18)

Although it does not belong strictly in this category, mention should here be made of a very severe earthquake which occurred on this date. The epicentre was " on the Fundian fault ". Extensive damage was caused in Boston. The tremors were felt over a large area including the lower St. Lawrence region. Damage was confined to Boston and its vicinity.

(1777—April 14)

Another shock, not quite belonging in this list, is this earthquake reported from James Bay. It is said to have been severe, but details are lacking. It is entered in the records of the Hudson Bay Co. in London.

1784—Jan. 2 and Jan. 14

Mention is made in old records③ of severe shocks at Quebec on these dates, but details are lacking.

1791—Dec. 6

The epicentre of this severe earthquake again appears to have been near Baie St. Paul. It should be remembered that the early records are confined to reports of earthquakes in the lower St. Lawrence and up as far as Montreal, because these were the only sections of the country then regularly occupied by settlers. There may have been equally severe disturbances west of Montreal and Ottawa, (such as, for example, the Timiskaming shock of 1935), of which no mention is made, because of the then sparsely settled nature of the country, the absence of ready communication, and the fact that no written records seem to have been compiled in these upper reaches of the St. Lawrence watershed.

The earthquake of 1791 is reported by Abbé A. Mailloux in his " Histoire de l'Isle-aux-Coudres ", published in 1879. The account is quoted by Laflamme③. Among other observations the abbé says that shocks had been felt from time to time " for the past thirty years " in the vicinity of Isle-aux-Coudres. In the shock of 1791, chimneys were destroyed; people rushed from their houses; no one was killed; " une pauvre femme a perdu l'esprit par la peur et ayant été obligée de sortir nue de sa maison "; *the damage was worse in the stone houses than in the wooden ones;* one stone house was practically destroyed (The italics are ours.)

Some " vieillards " averred that severe earthquakes occurred in these regions every twenty-five years with a variation of one or two years, and that all arrived at the same time of the year within a month or two. Laflamme③ would correct this to " about every 40 years " but adds that such cyclic figures are *très incertaines.*

" L'abbé Gagnon prétendait avoir vu, à cette époque, une éruption volcanique dans les montagnes situées au nord-ouest de la Baie . . . Chose étrange . . . Or aucune d'elles n'avait vu la fumée ou les flammes volcaniques . . . Le digne abbé avait été le seul à faire cette observation . . . L'abbé aurait bien pu être victime d'une illusion d'optique ".

There is a belief, general among some of the residents of Baie St. Paul, that one of the mountains there is a relatively-recent volcano. Sir William Dawson② writes: " In a notice of the earthquake (of 1870 to be mentioned below) in *Sillimans Journal* (one of the oldest scientific journals in North America, now known as the *American Journal of Science*) for January, 1871, by Mr. A. C. Twining, the following statement occurs with reference to the intensity of the shocks at Baie St. Paul and Les Eboulements—' They are in general conformity to what has long been known to British geologists respecting the volcanic character of the region ' with some other remarks based on this strange statement, which has no foundation in fact ". (The entries in brackets are ours.)

While on this subject, mention may be made of the statements by sailors that, in the earthquake of 1663, there were great and strange lights in the sky and that showers of ashes fell on the decks of their vessels. These too must surely have been *des illusions d'optique.* Similar stories about strange lights and electrical phenomena, received at the time of the St. Lawrence earthquake of 1925, were investigated and found without any foundation in fact.

1796—Feb.

The exact date is not given② but the earthquake is reported to have been " violent ". Rocks fell from the cliffs at Niagara.

1816—Sept. 9

This was a moderately severe shock, apparently centered near Montreal②. Details are lacking. A second tremor, probably an aftershock since it was " less violent ", occurred on Sept. 16.

1831—May 7-8

A moderately severe shock was reported③ in *Le Canadien* as having occurred on this date with the epicentre near Baie St. Paul and Kamouraska. Chimneys were demolished and walls thrown down. Animals were terrified. Five aftershocks were felt.

1840—Sept. 10

Dawson② reports a violent shock at Hamilton on this date. Further details are lacking.

1842—Nov. 8-9

The same paper lists a severe earthquake at Montreal and Three Rivers with " agitation of the river ". Shocks are also reported at Montreal in 1844 and 1847 but exact dates and all details are lacking.

1860—Oct. 17

This earthquake was a major disturbance, probably comparable with that of 1925. The epicentre was near Rivière Ouelle. Aftershocks were reported from Les Eboulements. Dawson says: " It appears from published lists that the late earthquake is the last of at least twenty-nine that have visited Canada since its discovery by Europeans ". He argues that the focus must have been very deep as " the shock appears to have been nearly simultaneous throughout (eastern) Canada ". In reports from several different places, mention is made of the fact

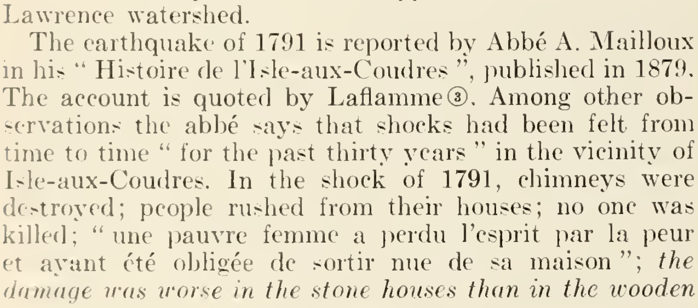

Fig. 3—Grain loading equipment on the banks of the St. Charles River at Quebec. This structure stands on deep, made ground. It is very top-heavy. At the time of the earthquake of 1925, the heavy superstructure of the distribution sheds (1,000 ft. long) swayed outward toward the river, but did not fall. The effect on the lower ends of the outer steel struts is shown in Figs. 4 and 5.

Fig. 4.—Base of steel strut supporting loading sheds at Quebec, shifted by the earthquake of February 28, 1925.

that the shocks were much more severe in low lying ground than on the rocky elevations, e.g. at Quebec and Montreal.

An anonymous correspondent, writing from Rivière Ouelle to a Quebec newspaper(7), states—" Jamais de mémoire de nos habitants, nous n'avons eu des coups aussi forts. Je suis demeuré devant mon horloge tout le temps pour m'assurer de sa durée, afin de pouvoir computer avec d'autres endroits la marche de ce grand et terrible phénomène ".

1864—April 20

This was a peculiar earthquake. No damage seems to have occurred at any point, but it was felt over a very great area in Quebec from Montreal to Rivière du Loup. Dawson(2) states: " Like other Canadian earthquakes it was felt almost simultaneously over a wide extent of country, indicating perhaps that its source was deep-seated, and the vibrations propagated almost vertically to the surface ". It was felt in Harvey Hill Mine at a depth of 180 ft.

(1864 ?)

In the *Saturday Evening Post,* May 25, 1929, Eugene Poole writes about an earthquake experienced in the Gatineau region north of Ottawa, which, though possibly rather weak to be included in this category, must be mentioned for a matter of considerable interest. He is writing a story of the life of the late Capt. Robert Dollar, founder of the famous line of steamships. He says: " He went on learning the woodman's trade and of those years he had stories to tell, but I have space for only one . . . he went with a gang of twelve men to haul provisions . . . it snowed all night . . . they were wakened by a slight earthquake . . . at first they were blinded by snow falling from the trees . . . then 'As it cleared we saw a grand, strange sight' . . . on the opposite mountainside they could follow the earth wave's course by the snow it shook from the trees . . . behind that long, sinuous, moving line the firs were green, in front they were white!"

1870—Oct. 20

This was probably the most severe earthquake Canada has experienced since 1663. Again, the epicentre was near Baie St. Paul. It is most interesting to read about this earthquake in old newspaper files at the Library of Parliament, Ottawa. On July 19, 1870, France declared war on Germany. The war news occupied the headlines and the front pages, then as now. But the earthquake of 1870 got front page and often headline space, as did the Cornwall earthquake of 1944 under similar news conditions.

The earthquake was felt from the Atlantic to western Ontario. It was reported from New York city. All movable objects were displaced at Baie St. Paul; stoves were overset; chimneys were demolished; some persons were injured; those who were outdoors were terrified by the " convulsions of the earth "; aftershocks continued to December 15 (when the notes were written); cracks opened in the earth at Baie St. Paul emitting water and sand; at Les Eboulements " les arbres d'un verger ont été renversés et complètement détruits " (evidently by a landslide).

Some important comments by Dawson must suffice for even this severe earthquake. He writes " In several places it is noticed that the shock was much more severe on sandy or loose ground than on solid rock "; and again " Other correspondents mention the opening of chasms in the ground from which streams of water and sand burst forth. This phenomenon arises from the landslips produced in the terraces of post-Pliocene clay, which in that part of the country rest against the steep sides of the Laurentian hills. These are ready to slide downward with any slight movement of the earth and to press the water out of the sandy layers associated with them, or give outlet to hidden springs and streams ". He adds also "A mass of rock 400 feet in length fell from the face of the cliff at Cape Trinity in the Saguenay "; and finally " The earthquake extended over 25 degrees of longitude from the Bay of Fundy westward and over at least 12 degrees of latitude from the north shore of the St. Lawrence southward. Its extension to the northward is not known ".

Shocks with approximately the same epicentre but relatively feeble and evidently aftershocks of the above earthquake were reported in 1871 and again in 1874.

1913—1914

Two earthquakes of about intensity V were investigated in the field by the late Dr. Klotz. The first, on April 28, 1913, was located near Iroquois, Ont.; the second, on February 10, 1914, had its epicentre near Labelle, Que. The accounts were printed in the *Publications of the Dominion Observatory*, the first in Vol. I., No. 1, the second in Vol. I, No. 5.

Other shocks of about intensity V or greater on the

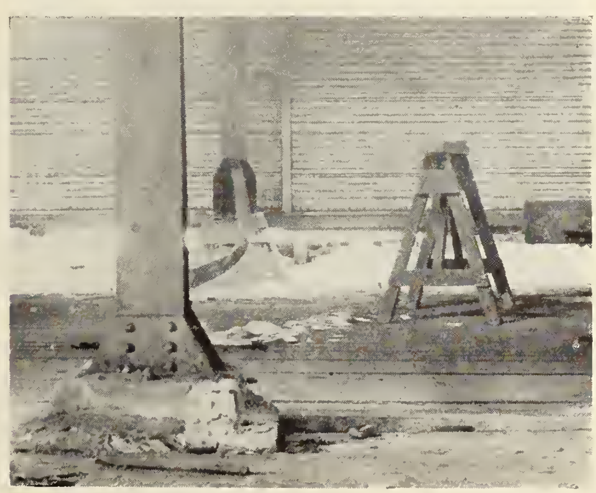

Fig. 5—Back brace at base of loading shed strut, bent by shift of the base of the strut, due to earthquake of 1925.

Rossi-Forel scale were reported from time to time in eastern Canada in the interval 1870-1925. Such reports deal with shocks in 1877, 1880, 1885, 1887, 1893, 1894, 1897, 1898, 1902, 1904, 1906, 1907, 1910, and 1924. The earthquake of 1897 (March 23) and that of 1904 (March 21) were each felt over about 300,000 square miles in eastern Canada and New England. But it was not until February 28, 1925, that the next really major shock occurred.

1925—Feb. 28

This earthquake was investigated in the field by the author, both immediately after the disturbance (when the ground was deeply covered with snow) and later in the spring and summer—six trips in all, each averaging about two weeks. To go into details is out of the question. To summarize the points of special interest to this investigation, we may note the following:

(a) The epicentre was found to be near the mouth of Rivière Ouelle, across the St. Lawrence from Baie St. Paul, Les Eboulements and Murray Bay.
(b) Damage in the epicentral region was decidedly greater on deep alluvium than on rock elevatons.
(c) On deep alluvium in the vicinity of the epicentre all chimneys were destroyed and all stone buildings were wrecked but frame buildings were very little damaged.
(d) Damage at Quebec city was confined to "lower town".
(e) Serious damage occurred at Three Rivers and at Shawinigan Falls, more than 200 miles in an airline to the west, though the seismograms furnish irrefutable evidence that there was only one epicentre.
(f) Aftershocks continued to be reported for several years. None was very severe. They diminished gradually in intensity and occurred at increasingly greater intervals.

Fig. 6.—Earth crack, Rivière Ouelle. This crack is shown some months after the earthquake of February 28, 1925. The crack is in deep alluvium. It runs parallel to Rivière Ouelle, some fifty yards back and beyond the slight flood escarpment. The width of the crack is indicated by a shoe.

1929—Aug. 12

An earthquake occurred on this date with its epicentre at Attica, N.Y., about 20 miles east of Buffalo. It was investigated in the field by U.S. observers (7), The intensity was assigned as between VIII and IX.

(1929—Nov. 18)

This earthquake, like that of 1755, does not properly come in this category, but should perhaps be mentioned since it presents another phase of our problem. The epicentre lay about 300 miles south of Newfoundland. The shock broke 12 of the 21 trans-Atlantic cables over an area some 200 miles long and almost as wide. But the point we need to note is that it caused a tidal wave, which, sweeping into the funnel-shaped Placentia bay on the south coast of Newfoundland, rose to a height of 30 ft. and inundated several villages, drowning 30 persons.

Now, the Gulf of St. Lawrence is also funnel-shaped and there have been several records (e.g. Nov. 5, 1884) of tidal waves which entered the Gulf and rose to considerable heights as they swept up the river. It is possible that a severe earthquake off the continental shelf just south of Newfoundland, or even in the St. Lawrence river itself, might cause a tidal wave which would seriously affect buildings on made ground close to the river, a type of structure to which reference will again be made.

It is interesting to note, in connection with this earthquake, with an epicentre nearly 900 miles from Ottawa, that it was detected by a lady living in Ottawa, who reported the tremors to the Observatory, by telephone, while they were still registering on the seismograph. This constitutes a record in our experience for personal (non-instrumental) detection of a major earthquake at a distance.

1935—Nov. 1

This earthquake was much more severe than the damage would indicate, although its epicentre was only about two miles from the town of Timiskaming, Que. It was felt over all eastern Canada, west to Duluth and south to Virginia. The focus was deep. The nearest towns of any size, besides Timiskaming, are Mattawa and North Bay, each about 40 miles distant. The shocks occurred so directly beneath Timiskaming that the chimneys were disintegrated but did not fall. No one was injured; several lakes, which had been quite clear, turned white at the time of the earthquake; there were so few man-made structures other than frame cabins in the general epicentral region, with the exception of Timiskaming itself, that it was difficult to determine the relative disturbance of adjacent points. Timiskaming is a "Company town" built and maintained by the rayon mills. The houses are well constructed and kept in good repair. In view of the intensity of the shock as shown by the seismograms, the town of Timiskaming is an excellent argument for simple honest workmanship, with good materials, on level solid ground, as an adequate precaution against earthquakes for the householder.

In spite of the relatively small damage at Timiskaming, many chimneys were thrown down at North Bay and Mattawa; some damage was done even at Ottawa (185 miles away in direct line); and about 200 ft. of a railway embankment, undermined by a stream at its base, slid out at Parent, Que., more than 200 miles distant from the epicentre.

1944—Sept. 5

There were other minor shocks in eastern Canada between the Timiskaming earthquake and the one at Corn-

Fig. 7.—Rotation effect on monument. This rotation in a monument in a graveyard beside Rivière Ouelle church was caused by the earthquake of 1925. This is typical of rotations in epicentral regions where the soil is deep. This one happened to be contra-clockwise. Most of the rotations on the south shore caused by this earthquake were in this sense, the ones on the north shore turning clockwise as a rule. (This rule was exactly reversed in the case of the Cornwall-Massena earthquake of 1944.) Practically every stone in every graveyard in the epicentral region was either rotated or overthrown.

wall but none was severe. Probably none could have been assigned a rating as high as V on the Rossi-Forel scale. The Cornwall quake was investigated in the field. A preliminary report is now in the hands of the printers and a complete analysis of data is being undertaken at the Dominion Observatory. This will, no doubt, be published at a later date.

The outstanding facts about the Cornwall earthquake which we should consider are as follows: Although the shock was certainly less severe than those of 1925 and 1935 the damage was very much greater. It is estimated as $1,000,000 at Cornwall and as much at Massena, N.Y. The author believes these figures are a bit high but is impressed by the convictions of those who are better qualified than himself to form an estimate and who are in a position to know more of the details. Whatever be the amount, we can all agree it was serious. Fortunately, no one was killed; only one or two are reported to have been injured, and these only slightly.

The second fact of importance is that the damage occurred in a very " spotty " pattern and the areas of greatest damage were definitely those places with a deep or sandy subsoil. Points in Cornwall itself, less than two miles apart but differing in the nature of the subsoil, showed differences in damage that have to be seen to be fully appreciated.

Analyzing the Evidence

So we come to the end of a very much abridged but reasonably adequate outline of the data on which must be based any estimate of industrial earthquake hazards in eastern Canada. It will, perhaps, simplify the analysis to consider the outstanding points of interest in a series of short topical paragraphs, after which it may be possible to present a brief outline of the conclusions deduced.

Is the Rossi-Forel scale④ a satisfactory measure of relative seismic intensity?

The answer is the classic " Yes, and no "; perhaps the author would prefer " no, and y-e-s ".

The earthquakes of 1663, 1732, 1791, 1860, 1870, 1925, and 1935 would each be classed as intensity IX or X according to the Rossi-Forel scale; but, evidently, they were not equally severe. If we were to compare the seismological records of a number of earthquakes in one of the lower grades, which would be given the same intensity factor under the rulings of the scale, we should probably find they would prove to differ greatly in intensity, since we would be considering the energy released at the focus. The deeper the focus, the less the epicentral energy for a given shock.

Moreover, the destruction, which is used largely in the scale as an index, depends on so very many factors: the nature of the ground; the amount of construction in the region; the design of the buildings; the quality, workmanship, and state of repair. The psychological factors are even more dependent on circumstances which are not constant from place to place or time to time, whether we speak of the psychology of those investigated or that of the investigator himself.

However, in working out the distribution of surface seismic energy in an epicentral region for a single given earthquake, the scale is useful as a means of reducing to a number the investigator's own evaluation of the relative conditions from point to point.

It is useful also as a rough index of energy, though the author would prefer to say *weak, medium, strong* and *very strong*. In any case, it should clearly be borne in mind that a Rossi-Forel scale assignment is far from a precise indication of seismic energy.

Are Canadian earthquakes caused by volcanic activity?

Absolutely not, although tradition to that effect is very strong in some places. They are believed to be caused by the readjustment of the earth, slowly recovering from the ice age conditions. Nearly a mile depth of ice was once piled on eastern Canada. Lying there for centuries, the upper layers of the earth's surface were forced down and adjustments took place at depth. After the ice melted, the ground began to rise. It is still rising slowly as is evidenced, around Hudson Bay and Labrador, by old wharves now some distance inland. It is said that the Atlantic coast is

Fig. 8.—The Parent, Que., slide, This slide occurred on the railway near Parent, Que., at the time of the Timiskaming earthquake of November 1. 1935. It is more than 200 miles away from the epicentre.

rising at the rate of about three inches a century. This imposes strains on the rocky strata in eastern Canada. When the strain exceeds the strength of the rock, the latter yields with a sudden release of great energy, and we have an earthquake. Such, at least, is the present accepted theory, which may be taken for what it is worth. In any event, there is no need to worry about a volcanic eruption complicating an earthquake in these regions.

Are aftershocks a menace?

When an investigation of the Timiskaming earthquake was being made, and again in the case of the Cornwall earthquake, the aftershocks were a source of considerable anxiety to many people. Some even went so far as to follow the example of the people of Montreal in the earthquake of 1732—they slept in their gardens. Several people near Kipawa contracted serious colds from sleeping in the open. The author was asked by the mayor of Timiskaming to issue a signed proclamation which was posted on the town hall bulletin board, to the effect that aftershocks were to be expected and would continue with irregularly diminishing strength at increasingly longer intervals for some months, none being likely to be comparable in intensity with the main shock. At Cornwall the mayor asked for a similar assurance, which was printed in the newspapers both in Cornwall and in Massena. We are told that the statements were most useful. At Timiskaming, many were preparing to leave their employment and going elsewhere to live. In the light of the evidence given in this paper, the reassuring statements were quite justified.

In the Cornwall notice, a rider was added, to the effect that broken chimneys should be taken down so that they might not fall during the aftershocks and injure someone. Also, the people were urged to carefully inspect the chimneys, in the walls as well as above the roof, and make complete repairs if any cracks were found. Finally, they were warned of the fire hazard, if stoves and furnaces were used before repairing the chimney. One case was noticed where smoke was rising from a chimney cut off at roof level on a frame house with wooden shingles.

This brings up a point to be remembered by householders and watchmen of large buildings. As soon as the tremors of a large earthquake cease, immediate steps should be taken to see that there is no danger of fire. It is remarkable that no fires were caused by any of the three earthquakes, 1925, 1935, or 1944, although in 1925, for example, many coal-oil lamps and stoves were upset in dry-as-tinder frame houses.

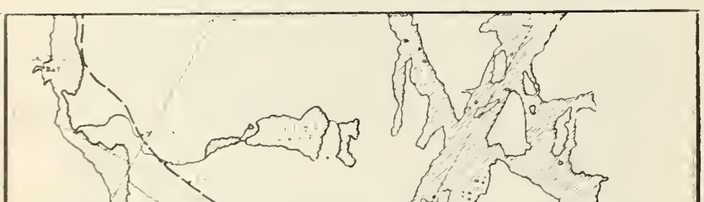

Fig. 9.—Map of the epicentral region of the Timiskaming earthquake of November 1, 1935. Note the positions of the mile posts on the railway from Kipawa to Dozois. At each post there were spare rails weighing over 900 lbs. each and resting on firm level supports. They shifted in toward a central point due to inertia, thus indicating the position of the epicentre.

Is any one part of the St. Lawrence watershed more likely to suffer a serious earthquake than another?

At first sight, after reading the records of the past, one is likely to nominate the lower St. Lawrence as more seismic than any other region. But we must consider the following facts.

(a) Nearly all our data, up to 1860 and 1870, are obtained from records written by the clergy. They deal with earthquakes in or near Quebec or Montreal, since it was in these places that the historians lived.

(b) Since seismological network services have been available—say since 1906, there have been only three major earthquakes. Our seismograms prove that there were no others, even in uninhabited sections. The one in 1925 was centered near Rivière Ouelle, it is true, but the 1935 quake occurred at Timiskaming on the upper Ottawa and that of 1944 at Cornwall on the upper St. Lawrence. The Timiskaming shock was strongly felt in the region of Montreal and also in Quebec. Is it not more than likely that some of the minor tremors recorded in Montreal and Quebec in those early years originated at epicentres west of Montreal and were caused by major disturbances? For example, consider the earthquakes of 1864, 1897 and 1904. These were felt "over 300,000 square miles," yet no epicentre was assigned. Had there been a seismograph network in service, the epicentre would have been located, probably west of Montreal.

(c) One of the outstanding lessons taught the seismologists by years of experience is that no place may be designated as certainly free from the danger of becoming an earthquake epicentre. Since 1925, major earthquakes have occurred at Timiskaming, Baffin Bay (four in all), and Montana (two), not one of which places would have been considered seismic in the light of all previous known seismic history. Going farther back, the earthquakes of New Madrid (Mississippi valley in southern Missouri and western Tennessee and Kentucky) in 1811 and Charleston in 1886 occurred in strictly "non-seismic" regions.

So, we conclude that, while the evidence available points to the lower St. Lawrence as our most seismic region, our sources of data are *very* heavily weighted in that direction. Indeed, the point raised in section (b) above, leads one to believe that this apparent distribution of seismicity is probably far from the truth. We might have an earthquake anywhere in the territory under consideration.

Will there be further major earthquakes in eastern Canada?

Practically speaking the answer is *certainly*.

When will the next major earthquake likely take place?

Let the reply be given in the words of Mark Twain. "I was gratified," he said, "to be able to answer promptly, and I did. I said that I did not know."

Let us note again the observation of Mgr. Laflamme in speaking of the possible cyclic occurrence of earthquakes as deduced by the "vieillards" in 1791. They averred that the major shocks recurred in close to twenty-five years. Laflamme says: "A ce propos, nous nous permettrons d'ajouter que depuis 1791, les paroxismes séismiques semblent se répéter plutôt tous les quarante ans ou à peu près. Si cette règle était vraie, nous devrions nous attendre à avoir des perturbations plus violentes que celles de tous les jours vers 1911. On peut cependant en douter, car ces répétitions périodiques, à dates précises, sont toujours très incertaines."

Why are the major earthquakes in Canada felt over such wide areas?

In speaking of several Canadian earthquakes Dr. Dawson[2] remarks that they must have occurred at a considerable depth " as they were reported almost simultaneously at widely separated places." It is doubtful whether his time data were even approximately accurate enough to permit such a deduction, which was probably suggested to his mind by earlier writings of the French seismologist, Alexis Perry, whom he quotes directly in his report on the earthquake of 1860.

Seismological records can now be used to determine, at least approximately, the depth of focus of major Canadian shocks. They are found to be at depths of ten miles and more. It is for this reason, coupled, of course, with their intrinsic intensity, that they are felt so widely.

This depth of focus is a contributing factor toward the earthquakes causing serious damage at distances of over 200 miles, as was the case in the 1925 earthquake, with serious damage at Shawinigan Falls, and in the 1935 shock which set off the embankment slide near Parent. It is a combination of strong, deep-seated disturbance with treacherous soil conditions, the latter being found at so many places in eastern Canada.

In no Canadian earthquake has there been any authenticated evidence of rock faulting at the surface. In every case, cracks in the ground have been caused by slippage of deep soil masses toward their unconfined boundaries, as is explained by Dr. Dawson, whose opinion is quoted in our report of the earthquake of 1870. The deep deposits of marine clays over much of the St. Lawrence lowlands present a hazard, even without the earthquakes. Earth slides are of two kinds [illegible]. In the first, very solid masses of clay, quite impervious to moisture but resting on sloping rock surfaces, are liable to slip toward their unconfined boundaries during a rainy season. Such a slide occurred at Poupore on the upper Lièvre river on October 11, 1903. A mass of clay, having a superficial area of about 100 acres, being roughly triangular, 600 yards long on the side next the river and having a depth inland of 800 yards, slipped bodily into and across the river. It carried with it a farmhouse with trees and a well for a distance of 150 ft. The well was not drained. In 1908 another slide on this same river caused the death of 33 people at Notre Dame de la Salette. There are many other cases which could be mentioned of this first type of slide.

In the second type, the clay is laminated — being composed of alternate layers of fine silt and coarser sand. This type of ground, when wet, flows like a liquid. A slide of this type occurred near Shawinigan Falls in the fall of 1924. A section of a farm 900 ft. long, 400 ft. wide and 40 ft. deep flowed out overnight into a ravine leading to the St. Maurice river. It was erroneously reported that this slide was caused by the earthquake of February 28, 1925. However, one can readily understand how much damage could be caused, were a strong, deep-seated earthquake to occur when the ground was very wet or even in the winter after a very wet fall. It would be interesting to know the weather condition in the fall of 1662, since there were so many slides associated with the 1663 earthquake.

Might an earthquake in Canada be catastrophic?

It might indeed, for the reasons we shall now outline, but the measures which ought to be taken to guard against the possibility require only relatively simple care and planning.

In 1932, John R. Freeman, an outstanding authority on insurance, completed a book " Earthquake Damage and Earthquake Insurance "(7). It is practically an encyclopedia of information on the subject indicated. Not only was the author extremely capable and painstaking but he had a unique opportunity to obtain authoritative information. On page 663 of this book he tabulates (in 1932) the total damage expressed as loss in dollars due to earthquakes (exclusive of fires caused thereby) in Canada and the United States during the preceding 100 years. He might as well have said since the time of the discovery of America. His total was $40,000,000. His book was published in 1932, as has already been twice remarked. On March 11, 1933, an earthquake occurred at Long Beach in which the damage was estimated as $50,000,000. The Cornwall earthquake damage (a grade VIII+ shock) is estimated at $2,000,000. Freeman's estimate of the damage caused by the St. Lawrence earthquake of 1925 is $100,000. The damage due to the Timiskaming earthquake would probably be less than $20,000.

Fig. 10.—Rock fall on edge of Lake Kipawa. This gives a good idea of the reason why epicentres are difficult to locate in wild country. It could not be determined whether this rock fell at the time of the earthquake; or, assuming that it did, whether [illegible] great or little energy was required to dislodge it.

To be sure, estimates are extremely elastic numbers, as is pointed out by the author in discussing the damage due to the Cornwall earthquake(6). But the fact remains that a serious earthquake occurring in eastern Canada today might cause incalculably greater damage than it could have caused fifty years and more ago.

So far as records show, only one person has lost his life as a direct result of Canadian earthquakes. In the account of the Montreal earthquake of September 5, 1732, we read: " one girl was killed ". But what would have been the case in Cornwall if the earthquake had occurred during school hours. That calamity, which did not occur simply because of the timing (12:38 a.m.), could have been avoided by a comparatively simple precaution which should be taken in the construction of all public buildings—leave no walls which cannot resist horizontal forces.

In the *Engineering News-Record* for September 21, 1944, an editorial reads: " The picture of roof parapet and cornice masonry piled across the entrance to the Cornwall, Ont., school, has a startling resemblance to those published following the Long Beach, Cal., quake in 1933 . . . . . *If design changes to make structures reasonably resistant to earthquakes were either extensive or expensive there would be more excuse for the existing situation.*" (The italics are our own.) The entire editorial is worth reading and should be read by all persons responsible for making reasonably adequate provision to meet earthquake hazards in eastern Canada.

Are Canadian earthquakes a menace to electrical installations?

So far as could be learned, with the exception of broken wiring which blew fuses and shut off lights and motors in a few cases, no marked damage has resulted to any hydroelectric generators, transformer stations, or running electrical machinery. At Timiskaming the lights of the town went out because a control relay was tripped. In Massena the aligning bolts of a very massive fly-wheel of a motor-generator set were sheared off and the shaft thrown out of alignment, but the equipment was not operating at the time and no damage resulted. This particular installation was on deep soil.

It seems reasonable to conclude that no earthquake damage would result to any equipment, such as a hydroelectric installation, in which the powerhouse, dam, etc., are of reinforced concrete and set on rock. However, there is a possibility that wing dams not based on rock and unreinforced earth dykes for restricting flooded areas might be damaged by such earthquakes as are to be expected in eastern Canada.

There is plenty of evidence that top-heavy structures built on deep alluvium or, worse still, on made ground built up behind pilings at the edge of a river are susceptible of serious damage even at quite considerable distances from an epicentre. Care should be taken to avoid these conditions wherever possible, in spite of greater expense or difficulty in locating and designing installations of this kind. Some thought should be given in such locations to the possibility of a tidal wave as has already been mentioned.

Elevated water tanks or heavy transformers should not be built with their supports tied into the walls of buildings. Steel frames with brick filler walls are also damaged very readily by earthquakes. A very good example of the steel frame, brick filler walls type of damage was found in the Palais station, Quebec city, and also in a large mill building in Shawinigan Falls, at the time of the St. Lawrence earthquake of 1925.

Fig. 11—Mushroomed chimney at Massena, N.Y. This chimney was damaged by the earthquake of September 5, 1944. When a building is very close to the epicentre of an earthquake of which the focus is deep, the chimneys are disintegrated by the almost-vertical shocks. The bricks are loosened but do not fall. It is an excellent sign that one is close to an epicentre.

Is there any danger of being "swallowed up" during an earthquake?

On any solid ground, on level alluvium, or on rock there is no danger whatever. On sloping ground, or ground having a deep depression (river, lake, or ravine) at one side, there is some possibility. In the Poupore slide of which mention is made elsewhere, several cattle were engulfed in cracks which opened and closed again. Such conditions are far from general, however. If one is on a deep clay bank it is well to get on to more solid ground as quickly as possible. In general there is no such danger in any Canadian earthquake.

What single factor is the most important in determining the distribution of destructiveness in an epicentral region?

By all means,—the nature of the terrain. Even in the most severe Canadian earthquakes of which we have any authentic information, the damage is very much greater on deep alluvium, on made ground, on fairly deep soil on a sloping base of rock or clay, or in places where there is a relief to one side of the point in question as in the case of a river, lake, or ravine.

In all the earthquakes studied, the damage to buildings on rocky terrain, even in the epicentral region, was practically nil. In buildings on deep soil, in the epicentral region, even relatively minor shocks are liable to cause damage to poorly constructed brick and stone buildings, chimneys, etc.

Conclusions

In view of the seismic history of the St. Lawrence watershed outlined above, it must be concluded that major earthquakes take place in that region at intervals which are quite irregular; but at least eight to ten have occurred in less than 300 years. The evidence, when carefully considered, must be interpreted as indicating that these disturbances are not confined to any particular part of the watershed.

The earthquakes are invariably deep-seated and are felt over wide areas. There have been no instances of surface displacement in exposed rock strata. Due to the fairly widespread regions of deep alluvium, with the variable contributing factor of moisture, landslides take place even when no earthquake occurs. In the case of severe shocks, slides are often set off at considerable distances from the epicentres and damage results to buildings erected on such unstable terrain. Buildings for industrial installations, schools, etc., should be erected on solid level ground or on rock wherever possible.

Top-heavy structures, on made ground close to a river, are particularly liable to damage and should be avoided. Care should be taken, in designing structures, to shun unanchored parapets and cornices, brick filler walls in steel framed buildings, earth dykes without reinforcement, wing dams not anchored to rock, uncoupled supports for bearings of long rotating shafts in high speed, heavy machinery.

There seems to be no need to adopt full seismic construction, as developed for example in Japan and California, *except for structures which must be erected on unstable terrain.* In such unavoidable conditions, it is estimated that adequate protection can be achieved at a cost of about ten per cent above normal approved construction for the type of building involved.

For the rest, honest workmanship, with good materials, using the designs approved in existant building regulations for the structures contemplated, would appear to meet all reasonable needs. However, schools and other public buildings should be more carefully designed, making full use of the lessons learned, for example in the Long Beach earthquake. To again quote, such precautions are not either "extensive or expensive".

It is hoped that the examination of seismic conditions as outlined in this paper may convince all responsible for extensive construction in the St. Lawrence watershed that industrial earthquake hazards do exist in eastern Canada, will present sufficient data to permit an estimate of their magnitude under any given set of conditions and will serve to assure all concerned that the reasonable precautions to be taken are both necessary and simple.

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④ Rossi-Forel Scale of Earthquake Intensities:

I. Microseismic shock: Recorded by a single seismograph or seismographs of the same model, but not by several seismographs of different kinds: the shock felt by an experienced observer.
II. Extremely feeble shock: Recorded by several seismographs of different kinds: felt by a small number of persons at rest.
III. Very feeble shock: Felt by several persons at rest; strong enough for the direction or duration to be appreciable.
IV. Feeble shock: Felt by persons in motion; disturbance of movable objects, doors, windows; cracking of ceilings.
V. Shock of moderate intensity: Felt generally by everyone; disturbance of furniture, beds, etc.; ringing of bells.
VI. Fairly strong shock: General awakening of those asleep; general ringing of bells; oscillation of chandeliers; stopping of clocks; visible agitation of trees and shrubs; some startled persons leaving their dwellings.
VII. Strong shock: Overthrow of movable objects; fall of plaster; ringing of church bells; general panic without damage to buildings.
VIII. Very strong shock: Fall of chimneys; cracks in the walls of buildings.
IX. Extremely strong shock: Partial or total destruction of some buildings.
X. Shock of extreme intensity: Great disaster; disturbance of the strata; fissures in the ground; rock falls from mountains.

⑤ "A Vanished Niagara", a translation by J. H. Lefèbvre of a paper "Un Niagara disparu" by Benjamin Sulte. The original paper appeared in the *Bulletin de la Société de Géographie de Québec*, Vol. 5, No. 3, pp. 205-211, Quebec, May-June, 1911. The translation was published in the *Bulletin of the Seismological Society of America*, Vol. 18, No. 2, pp. 104-109, Stanford, June, 1928.

⑥ A series of papers by Ernest A. Hodgson, as follows:
(a) "The St. Lawrence Earthquake, February 28, 1925 (A final analysis of the data collected)", *Transactions, Royal Society of Canada*, Sec. IV, Vol. 21, pp. 145-152, Ottawa, 1927.
(b) "The St. Lawrence Earthquake February 28, 1925", *Bulletin, Seismological Society of America*, Vol. 15, No. 2, pp. 84-105, Stanford, June, 1925.
(c) "The Rotation Effects of the St. Lawrence Earthquake of February 28, 1925", *Journal, Royal Astronomical Society of Canada*, Vol. 19, No. 6, pp. 169-178, Toronto, Oct., 1925.
(d) "The Marine Clays of Eastern Canada and Their Relation to Earthquake Hazards", *Ibid.*, Vol. 21, No. 7, pp. 257-264, Sept., 1927.
(e) "The Probable Epicentre of the St. Lawrence Earthquake of February 5, 1663", *Ibid.*, Vol. 22, No. 8, pp. 325-334, Oct., 1928.
(f) "The Timiskaming Earthquake of November 1, 1935. The Location of the Epicentre and the Determination of the Focal Depth", *Ibid.*, Vol. 30, No. 4, pp. 113-125, April, 1936.
(g) "The Cornwall-Massena Earthquake, September 5, 1944", *Ibid.*, Vol. 39, No. 1, pp. 5-13, 1945.

⑦ "Earthquake Damage and Earthquake Insurance", by John R. Freeman, McGraw-Hill Co., 904 pp., New York, 1932.

THE ENGINEER AND HIS RELATION TO HUMAN PROGRESS

A. P. YOUNG, O.B.E.
Chairman, Confederation of Management Associations of Great Britain

Address delivered before the Junior Section of the Montreal Branch of The Engineering Institute of Canada on April 8th, 1946

Before I begin to speak on the subject of my address, I think it is right that you should have a short pen picture of what I am, to supplement the words that I understand have been put on the notice cards inviting you to come to this meeting. Briefly, I have spent over forty years of my life in the electrical manufacturing industry and I was privileged during the whole of that period to work with one of the leading electrical manufacturing concerns in Great Britain and, indeed, in the whole world, the British Thompson-Houston Company. I started with that company when it employed only 260 people and finished my industrial career as such just over a year ago, when the number of employees had expanded to 30,000.

During the whole of that period, I expanded with it and perhaps took a hand in bringing about the expansion to which I have referred. The fact is that for the first twenty years of my industrial career I devoted my thoughts and energies to such design, to inventions, to a consideration of the physical forces and things that come within the sphere of the engineering world; and then when halfway through my career I was given the job, very suddenly, of controlling a factory, and I stepped forward from that point, nearly twenty-five years ago, along the path of industrial management, controlling factories that grew in size and complexity and I found that, quite inevitably, my thinking and energies were more and more absorbed by the human problems involved. The purely technical, mechanistic aspects of my responsibilities moved away from me to be dealt with by the appropriate members of the managerial departments, and finally I reached the stage in pondering these human intangible problems, as I had to, of concluding that if we are going to have a better world at all we have to rely more fully than ever before on education; we have got to view education as being the key that will open the door leading to that better world, and if we are going to use the key aright we shall have to view education in a much broader and deeper way than ever before, and forge new and improved educational implements and techniques to enable us to use the key in the right way. That is just a prelude to what I am going to say to you now.

The engineering era is something relatively new in human affairs. By that I mean that it is very young, roughly 200 years old, and it has evolved very much in step and in phase with the so-called scientific era; but I think it is right and wise that we should get our time perspective clearly, by appreciating the fact that 200 years, whilst it is a long time in relation to the individual, is but a speck on the time chart measuring human evolution on this planet.

Sir James Jeans, one of our greatest astronomers in Great Britain, put the life of the human family at at least

300,000 years, so that if we draw a line representing 300,000 years and put on that line a mark measuring the period of recorded history, roughly 6,000 years, and then a very fine line at the end for 200 years, we obtain a time perspective. I believe it is very helpful to do that in these troublous days because, from a proper time perspective, you have a better chance of developing the right attitude of mind toward the problems that are now welling up for solution.

It is always to me an encouraging, stimulating thought that our progenitors have been struggling and living, loving and hating, and doing all the things that have taken place on this planet for something like 300,000 years, battling with the tremendous forces of nature, concerned primarily with the fundamental struggle to secure food, shelter and clothing. It is an interesting reflection that even in the 20th Century we are again being brought face to face with those fundamental and primordial needs of mankind, especially the first one named, when at this very moment there is a food shortage pressing hard on the world. It was estimated by Sir John Orr many years ago that if we were going to feed the world's population in a right and proper way it would be necessary to nourish fully their bodies and minds and we would have to double the world's agricultural output, and that is roughly the position now.

Yet, during the whole of that time the human family went on and on and on, and I often ask myself why it did so. I submit that it did so for one reason only and that reason is that within the heart and within the soul of man there is something greater than the physical and mental attributes of man himself, that intangible something from God which we call the human spirit, that spirit which in Great Britain in those terrible months of 1940 flamed up to exalted heights such as we had never seen there before and which we are now struggling to recapture in the more prolonged battle to win the peace, the spirit that welled up and infused something into those people that you could not express on paper nor by means of an equation, but that intangible something which in the months of 1940 enabled us within that period to determine the defeat of Nazism.

We have reached a stage where the term "engineering" is now used to designate the activities of anyone who has applied scientific thinking and methods at any stage of the productive cycle, embracing as it does, research, design, planning, sales and distribution and one might even go so far as to say that the term is used to designate the scientific method and approach to any problem in any sphere of human endeavour. It is in this broad and deep sense that I am attempting to visualize the engineer and his relation to human progress, which necessarily involves his influence on and responsibility for human and social well-being.

As a result of the recent developments in the science of electronics and the new sea of wonder and bewilderment revealed by the atomic structure, the engineer now holds the key opening the door to an age of plenty that staggers the imagination. Whether we use the key aright depends not on the rate of scientific development or advancement in the realms of purely material forces and things but upon our ability to serve humanity, upon our ability to solve the predominant problems of human relationships, upon our skill in achieving a unity of purpose and outlook throughout the whole human family concerning economic and social values, upon the success we achieve through education in creating a co-operative world order in which individual nations and groups are prepared to sublimate their localized loyalties to a higher loyalty, which is the common good of humanity as a whole.

Brotherhood has been reverberating through the ages for nearly 2,000 years. It is the cornerstone of Christian faith and we are now face to face with this great issue, whether we like it or not. It is no longer an idealistic vision of a distant tomorrow. Very decisively we should implement this conception in all our plans, political, economic, educational or religious, through international co-operation, or most surely we shall crash into the abyss. There must be one world, one family, and we either learn to live together as one family or we cannot live at all.

Truly the engineering mind has precipitated this crisis in world affairs which has its roots in the ever rising curve of human productivity, the rate at which the individual aided by science, energy and machines is able to produce goods and services. The engineer is not to be blamed On the contrary it is up to all of us to see that he is proclaimed as a benefactor and, when I say all of us, I include the vast team of engineers who, because of their trained qualities of mind and the honesty of purpose that naturally arises from their calling and from their close association with nature's storehouse of materials and forces, they have an opportunity to exert a profound influence on this struggle which they must see with faith and confidence.

There are encouraging signs all to the good that the research teams in the realms of electronics are at last aroused to the dangerous use of some of their discoveries, such as the recent spectacular outcome of the use of atomic power in its relation to human life. It is indeed a pity that scientific workers everywhere did not concern themselves earlier, more critically, with the human element. Rousseau gave a clarion call nearly 200 years ago when he said "Science without morality is a curse". How has all this happened? And why the startling rapidity of the change? The power-driven machine, the proud handiwork of the engineer.

The stream of power-driven machines devised to serve human needs and ease the physical and mental burdens of living is ever widening. The machines themselves are with astonishing rapidity becoming more complex, more wonderful and capable of serving our needs in ways that were undreamed of thirty years ago. Within the lifetime of most of us here we have seen a procession of such machines which by themselves have initiated the greatest social revolution in world history, the internal combustion engine, radio, television, airplanes flown from Canada to Great Britain in just over five hours.

Two of the machines just mentioned are the most wonderful of all, the radio machine and the television machine. They virtually extend man's fundamental senses of speech, sight and hearing so that they can encompass the globe. The world is now compressed into a very small space by the onrushing scientific mind and the 2,000,000,000 humans are thus brought together in an economic, human and social sense, like unto the few hundred people living in a village community in England a century ago.

The cardinal problem overshadowing all of us now is to rebuild the whole house of human relationships to conform with the new conditions of living that have with startling suddenness been forced upon us by the scientific mind, intelligence motivating the thinking and acting of the engineer. One could say that a new kind of human engineering is needed, the engineering of the intangibles and imponderables, an engineering based on philosophy and religion, an engineering which builds lives on the principle of the law of Divine Love, the most practical and dynamic principle in human relationships, an engineering which gives practical expression in all forms of group life, plus group leadership, to the eternal truth that we are members one of another.

While the world in the human and social sense has been steadily compressed by the growing impact of scientific forces, the world of industry has been growing in stature, complexity and strength until it finally has become the dynamic centre of national life. What do I mean by the world of industry? I want to make myself perfectly clear. When I speak of the world of industry I am visualizing a world in which the bulk of the working people everywhere spend the bulk of their wakeful time doing four things.

In one division you have millions of people growing things, the worldwide agricultural industry. In another division you have millions of people mining things. In the third division you have millions of people making things, under the mechanized factory system of production. In the fourth division we have the workers who are moving things, transporting and distributing food and raw materials and the finished products to the community as a whole. Growing, mining, making, moving are the four divisions in the world of industry that I would like to picture for you and when you look at the world in that way it is important that you should not overlook what I feel are two fundamental considerations: first, that roughly 70 per cent of the world's working population at this moment are labouring in divisions 1 and 2, growing and mining the things needed to support life and maintain continuity, that constant, close-to-nature, primordial source of everything—70 per cent.

Secondly, that there is a law permeating everything down through the world, the law of interconnection and interdependence. By that I mean that as we advance into the future we must see to it that we obtain balanced progress on this divisional front. It would be fatal if we secured a big advance in one division at the expense of another division. Look back to 1929 and 1933, to the great economic crises that struck the world. Can anyone doubt now that they were due to our revision of that fundamental law? The people toiling on the soil did not get a square deal. The farmers in Canada—and I happen to know, because I have brothers who have been here for years—were selling their products below cost at that time and if we seek to repeat that process it will be the same. There is a law of interconnection and interdependence under which we must see to it that as we advance we must get balanced progress among these four fundamental big divisions within the world of industry. That is the first consideration.

The second consideration to which I would like to lead you is this: What is the purpose of this world of industry? In the way I have painted the picture I think I have very largely answered that question. There surely can be only one purpose—service; service to all those working within that world, which is the major part of the world's population, and service to the relatively few outside of that world of industry. Translating that into units, I would say that the purpose of the industrial people within the unit is to strive all the time to achieve optimum consumer service. Optimum consumer service means striving to see that the quality, cost and times are balanced. Any industrial organization that puts that objective first before the complete industrial scheme will, in my experience, achieve astonishing success.

Now if I am right so far, then I am right in my next statement. I must be right. Nothing can be of greater importance to each of us here, to the world as a whole, than to see to it that government or management of the world of industry is made as good as possible. How are we going to bring about better government or management of the world of industry? We have got to follow democratic principles. What do we mean by democracy? I think it is very important that we clearly understand what we mean by democracy. It is a much used word. I will try to clarify my own thinking and your thinking by giving you two very simple organization charts.

My first one is a picture of dictatorship and the second is a picture of democracy. The first one has a fuehrer at the top and there is a vertical line connecting the fuehrer to the state and under the state, the individual right at the bottom, the slave of the state. That is dictatorship: fuehrer, state, individual.

The second chart—democracy—is God at the top, a vertical line to the individual and another vertical line to the state, the servant of the individual, based on the tremendous conception of the inviolate link between the individual and his God.

Those two charts are tremendously important. I could not say anything more important than I am saying to you now and if I say nothing more I have probably given the best lecture I have ever given in my life, because we have fought the bloodiest war in history to determine, I hope for all time, that the government or management of groups of individuals, whether in the political, educational, economic or industrial sphere, shall be regulated by the second chart. That is democracy.

It was all beautifully thought out years ago by a great American philosopher, Mary Fuller, who saw that within the world of business or industry there would have to be evolved new leadership techniques, and she expressed the same thought that I am trying to convey to you in these important words: "The leadership we need is not by the whip of external compulsion but by the engendering of the will of others to do it ". That is democratic leadership. That is the second kind of leadership that we have to spread throughout every nook and corner of this world of industry if we are going to advance along the path given us by government or management in a truly democratic sense; and I say decisively that we are now at the crossroads, facing this tremendous issue.

All the problems in the world are very largely revolving around this cardinal problem of the steps we are taking and the rate at which we are advancing along the path of democratic government within the world of industry. In Great Britain we have been steadily moving along this path leading to some form of industrial democracy, for many years, and our rate of movement has been accelerated during the war period. We shall continue to step forward along that path and it may well be that in the years immediately ahead, Great Britain will evolve new techniques, new instruments and leadership within that world, showing others how they have to do the job themselves.

If you are going to apply democratic principles of government or management within this industrial world you have to build up an organization and the process of building up an organization is generally the same, no matter what kind of business it may be. You first have to split up the work into its main functions. You then select teams of people for giving leadership over those functions. You functionalize your business; and then the higher management has to do something which is always the most difficult of all. It has to create a psychological atmosphere in which the functional teams can work together and give this business the very best.

That is something that depends on the character and the mental and spiritual outlook of the higher management and if you are going to achieve the best results you must have at the centre of your organization a planning team. In other words you must plan the direction in which the organization is going to move and above all set out what should be its rate of movement toward clearly visualized goals. Planning, in the sense of which I am speaking, involves in my experience some form of budgetary control.

I referred earlier to the importance of education and I think if we are going to advance along this path heading toward some form of industrial democracy, we shall have to use the instrument of education more fully and effectively than ever before. The right kind of progress connotes the closest kind of co-operation between the world of industry, as I have pictured it for you, and the world of education. They have to be brought very close together. There should be communion of thought and spirit between those two worlds and I believe also that as industry grows in strength and stature and enlightenment, the world of industry itself will have to be evolved and developed through the managerial techniques as an education and spiritual force. I would say that one of the great purposes we should set before the management of this world of industry is not only to make good the things we have been striving to do for many generations, but to couple with that purpose or desire the other privilege and responsibility of making also good men.

The engineering mind, therefore, as I see the picture and the responsibility of engineering, is called to the great task of enlivening and enlightening the dominant field of group leadership and as management evolves along the path of enlightenment it will have to develop a spirit of co-operation as between individuals and groups. In a very real sense co-operation is the key to a better future. We either co-operate with one another as brothers, inspired with the ideal of giving service to all, or most surely we shall crash into the abyss.

This is very easy to talk about but it is the most difficult thing in the world to achieve because its success depends on the forces actuating the heart of the individual, the co-operative spirit radiated by the individual as a function of his attitude of mind, his philosophic outlook, and, above all, of the quality of the religion that motivates his daily life. I believe, therefore, that we can only make the right kind of progress a vital sphere of management within industry by decisively showing Christian principles and proving our earnestness by applying these principles in all our plans, programmes and policies. The managerial structure so dedicated will strive to provide the finest mechanistic devices in the form of the best factory buildings, the best machines, the best and most scientifically planned lay-out, the best working conditions, the highest wage levels commensurate with the highest productivity. The managerial structure must try earnestly to do all these things, conscious all the time that the most important thing within an industrial edifice is man himself with a free personal imagination, a free spirit.

In my long industrial experience I have always found it wise to set before the industrial people a target of achievement, a target that will inspire every member of the team to give of his best, so that as a band of brothers they may march forward toward a distant but clearly visualized goal. In this spirit I would like to conclude by giving you a target for a distant tomorrow, for the whole human family, at this great moment in history, as it strives eagerly to reach a better and happier future. Right at the centre is the bulls-eye and the bulls-eye is the home in which the family spirit of Christian fellowship should prevail.

In Great Britain we are now confronted with a great task of rehabilitating our homes in a physical sense; but also we must rehabilitate them in a psychological and spiritual sense. I believe the same kind of problem faces you here and, indeed, all people everywhere.

Around the bulls-eye of the home you draw a larger circle embracing the industrial family. Here we must strive through improved management to develop the family spirit so that the same kind of spirit that we have in our homes may permeate every nook and corner of the industrial structure where the bulk of the people spend the bulk of their wakeful time.

Around that larger circle I would draw a still larger one enclosing the national family wherein we must strive to have the same spirit of Christian fellowship; and bounding the target I have an outer circle indicating the world family.

Industrial management in the sense I am portraying it is becoming largely an educational and psychological process of group control. Industrial management in the future will have to combine with its technical skill the attributes of the teacher, preacher and artist and in saying this I point the way to revolution in our system of technical education which must come to ensure a proper blending of techniques with the humanities. Such management will be versed in the gospel of humanity and of humility, conscious all the time of its privilege and responsibility of trusteeship, conscious of and interested in what goes on within the human structure it controls but also conscious of and interested in what goes on in the world outside of its localized spheres of activity.

It will seek by all the means in its power to promote further education of itself and of the group it controls and, inevitably, such impulses within the managerial structure, the board of directors, managers, engineers, will surge right down the line to foreman and group leaders and express itself, in a growing measure, in all the processes of government, first within the local community and then in the national community. These interests grow and spread out to the widest spheres of world government. In a real sense we are being forced to train ourselves for world citizenship and industry, because it is a world-flung community service.

What a wonderful objective, leading the world through an enlightened managerial technique to that better future for which all people of goodwill are yearning with aching hearts! Right here is a challenge to the engineering profession, a call strong and impelling for service in rebuilding the house of human relationships which is mainly composed of its industrial planning. Success will depend on our sincere efforts to break down all barriers, economic, political, religious and educational, and to step forward with abiding faith along the path leading to a unity of all peoples is your privilege and responsibility. This prelude to co-operative endeavour has to start within the human heart and mind, and a start can only be made by an individual conscious of his inviolate link with God, his Creator, squarely facing those eternal questions, firm in the conviction that enduring progress is made only when we march along the path leading to greater achievements, and with an abiding purpose of dedicating ourselves to greater and better service.

The solution of this age-long problem leads us to the heart of the Christian faith. It means a continued striving, day by day, to live and act the Christian life. Of course you will say it is an ideal picture, a visionary picture, perhaps even an impossible picture; but surely we have reached the moment in human history when the truth of the pronouncement "Where there is no vision the people perish," is hammering on our inner consciousness with a great deal of insistence.

I believe in long-range planning. Planning services are the golden keys opening the future to all. Whether we open the door will depend on the quality of our vision at this moment. It must be set on the highest spiritual plane. Then as practical men we must eagerly strive to take a little step each day along the planned visionary path, realizing that we may never reach the idealistic target of tomorrow; but even so, a vision to guide, to inspire our daily thoughts and actions will be worth while a hundred times over, and will at least have kept us on the right track and we shall in the course of years have journeyed some distance along the path and in doing so shall have rendered some service to our brothers. But remember that the striving and the struggling, after all, are the things that really matter.

The overcoming of resistance, of obstacles and difficulties is necessary to healthy mental and spiritual growth and only in that way, by overcoming obstacles and resistances, are we vouchsafed the glorious opportunity of living our lives as builders in such a way that future generations may say that we builded well.

WARTIME PRODUCTION OF PRECISION OPTICS IN CANADA

D. C. R. MILLER, M.E.I.C

Development engineer, Fiberglas Canada Limited, Oshawa, Ont., formerly production superintendent of optical shops, Research Enterprises Limited, Toronto, Ont.

This is the third of four instalments of a paper describing the establishment, as a result of war exigencies, of a new industry in Canada. Previous instalments appeared in April and May issues—Ed.

Production Methods—Auxiliary Operations

A few optical parts such as filters and subsidiary optical systems—for example the rangefinder scale-viewing system shown in Fig. 4—are finished after polishing, and when inspected, are ready for assembly into instruments. But all lenses require centering and the majority of them are subsequently cemented into doublets, while these and most other optics are now required to be coated with anti-reflection films to improve transmission. Also the reflecting faces of many prisms and mirrors require silvering or aluminizing, certain prisms have to be cemented together into clusters, and graticules must be engraved. These auxiliary operations, performed on polished optics which are usually of considerable value, are therefore of vital importance and will next be dealt with in turn.

LENS CENTERING

All lenses after polishing are appreciably oversize in diameter, partly to permit edging out any chips which may occur during processing, partly to permit the removal of 'prism'. This condition, which has been mentioned earlier, is illustrated in exaggerated form in Fig. 23. Almost all lenses have some variance in edge thickness after polishing, and this must be corrected by centering.

Reference to Fig. 23 shows that after centering, the thickest part of the lens (with a convex lens) occurs exactly at the geometric centre—that is, optical and mechanical axes have been made to coincide. If a lens is located from one spherical surface and rotated, the image of a light reflected from the other surface will appear stationary when the optical axis of the lens coincides with its axis of rotation. This fact is utilized in most centering methods.

The centering machines have two essential mechanisms —a chuck for holding and rotating the lens and an abrasive wheel for edging it to the correct diameter. The chuck consists of a hollow tapered sleeve of diameter just less than that of the finished lens and bevelled to a narrow rim on the face which contacts the lens. This face must be very accurately trued at right angles to the axis of rotation, by means of a T-rest and hand tool, every time the chuck is removed from the machine. The lens is fastened to the chuck with high-adhesion cement, which is melted by means of a gas gun attached to the machine. After placing the lens against the face of the chuck, and before the cement has set, a hardwood stick is pressed against the exposed face of the lens, as close to the outside as possible, in such a way that the lens tends to slide automatically over the face of the chuck into the position of equal edge thickness. When the image of a light reflected from this face appears stationary, the cement is hardened by a stream of cold water and the lens is then ready for edging. This is done with a diamond or silicon carbide wheel, pivotted and weighted in such a way that it continues cutting until reaching an adjustable stop. The peripheral speeds and wheel types are the same as those described under planar grinding. The wheels must be very carefully trued to prevent vibration and chipping of the lens, and are usually provided with an oscillatory mechanism to prevent grooving of the cutting face. Actually, most of these machines are equipped with two or four chucks on a turret head, so that while one lens is being centered, the other is being edged. As the machine set-up time is considerable, the four-chuck type is the best, because it may be set up for two different lens sizes and quickly changed over from one to the other. A Jorgan machine of this type is shown in Fig. 24. After edging to the correct diameter, which is checked by means of go and no-go ring gauges, the chuck is indexed 180 deg. and the lens bevelled by means of a concave diamond lap or cast iron tool and medium abrasive. A flat brass plate is used for concave lenses, which are chucked with the convex side outwards as this provides the maximum support for the thinnest edge of the lens. Then the lens may be removed and re-chucked for bevelling the other side, or, if centering machine capacity is limited, this may be made a separate operation. After all abrasive is washed off by a stream of running water, the lens is placed in a rack and must be cleaned, by the methods described earlier, to remove the cement before inspection is possible.

Tolerance on edge diameters is usually ± .001 in. With diamond wheels this may readily be held: with silicon carbide wheels more trouble is experienced owing to wheel wear. The accuracy of centering required varies with the lens focal length and diameter. In most medium-power telescope systems, centering accuracy within .001 in. is sufficient.

Centering is an operation requiring intelligent and careful operators and skilled machine set-up. Lenses may be lost through inaccurate centering, inaccurate size, chips, scratches, and rings (marks from the chuck or centering stick). Losses with flint lenses are appreciably higher than with crowns, owing to their greater edge weakness. Lenses with excessive prism or large chips will not center out and must be discarded. It is seldom worthwhile to attempt to salvage centered lenses with surface damage, as the slightest amount of prism during reblocking and polishing would make them impossible to center out. Some firms do, however, salvage expensive lenses in this way.

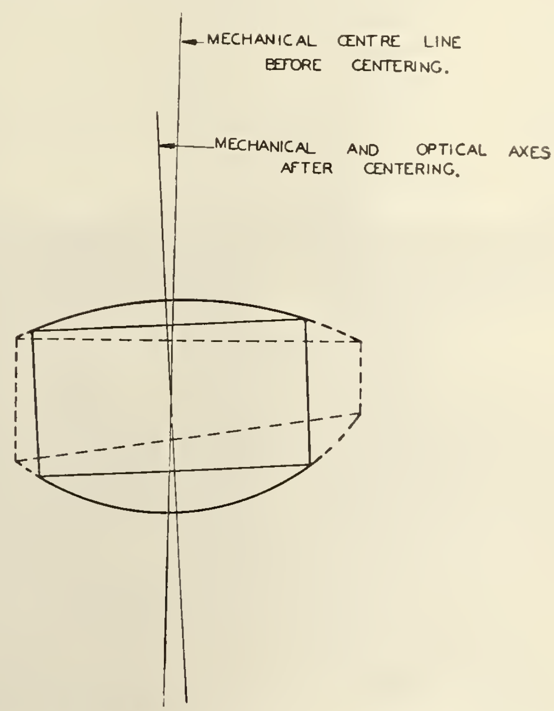


Fig. 23—Diagram illustrating the mechanism of lens centering.

Production rates for single components using diamond wheels vary from 25 per hour for $\frac{3}{4}$ in. diameter plano-convex lenses to 10 per hour for $2\frac{1}{4}$ in. diameter concave-convex lenses. For a given diameter, flint components take about ten per cent longer than crowns.

LENS AND PRISM CENTERING

Up until the last few years, Canada balsam was in universal use as an optical cement. This natural resin was available in liquid and solid form, and all stages of viscosity between, thus making it a versatile and useful cement. When applied as a liquid it was baked until the volatiles were removed, and by prolonged baking any desired degree of hardness was obtainable. Unfortunately, however, if the hardness of Canada balsam is made such as to withstand high temperatures, its low temperature properties are impaired, and 'flares'[1], 'balsam-starts'[1], or complete separations occur. 120 deg. F. may be considered the upper limit for a practicable Canada balsam and even at this temperature some softening and relative movement between parts tends to take place. The trend with military optical instruments has been to extend the temperature range requirements at both ends, so that some specifications now call for ability to withstand temperatures from —40 deg. F. to +160 deg. F. and these requirements can only be met by synthetic cements. Although Canada balsam was in full scale use up to the end of 1943, it may now be considered as obsolete, and cementing techniques for this material will therefore not be described here.

There are at present two main classes of synthetic cements in use—the high temperature thermoplastic type as represented by n-butyl methacrylate, and the thermosetting type as represented by the Pittsburgh Columbia resin CR-39, an allyl monomer, used by us under the designation PKR-15. Each of these types has certain advantages, but as we preferred the latter and used it exclusively from 1944 onwards, the following remarks will be confined to this type.

PKR-15 monomer is a thin, clear, colourless liquid. With the addition of a catalyst, polymerization takes place slowly at room temperature, and rapidly with heating, the liquid passing successively from a syrupy stage with increasing viscosity, then to a gel, and finally to a clear, hard and chemically very resistant solid. In preparing the material, it must be very carefully filtered after addition of the catalyst to remove all vestiges of dirt and undissolved matter. It is then heated until it partially polymerizes to the desired viscosity, transferred into small glass bottles, and stored at 32 deg. F. until ready for use. In this way it can be kept for several weeks. Enough cement is issued daily for the current day's needs and any surplus remaining is discarded.

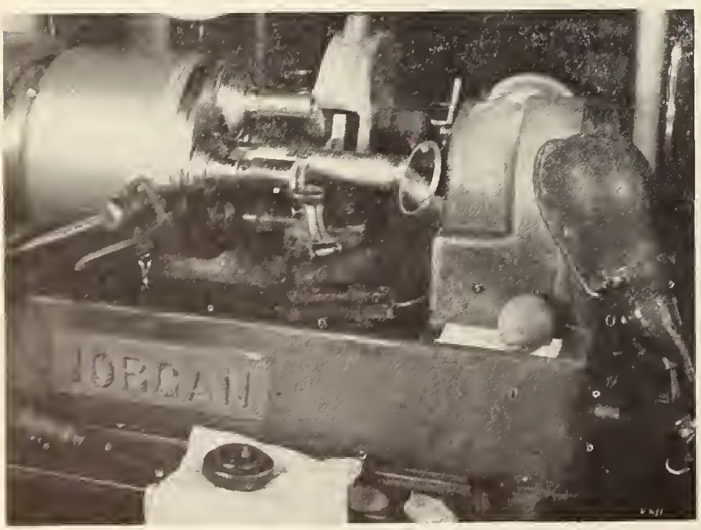


Fig. 24—Jorgan lens centering machine.

For lens work, the cement is used as a free-running syrup, viscosity 450-500 Saybolt seconds at 75 deg. F. For prism work, where the thinnest films are often necessary, and air bubbles harder to work out, the preferred viscosity is that of a thin watery syrup, say 350 Saybolt seconds at 75 deg. F.

Optics are prepared for cementing by first immersing in a warm 1-3 per cent soft soap solution, with added wetting agent; then they are wiped off with a soft linen or closely-woven cotton cloth, and finally brushed off with a camel-hair brush to remove every particle of lint and dust. These operations must be done under a strong light with very great care. Lenses, after centering, are cemented cold, using an eyedropper or glass rod to apply a drop of cement to the centre of the flint component. The crown is quickly placed on top and air bubbles worked out by sliding one piece over the other with a pencil eraser. After roughly registering the edges, any excess cement is wiped off. We tried several different methods and found that the simplest and best way of keeping the two components in alignment during baking is to lay the doublets in rows on edge with brass spacing rings between and roll them up into cylinders about 4 in. long, using thin cellophane sheet secured with scotch tape. In this form they are placed in small thermostatically controlled electric ovens and baked for 3 hours at 175 deg. F. to set the cement. This apparently crude method retains centering accuracy within .001 in., and has the additional advantage over other methods (such as V-blocks) that air is excluded from the edges of the lenses during baking—and with PKR cement this is important in reducing the number of edge separations or 'flares'. It is best to place the doublets in the oven cold, and bring them gradually up to temperature, and likewise to anneal the cement film by shutting off the heat and allowing them to cool slowly to room temperature in the oven.

To increase the speed of lens cementing, we built a machine operating on a conveyor-belt principle. The doublet components are first cleaned as previously described and placed in pairs on the conveyor belt. This passes through an electric oven and heats the doublets so that they emerge at a temperature of 210 deg. F. The cementing operator takes the doublets as they emerge and places the flint component, concave side uppermost, on a holding fixture[2]. After being positioned centrally on the holding device, a vacuum valve is opened and holds the lens firmly in position. A metered quantity of cement is next squirted into the concave face of the flint lens, the crown placed on top and bubbles worked out. The crown is then aligned with the flint in the same fixture. The two are held in this position for 30-40 seconds, at the end of which time the cement has hardened enough to permit handling, the vacuum is released, and the doublet automatically ejected onto a conveyor which takes it to the cleaning stage, for removal of excess cement. The doublet is kept hot by electric resistance heaters while in the fixture, which it is better to have in duplicate, so that while one lens is setting, another may be being cemented. After cleaning, the usual baking follows to complete polymerization of the cement.

Production rates with manual cementing methods vary from 17 per hour for doublets under 1 in. in diameter to 12 per hour for the sizes 2 in. and over. Use of the cementing machine reduces these rates by about 20 per cent in terms of man-hours. Rejections average between 5 and 10 per cent, mainly for edge flares and eccentricity. The latter may be checked optically, or more usually by the use of a ring gauge.

For cementing prisms much the same technique is used as for lenses. Most prism clusters require special holding and adjusting jigs to facilitate relative movement of the

[1] Types of partial separation.

[2] Details withheld from publication.

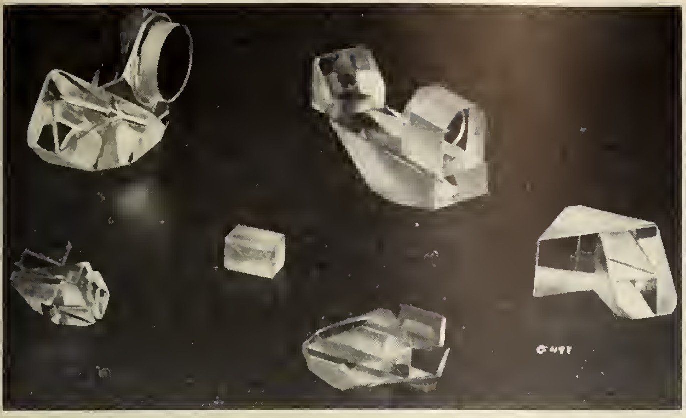


Fig. 25—A group of cemented prism clusters.

prisms during cementing and to maintain alignment during baking. Special optical fixtures may be necessary to adjust the prisms into their correct relative positions. Rangefinder centre prism clusters (Fig. 4, detail) are a good example of this class of work. The cementing of these clusters at production rates of 450-550 per month was probably one of the most difficult tasks of all those undertaken by Research Enterprises Limited. These clusters are built up in stages. After the first stage, certain faces of the combination must be hand-polished. Because of trouble with PKR cement during hand polishing it is found advantageous to cement these pieces with Canada balsam, then take apart and recement with PKR. Part of this cementing operation involves cementing a cover glass over the focal plane. Focal plane surfaces of this sort are cleaned off with a silk handkerchief and pure grain alcohol. The most scrupulous cleanliness must be observed, as the work is rejected for dirt visible only under a 7-power magnifier. Clusters of this sort require 4 to 5 man-hours of work in cementing. A typical selection of cemented clusters is shown in Fig. 25.

Edge flares are the biggest single cause of rejects in prism cluster cementing—partly because it is difficult to exclude air from the joints during baking, and even when this is done, as with a CO_2 atmosphere, there is still trouble. Temperature cycle control during baking appears to be important. The baking cycle ultimately used was similar to that for doublets, but the clusters were brought up to temperature more slowly, held there longer, and cooled off over a 5-hour period. Provision of the widest possible bevels at the edges of cemented joints is also advantageous. With all the various troubles encountered, a recovery of 50-75 per cent of the clusters cemented is considered satisfactory.

Work which requires de-cementing for any reason is best separated by thermal shock. There are several recommended methods, but we found the most satisfactory to be the blue flame from a Bunsen burner applied to the edge of the cemented joint, until the pieces 'pop' and can be separated with a razor blade. Any method used with this cement, owing to its inherent qualities, has to be drastic to effect separation and there are bound to be losses from breakage. With prisms, these may be as high as 20 per cent or more.

Another unfortunate feature of this cement is that it attacks the skin of the operators wherever it touches, and hands must be frequently washed, and contact with other parts of the body avoided, to prevent incapacitating dermatitis.

ANTI-REFLECTION FILMS

It is now some fifty years since the reduction in surface reflection by means of a thin transparent surface coating was first observed, but it is only within the last five years that the methods of applying such films and their durability have made them practicable for other than laboratory purposes. The use of anti-reflection coatings on almost all optical surfaces is now mandatory in military fire-control instruments.

With a plain polished glass component, from 4 to 7 per cent of the incident light is lost by reflection at each air-glass interface; but if these interfaces are coated with a transparent film of thickness equal to 1/4 of the wavelength of the incident light, interference occurs between light reflected from the glass-film and the film-air surfaces, so that the net amount of reflection is reduced to 0.6-2.0 per cent. In all but the simplest military instruments there are sufficient air-glass surfaces to effect an improvement of 40 per cent or more in light transmission if the optics are coated. In the more complicated instruments transmission may be more than doubled. Instruments with coated optics have higher brilliance and contrast of image which makes them more useful under the poor lighting conditions at dawn and dusk.

It can be shown that the anti-reflection effect is a maximum when the refractive index of the film is equal to the square root of the refractive index of the glass. Since most optical glasses have refractive indices lying between 1.5 and 1.7, this would necessitate a coating material of index between 1.2 and 1.3. In practice, materials of index closer to 1.4 are necessary for durability. For this reason such coatings are more effective on glasses of high refractive index. The presence of anti-reflection coatings is readily determined by the characteristic coloured reflection or 'bloom' when viewed at a low angle of incidence. The shade of colour in daylight varies from a yellow-red (450 milli-microns) to purple-blue (600 milli-microns), the former indicating a thin, and the latter a thick coating. Green, brown, or blue coatings are outside the acceptable thickness range. In judging the film thickness from the colour, the refractive index of the glass must be taken into account, as interference effects are stronger, and colours more intense, with the high-index glasses.

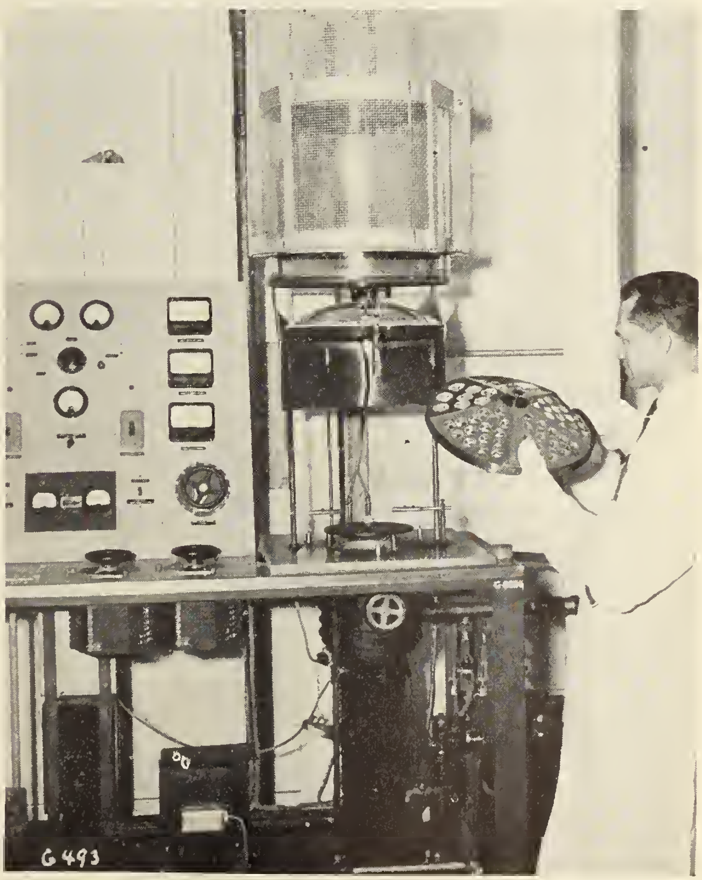


Fig. 26—General view of fluoriding equipment showing bell jar in raised position and work holding fixture.

Numerous different methods have been tried for applying anti-reflection films, including acid-etching of the glass surface to produce an artificial 'tarnish', and deposition by chemical means of various organic and inorganic materials. At present, however, the method in common use is a physical one in which the coating material, usually magnesium fluoride, is melted and evaporated in an extemely high vacuum and condenses uniformly over surfaces exposed to it, in a manner which permits close control of film thickness. Although this process was not employed on a large scale at Research Enterprises, since outside facilities already existed close at hand, a pilot unit was operated for emergency use, and it is believed that details of the methods are of sufficient interest to warrant inclusion here.

Evaporation of the magnesium fluoride is carried out in large pyrex glass bell-jars, about 3 ft. high and 18 in. dia. sealed onto a flat polished steel plate by means of a rubber gasket. The magnesium fluoride, in the form of a fine powder, is placed in a small porcelain crucible in the centre of the base plate, directly over the pump inlet opening. This crucible is heated by radiation from a heavy tungsten filament directly above it. The work to be coated is loaded into shallow recesses in a jig so designed as to give a spherical arrangement of the work about 18 in. above the fluoride source, with the surfaces to be coated facing downwards. The pumping system consists of an oil-distillation pump in series with a high capacity rotary vacuum pump. About 20 minutes is required for pumping down the bell-jar to an operating vacuum of 10^{-4} to 10^{-5} mm. of mercury. Down to 10^{-3} mm. the vacuum is measured by a Pirani gauge, and thereafter by an ionization gauge. When the necessary vacuum has been attained, the magnesium fluoride is melted and raised to a temperature of about 1500 deg C. During this period a baffle plate over the crucible prevents any coating. This plate is then swung aside by a powerful magnet from outside the jar and coating commences. Thickness of film is controlled by a disc of glass coated on the upper side to the correct colour and placed in the jig amongst the work in such a way that it may be observed from above. The coating is permitted to continue until the reflection from the lower surface of the test sample agrees in colour with its upper surface. This usually takes 5 to 6 minutes, so that the whole cycle occupies about 30 minutes.

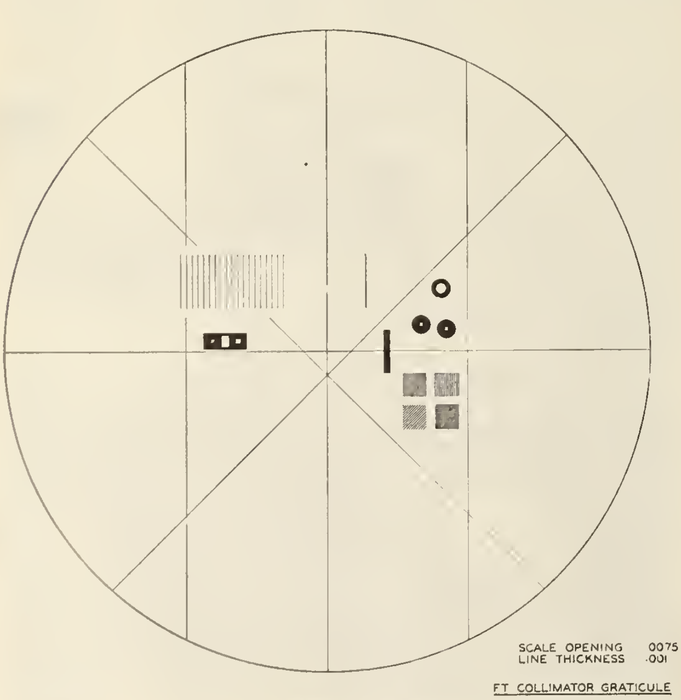


Fig. 27—A typical photographic gratucule for assembly equipment use.

The number of pieces which can be run at one loading of course depends on size and shape. With lenses in the usual range of sizes it varies from 30 to 100. Considerable time may be saved with windows and lenses by arranging the jig in pivotted flat segments which can be turned upside down by a magnet from the outside, so that one pumping cycle serves for both surfaces. The cost of applying fluoride coatings is inevitably high and not much less than chemical silvering. A general view of the fluoriding equipment, with the bell-jar in the raised position and showing a holding fixture for lenses, is given in Fig. 26.

The points to be carefully watched to ensure uniform, durable coatings are these: perfect cleanliness of the optics, baking of the optics during the coating cycle, a controlled quality of magnesium fluoride, use of the highest attainable vacuum, and avoidance of back-coating.

At one time, drastic chemical methods were used for cleaning preparatory to coating, but it now appears that the methods described under cementing give good results when carried out in a temperature-, humidity-, and dust-controlled atmosphere.

During the last two years it has been learnt that baking during fluoriding greatly improves the hardness and adhesion of the film. It is therefore standard practice at present to pre-heat the optics while pumping down to the right vacuum and continue the heating while coating proceeds. This is done by means of coiled radiant heaters inside a spherical aluminum reflector placed directly over the work and visible in Fig. 26. A temperature of not less than 250 deg. C. is thus maintained on the work throughout the cycle, care being taken to keep below the annealing range of the glass.

The magnesium fluoride must be chemically pure and free from absorbed moisture, otherwise it will splutter when melted and cause spatter-marks on the work. This trouble may be reduced by gradual heating of the crucible towards the end of the pumping cycle.

The holding fixture must be so designed that there are no openings round the work through which the fluoride vapour may pass and partially coat the back surfaces. Otherwise, adhesion on these surfaces will be poor after they are coated. Such back-coatings are also objectionable on the reflecting faces of prisms, especially if these are required later to be silvered.

After fluoriding, the optics are inspected for surface imperfections, correct colour and durability. Colour is checked by visual comparison with known samples. Durability is checked by giving each surface 20 double rubs with a special pumice-loaded rubber pencil eraser using a pressure of 2-2½ lb. Surfaces which will withstand this test require no special handling care.

Properly applied fluoride films are very difficult to remove if rejected for any reason. Of the numerous mechanical and chemical methods so far tried, the best appears to be soaking in hot concentrated phosphoric acid for periods of 15 minutes to 2 hours. Mixtures of boric and sulphuric acid are sometimes effective. Another method is alternate immersion for 5 minutes in saturated potassium hydroxide solution, followed by dipping for 30 seconds in concentrated nitric acid. This cycle is repeated 3 or 4 times as necessary. All these methods, particularly the last, are likely to etch the glass surfaces, because the fluoride film does not dissolve uniformly and before it is all off, large areas of bare glass may have been exposed to chemical attack. Mechanical removal by polishing is usually impracticable.

Lenses which require fluoriding are coated after centering, the cemented surfaces being of course left uncoated. The temperature of baking during fluoriding makes coating of doublets impossible with present cements.[1]

[1] Recent development of silicone optical cements may change this to advantage in the near future.

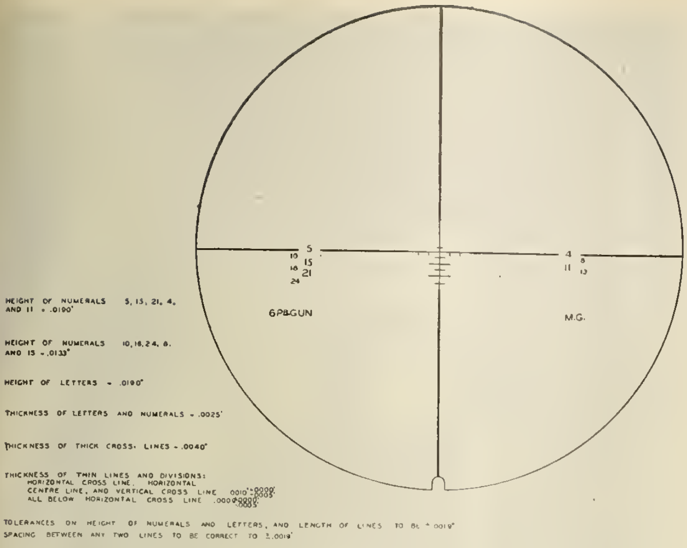


Fig. 28—A typical sighting telescope graticule produced either photographically or by ruling and etching.

Focal plane surfaces are left uncoated at present, because so far it has been found impossible to avoid the minute surface imperfections which are considered inacceptable for such use.

METALLIZED SURFACES

Metallizing of optical surfaces is usually necessary in order to provide front-surface mirrors (CA-2, Fig. 2) or semi-opaque films of very high density. There are two basic methods used, in both of which the metal is volatilized and condensed on the glass. In the process known as 'cathodic sputtering' the metal is bombarded with gaseous ions in a moderate vacuum (10^{-2} mm.). The other method involves evaporation of the metal in a very high vacuum and is the same in principle as that used for fluoriding[1]. The latter process only will be discussed here, as it has now virtually superseded the other, being both quicker and cheaper.

Aluminum is the metal most commonly used for front-surface mirrors because of its high reflectivity, second only to silver. Such coatings are highly durable in normal atmospheres, being protected by the formation of a very thin transparent film of oxide. The metal is first melted directly on the tungsten resistance coils by hanging over them short lengths of aluminum wire. When the aluminum melts it wets the tungsten wires to form a uniform film all over them, and in subsequent heating to higher temperatures, volatilizes and condenses on the glass. As the aluminum has poor adhesion to glass when applied directly, it is customary to apply first a coating of metallic chromium which has very high adhesion to glass. The chromium is placed in lump form in the centre of a closely wound coil of tungsten wire and sublimates to a vapour when heated to incandescence. Because of its softness, the aluminized surface is difficult to clean without marring and hence is easily rendered useless by fingermarks in handling during assembly. For this reason, it is sometimes protected by a coating of transparent material such as quartz or magnesium fluoride. If quartz is used, it is evaporated from a crucible of molybdenum, tantalum, or tungsten. All three coatings—chromium, aluminum and protecting film—are applied successively with but one pumping. The thickness of transparent film must be such that no interference results—a second order film, one half wave-length thick, with a light yellow colour in reflection is satisfactory, but all such films reduce reflectivity somewhat. For naval use, where mirrors may have to meet a salt spray or salt atmosphere test, organic coatings of cellulose nitrate or polyvinyl acetate are used, applied by spinning. These are of doubtful durability.

Aluminum mirrors rejected for any reason are difficult to strip because of the chemical resistance of the chromium coat. After removal of the aluminum with alkali, the chromium may be stripped using strong nitric or sulphuric acid, activated by the presence of powdered metallic zinc.

Rhodium or other precious metals are applied by electro-plating the tungsten heating wires. Rhodium mirrors have good handling qualities and durability, but about 13 per cent lower reflectivity than aluminum. No protecting coating is required, however. Semi-opaque rhodium films of extreme density are used on some of the larger rangefinders for sighting into the sun when adjusting the infinity range setting. Silver may be deposited in the same way as rhodium, but the method appears to have no advantages over the standard chemical means.

The presence of dust particles on the glass surface before metallizing results in small pinholes which, if numerous, are cause for rejection. Particular attention must therefore be paid to cleaning. The same trouble also results from minute grinding pits in the surface, so that a high quality of optical polish is necessary for the best results. For this reason, ordinary plate glass, unless specially selected, is seldom satisfactory for metallizing.

Metallic films of the highest reflectivity are obtained only by strictly controlled conditions of vacuum and glass cleaning and moderate rates of deposition.

CHEMICAL SILVERING

Mirrors and reflecting prism faces which require silvering are silvered by the standard Brashear or Rochelle Salts methods, which are sufficiently well-known to require no description here. The Bashear method gives deposits of slightly higher reflectivity, and use is sometimes made of this to balance the brilliance of two separate optical systems, viewed side by side. In some coincidence-type rangefinders for example, the left pentagonal prism is silvered by the Brashear, and the right by the Rochelle Salts method. After deposition of the silver a thin coating of copper is electro-plated on, followed by a suitable backing paint, which may be of asphaltic or bituminous base, or a standard mirror-backing lacquer. These may be applied either by brush or spray. Neither backing appears to be entirely satisfactory. The bituminous paint remains soft and elastic at normal temperatures, but is

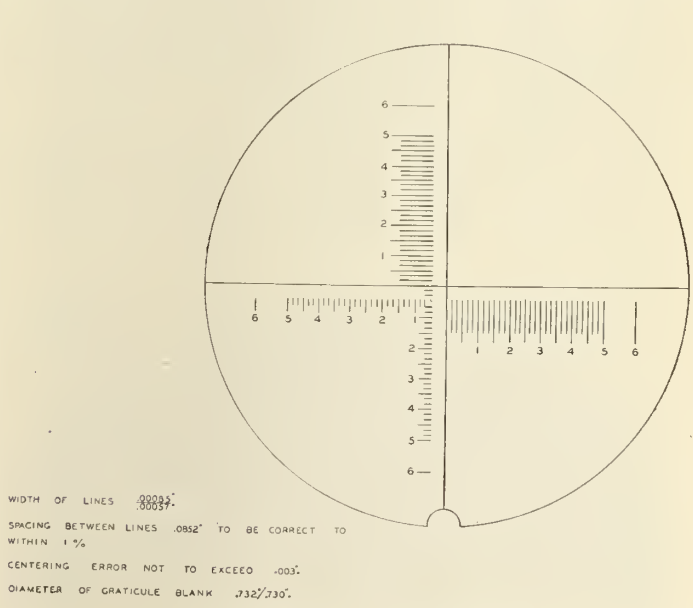


Fig. 29—An intricate design of very fine lines produced by ruling and etching.

[1] See S. Bateson—Vacuum Evaporated Films on Glass (Canadian Chemistry and Process Industries, August 1943.)

subject to handling damage during assembly. The lacquer type backing tends to transmit shrinkage stresses through to the silver on drying, so that there is danger of it peeling when subjected to frequent wide temperature variations. Where prisms are exposed to extreme weathering conditions, as in tank periscope prisms, thin lead foil may be cemented over the paint for additional protection.

There appears to be scope for further research to develop more durable silver backings.

ENGRAVING

Of all the auxiliary operations performed on polished optical components, that of engraving is probably the most difficult. To engrave fine lines and figures within a tolerance sometimes of ± .00015 in. in width and as little as half this amount in spacing, and with designs often of considerable intricacy, necessitates the utmost in skilled attention to detail and precision equipment. The already great difficulties are still further increased by the fact that the engraving has almost invariably to be carried out on focal plane surfaces, where the most minute surface defect, whether introduced during etching or during the necessarily large amount of handling, may be cause for rejection. The engraving itself, too, is viewed in the instrument under high magnification and must be correspondingly perfect. It is the maintenance of these high standards of engraving and surface quality which constitute the principal difficulty, once the necessary equipment is available and the techniques mastered.

There are two basic methods by which patterns of fine lines and figures may be applied to polished glass surfaces: photographically, whereby the design appears as an opaque raised coating adhering to the glass; and mechanically, whereby the design is ruled through a resist, acid-etched, and rendered opaque by filling. These are the two methods which we used successfully and which will now be described with a minimum of detail. Other methods are also used elsewhere, of which brief mention will be made later.

Photo-Embossing

Photo-embossing, by its very nature, is not a satisfactory method for production use: the figures and lines, sometimes as fine as .0005 in. wide, no matter how well applied, are too easily damaged during assembly, to say nothing of serviceability in the field. It is however a valuable method of producing the intricate designs sometimes needed in optical assembly equipment, and also where several different line widths are required. Two such examples are shown in Figs. 27 and 28, the first being an assembly collimator graticule for the coincidence-type rangefinder, the second the graticule in the sighting telescope, No. 33 Mk. 1 (Fig. 1, BB-9).

For photographic graticules we used the English bichromated glue method. With this method the graticule is first coated with an emulsion of engraving glue and potassium dichromate, and an image of the required design projected onto it from a photographic negative, using a very powerful light and an exposure of the order of several minutes. This renders the exposed portion of the emulsion relatively insoluble and the remainder is then washed off in running water, leaving the design as a darkened, raised pattern on the surface. A preliminary baking for 20 minutes at 100 deg. C. follows, to harden the design sufficiently to withstand handling, after which any stains are very carefully removed by swabbing with cotton-wool and alcohol. The pattern is next intensified and opacified by immersing in chemical solutions which impregnate it with lead ferricyanide. This in turn is converted into lead sulphide, a dark opaque pigment, by immersion in ammonium sulphide. The intensification treatment is repeated as many as three or four times until sufficient opacity is obtained. If carried to excess, however, no glue will be left to act as a binder, and the deposit will be powdery and easily removed. The design is then finally baked for ½ hour at 225 deg. C. to complete the hardening process.

Fig. 30—General view of Wilcox multiple engraving machine, showing tool arm at left, master and stylus at right.

In making the necessary photographic negative, a scale drawing must first be made 30 times or more full size, reduced to perhaps three times size after photographing. Extra illumination may be required round the outer portion of the drawing in order to give fine clear lines near the edge of the field. The very highest quality photographic objectives are necessary both for making the negative and for the projection lens, to obtain undistorted lines, clear definition, and even illumination all over the exposed surface of the graticule.

The photographic process is not simple, especially as the length of exposure and amount of intensification must constantly be varied to suit the changing characteristics of the animal glue, and these changes may in turn affect line width. With skill and experience, however, line widths may be held within .0002 in., with a minimum width of .0005 in. To protect very fine patterns, a cover-glass is sometimes cemented over them—the most difficult class of cementing work.

The preparation of the original negative is the most expensive item, but once this is available, large runs may be made at costs comparable with those of mechanical methods.

Mechanical Ruling and Etching

With the mechanical methods of engraving, the graticule is first coated with a wax resist, the design ruled through it, and the portions of the glass thus exposed etched to the requisite depth and filled with some opaque substance.

Simple straight line designs may be ruled singly or in multiple with a dividing machine having an accurate lead-screw. Intersecting lines may be ruled either by means of an additional traversing lead-screw or by rotating the graticules the required amount and using the main lead-screw.

Undoubtedly the best mechanical method of ruling is with a pantograph-type machine, as this is equally adaptable to the simplest and the most intricate designs, and for figures as well as lines. But unfortunately we very early found that there were no commercially-available multiple pantograph machines of sufficient accuracy to be able to repeat or re-rule a very fine line without appreciably increasing its width, and this requirement is fundamental in fine work involving ruling through a wax resist, especially for clearing the intersection points of lines, letters, or numerals. Other firms had solved this problem by designing their own machines, using either inelegant and cumbersome arrangements of wires and weights to support the moving arms, or buoying them in pans of viscous liquid—a machine of the latter type at the Eastman Kodak plant at Rochester being familiarly known there as The Two-Ocean Navy. Whatever method is used, some means has to be found to support the pantograph arms in all possible positions, in order to remove backlash or lost motion due to spring and bearing play. The machine which we built for this purpose was designed by Mr. R. Wilcox, who was also responsible for the lens cementing machine already described. This design is a considerable engineering achievement, and solves the problem so successfully and so unconventionally as to justify some description of its main features.

In the Wilcox multiple-pantograph, of which a general view appears in Fig. 30, the arms are supported by disc-type bearings resting on an accurately flat polished surface plate about 5 ft. square. The bearings devised for this purpose are discs of varying size, fed with dried and filtered compressed air at moderate pressure. The air acts as a lubricant and permits the bearings to slide over the surface plate virtually without friction, even though carrying an appreciable load. A sufficient number of these bearing pads are disposed along the pantograph arms to give them uniform support. The pivotal bearings of the arms themselves are made of large diameter spherical balls lapped into spherical seats, the amount of pressure at each pivot point being adjustable in such a way as to permit applying the least amount of pressure needed to maintain contact between the balls and their seats, reducing bearing friction to the minimum without backlash. The centre-to-centre distance between pivot points on the main arms is about 40 in. and these centres are accurately jig-bored to ± .0001 in. to ensure perfect operation in all positions. The arms themselves are of special light-weight construction.

This pantograph machine is designed for ruling 14 graticules simultaneously, with a reduction-ratio of 10:1 from the master pattern. The fourteen cutting points are carried in specially ground and polished steel slides of lozenge-section, running on small spherical balls in ground and polished cylindrical sleeves, split and spring-loaded, and interconnected so as to permit raising and lowering all tools at once between cuts. Very careful design is required here as the least play in the slides would spoil the accuracy of the machine, yet the amount of friction must be negligible in order that the pressure on each point may be individually adjusted to a fraction of a gram. This pressure is controlled by sensitive coil springs and must be adjusted by trial and error to suit the width of line and characteristics of the wax resist. The raising and lowering of the tools is effected pneumatically from a solenoid valve operated from a micro-switch in the stylus which follows the pattern in the master. When the stylus is released to transfer to a new figure or line, the tools are all automatically raised, and are dropped again to resume ruling when pressure is next applied. A dashpot mechanism ensures that the delicate cutting points will not be damaged when this occurs. The graticules are held face upwards in 3-jaw chucks specially designed to retain centering accuracy within .001 in. over a range from ¼ to 2 in. in dia. A front view, showing the tool arm, 14 cutting points, and chucks, is given in Fig. 31.

This machine is so accurate that it will rule the same pattern over and over again without increasing the line width by any more than .0001 in. Because of this characteristic, it may be used for ruling lines of different widths in the same graticule. The graticule in Fig. 28 was ruled by this means in very large numbers. The most convenient way of accomplishing this without changing the line width on the master is to raise the stylus to a fixed stop and rule first down one side of the groove, then the other, then drop the stylus and rule down the centre. The stylus point and groove are both V-shaped, so that by this means the line width may be increased several fold. At intersections, whether of lines or in figures, the best results are obtained by having horizontal and vertical portions of the design on two separate master plates, arranged so that one may be exactly superimposed on the other, and the two ruled successively. This ensures crossing the lines in the right sequence and proper removal of the resist at intersection areas.

Accuracy of line spacing and length is limited only by the accuracy of the master and as this is usually machined on a jig-borer, the ruling accuracy of the pantograph is perfect within the limits of measurement. Once in operation late in 1942, our problems of large-scale production of graticules were solved. With simple patterns an output of 4 loads per hour (56 pcs) may be obtained with one operator. The more intricate designs (Fig. 29) may require as much as 45 minutes per load, and to rule them is a difficult and exacting task.

The cutting tools used for ruling are of vital importance in affecting the results, and making them is by no means the least of the difficulties involved. There are two main problems: the correct hardening and tempering of the points, and grinding to the correct shape. The material best suited for this purpose is 1.1 per cent carbon steel drill rod, about .060 in. dia. hardened to 62-64 Rockwell C by heating for 5 min. at 1,490 deg. F., quenching in 10 per cent brine, and tempering at 400 deg. F. for 10 min. It is important that this be done before the point is ground, as otherwise proper hardness will not be secured at the extreme tip owing to decarburization on heating. The cutting point must then be ground to an approximate 60 deg. included angle, with a flat on the end equal in width to that of the line to be ruled. The average lines are about .0015 in. wide, ± .0003, and the finest .0007 in., ± .00015. To maintain these tolerances involves holding the width of flat on the point within .0001 in., and the flat itself must be polished and accurately at right angles to the axis of the tool. Considerable difficulty was experienced in making these tools until we designed a special grinding machine for that purpose. In this machine the point is held in the collet of a small jeweller's lathe, on the compound of which a grinding spindle is mounted. The rotor of this spindle is driven by a compressed air jet

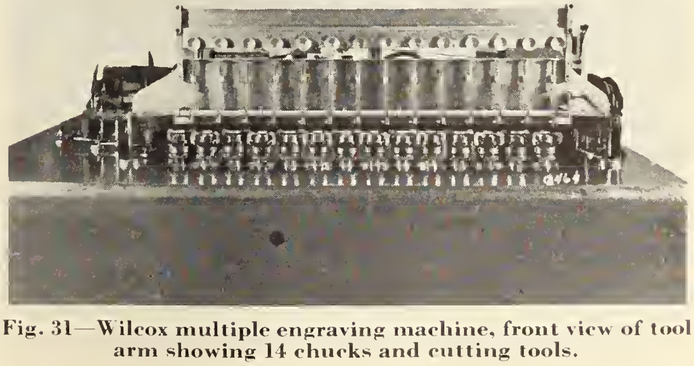


Fig. 31—Wilcox multiple engraving machine, front view of tool arm showing 14 chucks and cutting tools.

and the spindle runs in a compressed-air-lubricated bearing. The spindle revolves at 160-170,000 rpm., and a fine silicon carbide wheel is mounted directly on the end of the rotor shaft, in such a way that it can be used either for edge or face grinding. Grinding is done under a high-power microscope fitted with an eyepiece graticule with fine graduations for measuring the width of flat. With this equipment it is possible to hold the necessary tolerances without undue difficulty.

The life of properly made steel cutting points is two weeks or more of continuous use. For this reason we made no efforts to try natural or synthetic gem points, after finding no manufacturer able to supply them to the requisite tolerances.

The first operation in producing etched graticules is to coat them with a very thin film of a resist composed of an equal mixture of ceresin and carnauba waxes[1], carefully filtered to remove dirt. This mixture is melted in small thermostatically controlled electric melting pots and applied by spinning directly onto the rapidly revolving graticule surface. The temperature of the wax, speed of spinning, and amount applied must be so chosen as to give the right film thickness, as determined by trial and error from behaviour during ruling and etching. Too thin a coat results in the acid etching right through the resist; too thick a coat causes shallow rounded lines which may be impossible to fill. The resist is then baked for 20 minutes at 70 deg. C., to remove any possible porosity, after which the design is ruled as already described. Every graticule after ruling is inspected under a 15 power microscope for ruling defects and defects in the resist which are marked for later re-touching. One graticule in ten is checked under a measuring microscope for correct line width, spacing, and centering of design. The ruled surface of the graticule is then given an additional protecting coat of resist all round the pattern and wherever local retouching is required. This is applied by hand with a small brush. The graticules are next waxed onto small brass plates equipped with handles and these are stacked together with spacers between so that about 20 graticules may be etched at once.

Etching is carried out in a large, shallow, lead-lined tank with a fume-hood overhead. The tank is filled about 6 in. deep with water and the wax pot holding one pound of acid placed in the middle. The acid normally used is 60 per cent hydrofluoric, which is satisfactory for the easily etched barium light flint glass normally used for graticules. If commercial colourless plate or other crown glass is used, a stronger etching action is obtained by adding up to 40 per cent concentrated sulphuric acid and using after the mixture has cooled. The time of immersion varies from 3 to 5 seconds and is critical to less than ½ second. Too long an immersion will result in undercutting of the lines and etching pits from local failure of the resist. Too short a time causes shallow irregular lines which are impossible to fill. After lifting from the acid, the graticules are instantly plunged into the surrounding water and rinsed off. They are then heated off the brass plates and loaded onto racks for removal of the resist. This is accomplished with a minimum of handling in a small degreaser of the trichlorethylene vapour type, after which the graticules are ready for filling.

The filling of fine engraved lines was once one of the most troublesome of all the engraving operations. After experimenting with the materials most commonly used elsewhere—hard black waxes and very quick setting mixtures of metallic oxides and sodium silicate—we have found the best material to be a standard white baking enamel. This appears black in the instrument and is better than other filling agents on graticules which are edge-illuminated for night use. The paint is applied with a cotton wool swab, under a low-power microscope, allowed to harden for a few minutes, and the excess wiped off. The filling is then baked for about 1 hour at 350 deg. F. and any surface residue of paint rubbed off with cotton wool and alcohol. With very fine lines several fillings may be required. The enamel used must be carefully tested, to ensure that the white pigment has no abrasive characteristics which might cause scratches. After inspection under a strong light and powerful magnifier for surface and engraving defects, the graticules are then ready for use.

From consideration of the amount of handling and the many difficulties and variables involved, it should not appear surprising that recovery of engraved graticules seldom exceeds 75 per cent and on large runs of average designs lies between 65 and 75 per cent. The rejects are usually at least 50 per cent for surface defects, some portion of which may be assumed to have escaped inspection after polishing and to have been present at the outset. Production times for the complete engraving operation vary from 5 pieces per man-hour for the simplest cross-line designs to 1.3 for very elaborate ones.

Other Methods

Another important method of engraving combines the photographic and etching techniques in a photo-engraving process which is capable of producing useful results providing line widths are not excessively narrow. We did not use this process ourselves, but in the hands of a subcontractor it was instrumental in supplying us with graticules in quantity during the period in 1941 and 1942 before our mechanical etching equipment was designed and built.

In the method used, the etching resists are a layer of silver and light-sensitive varnish. The silver is first applied chemically, in as thick a coat as is practicable. The silvered surface is then covered with a light-sensitive varnish and an image of the proposed design projected onto it. The portion exposed to light is thus rendered insoluble, and the pattern itself is dissolved out with kerosene, leaving bare the silver below. This silver is then dissolved in nitric acid to expose the glass surface, and etching follows as with wax resists. After etching, the resists are removed—first the varnish with organic solvent, next the silver with nitric acid. Filling then takes place as usual. The films of resist which can be applied in this manner are barely strong enough to withstand the etching action, making this part of the operation perhaps even more delicate and critical than with a wax resist. Also, minute pin-holes in the resist are unavoidable, and must be hand retouched under a microscope before etching. Thus, although photo-engraving is a useful method for intricate designs of varying line widths, it has not proved practicable for widths below .0015 in., and rejects, principally for etching pits and shallow lines, tend to be somewhat higher than where wax resists are used.

Another method which appears promising is to apply a photographic stencil as above, and imprint the design on the clear area by sputtering or evaporating a coating of metallic chromium over the entire surface. The photographic mask is then removed, leaving the chromium pattern behind. Graticules made by this process are far more serviceable than the bichromated glue type, owing to the high tenacity of the chromium pattern, but it is not possible at this time to say whether the method can compete in cost with other methods, and further work is required before it may be regarded as commercially practicable.

(*To be continued in the July issue.*)

[1]Many other mixtures are used by other manufacturers.

From Month to Month

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

KOOTENAY BRANCH IS INAUGURATED

The twenty-seventh branch of the Institute became a reality on May 17th when the president presented a charter to the Kootenay Branch, with Headquarters at Trail, British Columbia. The occasion was marked by a dinner in the Tadanac Community Hall, presided over by S. C. Montgomery and attended by one hundred and seventy ladies and gentlemen.

The presence of nine councillors from other parts of Canada as far apart as Halifax and Victoria as well as that of Mr. Gaherty from the Montreal Branch, was an interesting and unusual feature. The presence of a great many non-members was a much appreciated compliment both to the branch and the Institute. The participation of Dr. C. A. H. Wright, vice-president of the Chemical Institute of Canada, added to the programme a graceful touch of inter-society goodwill.

In introducing the president, R. W. Diamond, vice-president and general manager of the Consolidated Mining and Smelting Company of Canada Limited, expressed the wish that the branch would serve a useful purpose by rounding out the representation of societies in the district. He referred to the excellent service already rendered by the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada to their specialized groups and believed the Engineering Institute would be able to do a similar work for the group represented by its membership. He welcomed the president and all the other out-of-town guests and extended to them an invitation to return often.

Lorne A. Campbell, president and general manager of the Kootenay Light and Power Company, gave a condensed outline of the history of the power development on the Kootenay river, referring to personalities and events that highlighted that period. His long association with the work and his excellent memory provide the material for an exciting story of engineering achievement.

Letters and telegrams from officers of the Institute, the branches at Halifax, Saint John and Montreal, the Dominion Council, and the Associations of Professional Engineers of Saskatchewan and Nova Scotia, were read by the president, expressing congratulations and good wishes.

The new branch starts off under excellent circumstances. Already with a corporate membership of about thirty and a large body of potential members, it should become a useful agency in the neighbourhood. It is fortunate in the selection of its first officers, which of itself assures its success. Chairman, S. C. Montgomery. Executive, E. Mason, C. E. Marlatt, R. Pollard, J. P. Coates. Sec-Treasurer, J. V. Rogers.

A BRANCH FOR CORNWALL

At the May meeting of Council, held in Trail, British Columbia, an application for a charter was received from a group of members in Cornwall, Ontario, and was approved.

The application revealed that a canvass had been made and that in addition to the existing members, twenty others had expressed their wish to join if a branch were established. There are many industries in the area, most of them employing several engineers, so Cornwall should be a good field for service.

It is expected that the formal inauguration of what will be the twenty-eighth branch will take place in the fall.

POSITIVE APPROVAL

All the proposed amendments to the by-laws, submitted to the corporate membership in April, have been approved with sweeping majorities.

It is doubtful if a clearer result has ever been shown on any Institute by-law proposal. Three of the proposals carried with majorities of 96, 97 and 98 per cent, and the fourth, relating to increase in fees, carried with a majority of approximately 80 per cent. The total number of ballots cast was 2,371, which, too, is an unusually good showing.

It will be a great satisfaction to the committees that worked so long and diligently studying the situation, to know that the membership has supported them so handsomely. Special congratulations are due to the Membership Committee, the Finance Committee and the Board of Examiners, and due also are the thanks of the membership for their untiring efforts.

These amendments are among the most important ever advocated. They were a natural corollary to the expansion of the Institute and the activities of the profession. The generous approval of the proposals is a recognition of that fact. The Institute now is in a position to meet the challenge of its opportunities, and to continue on an expanded basis its service to the profession.

According to the by-laws, all amendments " shall take effect forthwith ". This will mean a great activity at Headquarters. The sorting out of overage Students and Juniors, of Members who meet the new qualifications for automatic election to Life Membership, the appointment of the new Admissions Committee, the preparation of material for study as a basis of its operation, and the reprinting of all by-laws, will present some complex problems, but it is expected that everything will be in full running order within a reasonable length of time.

It is hoped that the increased revenue which, of course, will not be available until next year, will quickly bring about many of the desired improvements, including an enlargement of branch activities. The new scale of fees will increase branch income by about fifty per cent, which will be very welcome to many branches.

All in all it looks as though the Institute had passed through the door of opportunity and was well on the way to new levels of accomplishment.

MARITIME PROFESSIONAL MEETING

Arrangements are progressing satisfactorily for the Maritime Professional Meeting which is to be held at The Pines, Digby, N.S., on September 5th, 6th and 7th 1946 under the joint auspices of the Institute and the provincial professional associations. A large attendance is expected from all branches of the Institute in the Maritimes as well as from other provinces.

Special 21-day railway tickets to Digby, at the rate of single fare plus one tenth, are available to members in Ontario and Quebec west of Montreal, upon application to local railway agents. Members in other locations can obtain tickets at the rate of single fare plus one-third upon presentation of an identification certificate which will be mailed to them in the course of the next few weeks.

A local committee has been formed made of representations of the Maritime branches and of the Associations under the chairmanship of Larry Mitchell of Halifax.

No president has undertaken, on behalf of the Institute, a single continuous itinerary the length of the one started by Mr. Hayes in Halifax on April 24th, which gets him back to his home almost eleven weeks later. He visits all branches from Toronto west, participating in forty meetings of one kind or another, including three council meetings. At the time of writing he is still on the road, but this brief account will tell something of where he has been and what he has done up to now.

Toronto

The presidential party left Montreal for Toronto on the evening of April 25th, and included, besides President and Mrs. Hayes, Councillor G. J. Currie of Halifax, the general secretary and the assistant general secretary.

The branch executive was host to the president and his party at dinner in Hart House on the 26th, and a successful branch meeting was held afterwards under the chairmanship of E. A. Cross.

Saturday, April 27th, a regional meeting of Council was held at the Royal York Hotel, convening at 10.00 a.m. and adjourning at 5.45 p.m. At the noon recess, members of Council were guests of the Toronto Branch executive for lunch at the Engineers' Club.

The council meeting was presided over by President Hayes and was attended by the two Ontario vice-presidents and by councillors from most of the Ontario branches. In addition, there were present several members of council from Montreal and Quebec, as well as many past-officers of the Institute in Ontario, and members of the executive of the Toronto Branch. Problems of special interest to members in Ontario were discussed at length and, in this respect, the meeting proved to be particularly useful.

Hamilton

On Monday morning, April 29th, the presidential party —minus the general secretary who had returned to Montreal—motored to Hamilton with Vice-President and Mrs. Sisson. Upon arrival they were greeted by Branch Chairman A. R. Hannaford and Branch Secretary L. C. Sentance, and taken over to the city hall where they met with the mayor and the board of control. A pleasant feature of the visit at the city hall was the signing of the visitors book.

The chairman of the branch, with the secretary and the Hamilton councillor, entertained the visitors at lunch at the Royal Connaught Hotel. In the afternoon the party went through the plant of Canadian Westinghouse, under the able guidance of Larry Sentance.

The branch meeting, under the chairmanship of A. R. Hannaford, was held in the refectory of McMaster University where dinner was served. In addition to several members of the branch, there were present engineers from the Grand Valley Group and the immediate past-chairman of the Winnipeg Branch, C. P. Haltalin.

Toronto Branch. Left to right: Vice-president C. E. Sisson, President J. B. Hayes, Chairman E. A. Cross.

At Niagara Falls. Mrs. and Mr. A. G. Herr, Miss Betty Inglis (now Mrs. P. A. Pasquet), Mr. Pasquet, Mrs. J. H. Ings, Mrs. W. D. Bracken, Mrs. Hayes, President J. B. Hayes, Mrs. Manock, P. E. Buss, W. D. Brownlee, and W. R. Manock.

Niagara Peninsula

The next morning, April 30th, the party motored through the blossoming peninsula to Niagara Falls where they arrived for lunch at the General Brock Hotel with the executive of the branch and their ladies. In the afternoon, the entire group were shown the beautiful sights of the district in a motor excursion which took them to the Queenston power plant, the Welland canal, Thorold where a short visit was made to the Spun Rock Wool plant of Councillor P. E. Buss, and finally to St. Catharines where a dinner meeting of the branch was held at the Leonard Hotel.

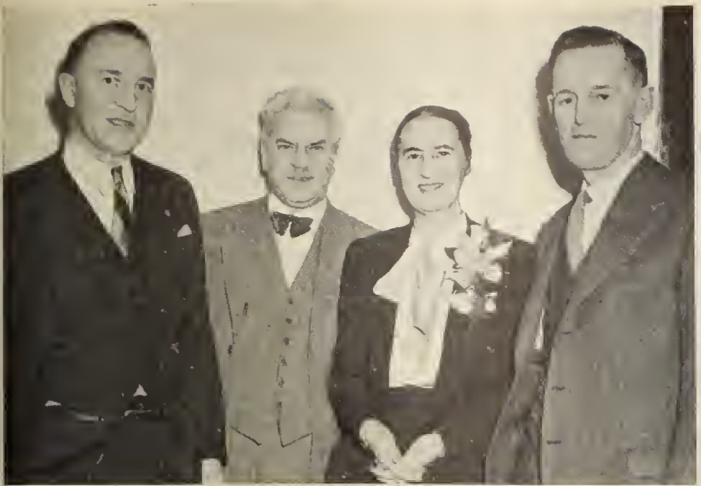
In the absence of Chairman Ings, the meeting was presided over by Vice-Chairman W. D. Brownlee and was very well attended. Among the guests at the head table were Past-President J. A. Grant, Vice-President W. R. Manock, Councillor J. R. Dunbar from Hamilton, and Councillor P. E. Buss.

After the meeting the president's party returned to Niagara Falls for the night and, the next morning, Mrs. Ings graciously drove them to Welland where they entrained for Windsor.

Border Cities

At the station in Windsor, the president and his party were met by the chairman and the vice-chairman of the branch, F. J. Ryder and A. D. Harris. In the afternoon, accompanied by members of the executive and their wives, they went through the Ford Motor Company plant under the guidance of the chief engineer, Branch Vice-Chairman Harris. The visitors marvelled at the achievements of engineering organization displayed everywhere in the plant and watched with great satisfaction the cars coming out of the production lines.

Preceded by a reception, a dinner meeting of the branch was held at the Prince Edward Hotel under the chairmanship of F. J. Ryder. Perpetuating a time-honoured custom in the branch, A. C. Pasini, chairman of the Detroit Section, and J. W. Armour, chairman of the Semi-Annual Meeting Committee of The American Society of Mechanical Engineers, were head table guests and addressed the meeting.



Border Cities Branch. Chairman F. J. Ryder, President and Mrs. Hayes, Councillor G. J. Currie.

London

On the morning of May 2nd, the presidential party left Windsor by train for London where they were guests of the branch executive for lunch at the Hotel London. In the afternoon the branch chairman, J. H. Johnson, chief engineer of the Borden Company, took the presidential party to near-by Belmont where they were privileged to inspect one of the most modern dairy and powdered-egg plants.

The branch meeting, with the ladies present, was held that night at the London Golf and Country Club and was preceded by a most enjoyable reception and dinner. Councillor J. A. Vance, who is chairman of the campaign for the Harry F. Bennett Educational Fund, was able to announce that the London Branch had already trebled its objective, with the canvassing incomplete.

Woodstock

The next morning, May 3rd, Councillor Vance drove the party to Woodstock where he entertained them at lunch with a group of members of the Institute and prominent local citizens. In the afternoon, a visit was made to the Truck Engineering Company where the guests were received by Mr. Verne King, president. After a short visit to the farm of Councillor Vance, President and Mrs. Hayes, with Councillor Currie, returned to London where they entrained for Windsor in the evening.

The presidential party stopped at Woodstock as guests of Councillor J. A. Vance. The party is shown here after inspection of the plant of Truck Engineering Company. Left to right: G. J. Currie, Mrs. Vance, Mrs. Hayes, President Hayes, Mr. Verne King of Truck Engineering Company and J. A. Vance.

The dinner meeting of the Border Cities Branch was honoured by the presence of American guests.

Through the United States to Winnipeg

Leaving Windsor on May 4th the party, with the general secretary now included (replacing Louis Trudel), journeyed through Detroit, Chicago and Minneapolis to Winnipeg, stopping over in each place for a short time.

At Winnipeg the branch executive entertained the group at dinner on the 8th, with the branch meeting being held at noon on the 9th—G. R. Fanset, branch chairman, presiding. Later in the day, Past-President Dean Fetherstonhaugh met the party at the university, and showed them over the engineering building.

Saskatoon

At Saskatoon the president arrived on Convocation Day, May 10th, and along with Mr. Currie was a head table guest at the alumni banquet. On the following day, a tour was made of the university grounds and the engineering building. At noon that day a meeting with members was held at the Bessborough Hotel with E. K. Phillips, vice-chairman, presiding. Vice-President Dean R. A. Spencer introduced the president, drawing much of his material from the fact that both he and the president and many others present were maritimers.

Edmonton

The growing city of Edmonton was reached on Sunday, May 12th, and that afternoon a delightful tea was given at her home by Mrs. J. W. Porteous, the wife of the newly elected chairman of the branch. On Monday noon, the executive met with the party at the university staff dining room after a tour of the engineering facilities. That afternoon the president, Mr. Currie, and the general secretary spoke to a group of ninety students—all of them returned men who had started their engineering courses in January.

That evening in the main dining room of the Hotel MacDonald a large number of members and their wives joined with the president for dinner, Past-Chairman F. R. Burfield presiding in the absence of Professor Porteous who was in Ottawa. At this point, Mr. G. A. Gaherty of Montreal, chairman of the Institute Committee on Prairie Water Problems, joined the presidential group for part of the tour. That night the president's party moved to Calgary.

Lethbridge

It was an unusual experience to pass right through Calgary without stopping, but the party left by motor for Lethbridge immediately after breakfast, and arrived there early in the afternoon of the 14th. A most delightful dinner meeting was held in the Marquis Hotel at which Chairman P. E. Kirkpatrick did the honors.

Robert Lawrence gave leadership in some of the lustiest community singing the Institute has ever heard at any branch. He would be a great asset at any branch meeting. Several members from Calgary were present as was also

At the regional Meeting of Council held at Trail, B.C. Seated, left to right: P. M. Sauder, Kenneth Reid, Miss M. McLaren, L. Austin Wright, President J. B. Hayes, S. C. Montgomery, G. J. Currie, J. P. Coates. Standing, left to right: C. S. Clendening, Ernest Mason, R. A. Spencer, A. H. W. Busby, C. W. Carry, R. Pollard, Ernest Smith, J. G. MacGregor, Stewart Young, J. V. Rogers

Mr. G. A. Gaherty of the Montreal Branch, and J. G. MacGregor, Calgary councillor, both of whom travelled with the party from Edmonton to Trail.

The Trail Area

The party, including Mr. Gaherty, spent four days in this area, detraining on the first day at South Slocan where they were guests of Mr. Lorne Campbell, vice-president and general manager of the West Kootenay Power and Light Co. Ltd. Here they visited the unique chain of power developments that so efficiently harnesses the Kootenay river, all of them being built over several years under the supervision of Mr. Campbell. Their story is one of the outstanding sagas in the history of Canadian engineering and industry.

At Trail an extensive programme was arranged whereby all visitors could see something of the country and a lot of the industry. Emphasis was placed on the plants and processes producing the four main products—lead, zinc, acid and chemicals, the latter largely in final form as a nitrous fertilizer, developed as a by-product of the gases formerly escaping through the stacks.

Three social events which rounded out the programme for the visitors were provided by Mr. Diamond. One was a luncheon at the plant, another a dinner at the Trail-Rossland golf club, and the third a reception at his home previous to the inaugural dinner. The latter was held in the garden under summer weather conditions, which were almost fantastic to the easterners. High on the banks of the Columbia river, surrounded by a luxurious growth of plants, flowers and trees, it was an ideal setting for such an event.

Council Meeting

On Saturday the 18th a regional meeting of Council was held in the Board Room of the Consolidated Mining & Smelting Company of Canada, Ltd., with the president in the chair. Every branch but two in Zone A was represented, and a most useful discussion was obtained on every subject. Representatives of the Association of Professional Engineers for both Alberta and Saskatchewan were also present. From every point of view this was one of the most successful regional meetings ever held any place.

Okanagan Valley

With the party augmented by the presence of Kenneth Reid, councillor from Victoria, a luncheon meeting was held in Kelowna on May 20th, attended by twenty-two engineers. The chair was occupied by F. W. Groves. The party then motored through the beautiful valley to Penticton to once again pick up the railway.

Vancouver

The next morning the group was greeted in Vancouver by the officers of the Vancouver Branch. That night there was a meeting with the executive of the branch and the following evening was spent with the branch at the pavilion in Stanley Park, with Ralph Pybus in the chair. At noon the same day the president's party were guests of the officers of the Association of Professional Engineers of British Columbia, under the chairmanship of the president Mr. Scott.

Victoria

At Victoria the branch meeting was held in the Empress Hotel on the evening of May 27, with chairman S. R. Weston presiding. For this function the ladies were in attendance, but another meeting for members only was held the following evening at the Oak Bay Municipal Hall, at which the affairs of the profession and the Institute were discussed at great length. A meeting with the executive was held at noon at the Union Club on the same day as the dinner.

Turning to the East

From Victoria the itinerary brought the party back to the mainland and to a prolonged return home. Unlike previous presidential tours, this one left many visits for the return journey, including attendance at the Semi-Annual Meeting of the American Society of Mechanical Engineers at Detroit on June 17th, a Council meeting in Montreal on the 22nd, and a visit to the Saguenay Branch. This portion of the trip comes too late to be included in this account, but will be described in the July issue.

RESULTS OF BALLOTS FOR AMENDMENTS TO BY-LAWS

We, the undersigned, having been appointed scrutineers to canvass the ballots for the proposed amendments to the by-laws, certify that the ballots have been duly counted with the following results:

Total number of ballots received	2371
Invalid ballots	28
Spoiled ballots	14

Ballot No. 1—(Proposed amendments to Sections 7, 9, 10 and 23):

Yes	2193	
No	103	
Did not vote	33	
Spoiled ballots	14	
Invalid ballots	28	
		2371

Ballot No. 2—(Proposed amendments to Section 45 and a New Section 50A):

Yes	2226	
No	40	
Did not vote	63	
Spoiled ballots	14	
Invalid ballots	28	
		2371

Ballot No. 3—(Proposed amendments to Sections 21, 22, 26 and 28):

Yes	1780	
No	479	
Did not vote	70	
Spoiled ballots	14	
Invalid ballots	28	
		2371

Ballot No. 4—(Proposed amendments to Section 66):

Yes	2204	
No	72	
Did not vote	53	
Spoiled ballots	14	
Invalid ballots	28	
		2371

Respectfully submitted,

Fraser S. Keith, M.E.I.C.,
L. C. Jacobs, M.E.I.C.,
Gerald N. Martin, M.E.I.C.,
Scrutineers.

SALARY SCHEDULES

Not long ago the Junior Section of the Toronto Branch recommended to Council that salary schedules as recommended by various organizations be published in the *Journal*, as a means of informing employers and employees alike of proper rates. Under Council's instructions the first schedule is reproduced herewith. It is that of the Association of Professional Engineers of the Province of Ontario.

It is only fair to point out that there is no schedule to which employers must adhere, nor is there any that has received the unanimous support of all employees. Actually, there is quite a variation in schedules which is probably confusing to all concerned. It should advance the interests of the profession if some one set of figures could be prepared that would be acceptable at least to all the employees.

It is not the purpose of the *Journal* to comment either favourably or otherwise on any schedule which is printed in this series. Some such comments were made in the October, 1944, issue and probably there is nothing to be gained now by repeating them, but, if the members wish to comment, the *Journal* will be interested in receiving communications from them.

MINIMUM ANNUAL COMPENSATION FOR THE EIGHT PROFESSIONAL GRADES IN AN ENGINEERING ORGANIZATION

As compiled and recommended by the Association of Professional Engineers of the Province of Ontario.

Professional Grades	*Annual Salary*		*Annual Increase*
I	From $2,400	to $2,850	$150
II	2,850	3,450	150
III	3,450	4,050	150
IV	4,050	5,050	250
V	5,050	6,250	300
VI	6,250	7,750	300
VII	8,000	9,500	300
VIII	9,700	and up	and up

Professional Grade I—To include all junior positions in which professional engineering work is done under supervision, with opportunity for the use of some independent judgment.

Professional Grade II—To include all positions involving the performance of professional engineering duties under general supervision, with limited latitude for independent, unreviewed actions and decisions; to perform engineering work of intermediate professional difficulty and responsibility, and to exercise independent judgment.

Requirements—Three years' successful experience in engineering work with demonstrated aptitude and capacity for increased responsibilities.

Professional Grade III—To include all positions involving the performance of professional engineering duties under general supervision, and with considerable latitude for independent, unreviewed actions and decisions; to perform engineering work of substantial professional difficulty and responsibility; to exercise independent judgment and, in certain cases, to supervise the work of others.

Requirements—Five years' successful experience in engineering work, with demonstrated aptitude and capacity for increased responsibilities, one year of which must have been in responsible charge of work.

Professional Grade IV—To include all positions involving the performance of professional engineering duties under general supervision, and with wide latitude for independent, unreviewed actions and decisions; to have responsible charge of a subdivision of a major engineering organization; to perform difficult professional engineering work requiring technical training, previous experience, recognized leadership, and the exercise of independent judgment.

Requirements—Eight years' successful experience in engineering work, with demonstrated aptitude and capacity for increased responsibilities, three years of which must have been in responsible charge of work.

Professional Grade V—To include all positions involving the performance of professional engineering duties under general supervision and with wide latitude for independent, unreviewed actions and decisions; to have responsible charge of a division of an engineering organization; to direct a staff on design or construction or to supervise an investigative survey or direct extensive studies of projects.

Requirements—Ten years' successful experience in engineering work, with demonstrated aptitude and capacity for increased responsibilities, four years of which must have been in responsible charge of work.

Professional Grade VI—To include all positions the duties of which involve the responsibility for a major division in a large engineering organization.

Requirements—Extensive successful experience in engineering work with demonstrated aptitude and capacity for increased responsibilities, six years of which must have been in responsible charge of work.

Professional Grade VII—To be the technical and administrative head of an extensive engineering organization, such as the principal assistant to the chief engineer.

Requirements—Extensive successful experience in engineering work, eight years of which must have been in responsible charge of important work, of which four years shall have been in an administrative capacity involving the direction of the work of a major technical organization.

Professional Grade VII—To have entire charge of and be responsible for all the functions of a major engineering organization.

Requirements—Extensive successful experience in engineering work; high order of executive and advisory service; evidence of success and demonstrated outstanding professional attainments.

BUILDING CANADA'S EXPORT TRADE

The wisdom of the policy outlined in the following letter, from an official of the Department of Trade and Commerce, should appeal to everyone. Engineers, who are so directly concerned with industrial prosperity, should miss no opportunity of enlightening the public on the motives which lay behind the educational campaign undertaken by the Department.

Department of Trade and Commerce

Ottawa, April 27, 1946.

The Editor,
The Engineering Journal.

Dear Sir:

You may have seen the first advertisement of a campaign that has been launched by the Foreign Trade Service of the Department. Since it is something new in our

Departmental advertising, we should like to explain the thinking that lay behind it and the other advertisements to follow.

Statistics of Canada's experience over a number of years support the view that Canadian prosperity during the critical years ahead, will depend in large measure upon the success of our efforts to market a good portion of our production in other countries. For this reason we think that the importance of foreign trade should be brought home to the public of Canada.

The time element enters, because if we wait until our production has satisfied domestic demand, many markets will be lost to us. It may be desirable, therefore, to forego some comforts, luxuries and replacements in the next couple of years, in order that we may export enough to establish our goods in the markets of the world.

In a recent speech at Montreal, the Hon. James A. MacKinnon, Minister of Trade and Commerce, referred to the importance of the time element when he said: "This is a testing time for Canadian business and the Canadian people. What is done in the immediate future—or equally important, what fails to be done—will fix the pattern of our commercial relations for a long time to come".

So in this campaign we want to achieve two things; to suggest the wisdom of doing without a few things for a while, should this be necessary, and to induce competent producers to set aside a share of their output for export. Accordingly, we are running two separate but allied advertising campaigns, one in newspapers and magazines, and one in business publications. In both we have tried to follow the most effective advertising practice, by making our material attractive and our message easy to understand. Our theme is: "One-third of your dollar"—the proportion of our national income conservatively estimated as earned, directly or indirectly, by foreign trade. We have done our utmost to avoid the stilted type of governmental announcement, because we want the widest readership possible.

As we believe this to be a national project of prime importance, any suggestions or comments you may care to make will be welcomed as a means of improving our campaign.

PROFESSIONAL ASSOCIATIONS

A REVIEW OF THE FOURTH REPORT OF THE FABIAN RESEARCH COMMITTEE

By E. P. Muntz, M.E.I.C.
Mem'er of Institute Committee on Professional Interests

A comprehensive special supplement under the title "Professional Associations" was published with the *New Statesman* in 1917. It might be reprinted as a text book worth reading by everyone interested in professional Associations and particularly by those who direct the course of professional organizations anywhere.

While written with specific application to the United Kingdom it should be of special interest in Canada at the present time, in view of the growth of the older organizations, the formation of new, and the discussion which has arisen regarding the advisability of an over-riding body in which all scientific organizations are represented. It is evident that the multiplicity of organizations in Canada had its counterpart in the United Kingdom thirty years ago. Practically every problem with which the engineering profession has been wrestling in Canada had appeared in the United Kingdom by 1917.

The special supplement contained the draft of the Fourth Report of the Fabian Research Committee investigating "The Control of Industry". It was compiled by Sidney and Beatrice Webb, with the section on professional artists by G. B. Shaw, and dealt directly with the question "What is to be learnt from the Professional Associations of Brainworkers as to sphere of control by Vocational Organizations?"

Practically every paragraph is replete with information. The following notes are largely extracts from the forty-eight 9" x 12" pages. They do not pretend to give more than a bare outline. The text must be read to be appreciated fully.

It is evident that some at least of those who "leaned to the left" thirty years ago might be considered now as leaning somewhat "to the right".

Introduction

Page 1 Some interesting general information is given including a definition of a profession. "A profession is a vocation founded upon specialized educational training, the purpose of which is to supply disinterested counsel and service to others for a direct and definite compensation wholly apart from the expectation of other business gain".

Classes of Professional Associations

Professional associations are divided into five classes; the Learned Professions, the Technicians of Industry, the Technicians of the Office, the Manipulators of Men, and the Professional Artists. The draft report analyses each class, deals with "The Success of Professional Organization; with its Shortcomings and Limitations", and states certain conclusions. This review deals primarily with "Professional Organization among the Technicians of Industry". Some short comments are added.

Technicians of Industry

There were no organizations of engineers, architects, surveyors, chemists, etc., earlier than the nineteenth centry. All started as scientific societies, and their ostensible purpose was, and still mainly is, the improvement of technical processes. These organizations are closely connected with the direction and management of industry and with Employers' Associations. Some members combine professional qualifications with ownership of instruments of production and with the employment of subordinate labour in pursuit of personal profit.

Page 4 "As we shall see, it is difficult to draw exact lines of division between Professional Associations and what are, in the same industry, essentially Employers' Associations on the one hand, and Trade Unions on the other".

Engineering

Page 20 "In the present century" (first seventeen years) "there seems to have been a rush of specialized organizations"—referred to in the draft as "Subject organizations".

Page 20 "The majority of Professional Associations of the Technicians in the Engineering Industry partake more of the character of Subject Organizations than of Trade Unions; though they are always attempting directly or indirectly, to secure a monopoly of work for their own members".

Page 20 "The Consulting Engineer paid by fees and working successively for innumerable customers, finds himself increasingly in competition, not only with the Contracting Engineer, who is himself a manufacturing employer, and who undertakes the production of commodities for profitable sale; but also with the Salaried Engineer who gives his whole time as a professional to an individual employer who is usually a public authority or Joint Stock Corporation ".

Page 20 " The leading feature of the Professional Organization of Engineers within the United Kingdom is thus the multiplicity of socities mostly distinguished from one another by specialization. . . . "

Page 21 " There may well be, in the engineering societies of today, with their frequently duplicated membership, a complete chain of individuals belonging to two or more organizations linking up the Institution of Civil Engineers, the premier organization of brainworkers, with the Amalgamated Society of Engineers, the premier organization of manual workers ".

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Architects

" In the case of the architects we have a profession which has gradually withdrawn itself from all pecuniary responsibility for the business enterprise of erecting buildings, and has taken up the position of supplying—either for a fee (or, in a minority of cases, for a salary)—nothing but advice and plans, which are carried out under the architect's supervision, either by a building contractor, or by the 'Works Department' of a corporate body, or a landed proprietor. The Architectural Profession, now about 12,000 strong in the United Kingdom, is distinguished from the engineering and some other vocations by its near approach to unity of professional organization, there being only one main society, the Royal Institute of British Architects, with allied local bodies, together with a smaller and newer second organization, the Society of Architects, aiming specially at statutory registration ".

Surveyors and Chemists

The professional associations in both groups are described.

The Success of Professional Organization; With Its Shortcomings and Limitations

Page 36 " We have presented in some detail the facts with regard to the principal Associations of Professionals in order to enable the formulation of general conclusions as to the causes and results of this remarkable revival of Vocational Organization in the nineteenth and twentieth centuries. Apart from Law and Medicine, this modern Vocational Organization is, as we have seen, entirely a creation of the past hundred years. What is remarkable is the rapidity and continuity of its growth, not merely in the aggregate membership of the various Professional Associations—which we put, in the United Kingdom of today, at more than a quarter of a million—but in the extension of organization to one class of brain-workers after another ".

The three separate motives for professional organizations are given as the creative impulse, the fellowship impulse, and the possessive impulse.

The conditions favouring the growth of vocational organizations among brainworkers are stated as chiefly more definite control by Government, such as through General Medical Act, various Public Health and Registration Acts, National Insurance Act, Pharmacy Act, etc.

Page 37 " This may be less true of engineering, but even in this profession the great Institutions of Engineers, like the leading professional organizations of accountants and actuaries, owe a large part of their strength to their increasingly frequent recognition by the State for public purposes. *In fact, the State, whether acting through Parliament, the National Departments or Local Government, as it has grown in the scope and complexity of its operation, has been steadily making more and more use of, and therefore extending the influence and the power of the Professional Organizations of brain-workers, as a corrective to that development of bureaucracy which the collective control and conduct of public affairs inevitably necessitates*". (Italics by reviewer).

A sub-section is devoted to each of the following: the Government of a Vocation, the Entry into the Profession, the Professional Training Required, Professional Remuneration, the Organization of the Service, Professional Ethics, the Militant Methods of Professional Associations, the Demand for Statutory Registration of Qualified Practitioners, Statutory and Voluntary Organization. All are discussed at some length.

Under Statutory and Voluntary Organization there are three divisions, the Unit of Organization, What is a Vocation, and The Government of Professional Organizations.

Conclusions

Page 45 " We may now sum up the conclusions to be drawn, so far as the brain-working occupations are concerned, from the history and experience in this country (United Kingdom) of the participation by Professional Associations in the control of their services ".

(a) *Modern Growth and Development:*

" . . . self-governing Associations of the brain-workers in an ever-increasing number of specialized professions sprang up in new forms in the course of the nineteenth century; and that, during the last few decades, these Associations have everywhere grown in membership and power, and have obtained a constantly increasing recognition as organs of control by the Government and public opinion ".

(b) *Impulses and Motives:*

Page 45 "Analysis of the Origin and Development of these Associations shows that there have been at work in their formation three main impulses . . . ", as noted above.

(c) *Conditions of Development:*

Page 46 " Changes in social and economic environment have resulted from increasing consciousness of a collective interest distinct from that of individuals, and the decay of belief in their efficacy to secure that freedom of competition among individuals ".

Page 46 " The organization of any one profession depends, in fact, on their being a sufficiently broad difference in capacity for the performance of the particular service, between its professional practitioners on the one hand, and either the ordinary cultivated man or a professional of another kind, on the other ".

(d) *The Unit of Organization:*

Page 46 " If we survey the growth in membership and increase in power of professional associations, we see everywhere a curious intermingling of statutory and voluntary organization.

" In so far as organization is left to voluntary association, experience shows that the members composing the unit of association must have essentially identical interests on all the main issues of policy. This identity may depend on the possession of a common technique and training, or on engagement by the same type of employer, or on a common method of remuneration, or on an identical organization of the service, several of these conditions being usually combined in each case. The fact that all these conditions have been, during the past hundred years, perpetually changing, and also shifting in relative importance, accounts for the characteristic impermanence of voluntary associations of brain-workers, to constant supersession of one association by another within the same profession; and the rising and falling in relative importance of the associations that endure. The result has so far been that the voluntary organization of each profession has tended, with every increase in the diversity of the service, to be perpetually breaking up into new units, corresponding with new group interests ".

Then following sub-sections (e) to (k), all with pertinent information under the titles, Demarcation Disputes, The Methods of Professional Associations, The Devices of Professional Associations, The Statutory Register, The Claim to Professional Self-Government, The Government of a Profession, Results of Professional Organization.

Page 47 (l) *The Sphere of Professional Organization:*

"A survey of the whole field makes it clear that there is a very real, and, as we venture to think, an ever-widening sphere for the Professional Organization of brain-workers in the Control of Industries and Services in the Modern State, although not exactly the sphere to which its most enthusiastic adherents have aspired.

"We suggest that where Professional Organization has shown itself to be of the greatest use to the community is where it has been inspired by the Creative Impulse, with which the Fellowship Impulse is often associated. It is in the main to the individual and collective activities of the existing body of practitioners — these activities being heightened, as we have seen, by Professional Association—that the community owes most of the continuous advance in the science and art of a profession; because these practitioners alone enjoy that combination of knowledge, training and daily opportunities for discovery upon which progress normally, although by no means invariably, depends.

Page 48 "Professional Organization is, moreover, indispensable as a defensive force. Experience demonstrates that it is required for protection, alike of the individual practitioner against the economic oppression and lay tyranny to which he may otherwise be subjected, and of the profession itself against conditions and restrictions which would withhold from it the necessary means of training and improvement, deny to its rank and file members an appropriate Standard of Life, and prevent the most efficient service ".

"What is required is some sort of composite authority, such as the Engineering Standards Committee, in which there can be represented, not only the knowledge and desires of the profession, but also the interests of the consumers or users of the particular service, the larger and more enduring interests of the State, and even the knowledge and desires of other professions which may be indirectly concerned. The first function of Professional Organization, whatever its form, in connection with the government of its service, is, in our view, to supply duly authorized representatives of the profession to such a composite authority as we have described.

"The second function of Professional Organization in connection with the government of its service, and, in our view, the most important of all, is one which has so far scarcely been claimed by Professional Associations. This is the function of independent authoritative criticism of the Government of the State, alike in its central and its local administration, and of responsible advice both to the Legislature and the Executive, on matters in which the profession has special competence. One of the gravest drawbacks of the bureaucratic administration which is involved in all enterprise on a large scale, and therefore especially in Government and in Consumers' Co-operative Societies, is the immunity from expert criticism which is now secured by official secretiveness and departmental discipline, and the practical monopoly of access to the mind of the Minister or governing committee possessed by the departmental chiefs. We know of no effective organ of criticism except that which might be afforded by Professional Organization.

(m) *The Unsolved Problem of Professional Organization:*

Page 48 "*The most intractable problem of Professional Organization, and one for which we can offer no complete solution, is how to discover, in each profession and in each branch of a profession, the most effective unit of organization, and the most appropriate method of formulating its general will, alike as an organ of expression and criticism, and as an instrument for supplying representatives to composite authorities.* (Italics by reviewer). The simple solution of asking all the registered or recognized practitioners to elect a Council representing the entire profession has two capital drawbacks. It submerges all the expert specialists, and all the newer and smaller sections, in the undistinguished mass of the rank and file pursuing the old routine. Moreover, even when provision is made, in one or other way, for enabling these minorities to have a share in any pronouncements of the Council, the result is blurred and ineffective—in the compromise between the different elements the specialization of knowledge and intensity of emotional experience, or just what is most valuable in Vocational Association, is inevitably lost. Finally, the characteristic impermanence of Professional Associations, which results naturally from the constant shiftings of a progressive technique and a changing social environment, makes it difficult, without an objectionable stereotyping of that which is in its nature variable, to base upon these Voluntary Associations any formally constituted Professional Council which is intended to be permanent. The only inference we can draw is that the constitution of any Professional Council, whether statutory or voluntary, must necessarily be complicated, ought to be elastic, and will need to be perpetually revised ".

Reviewer's Comments

The authors infer that there may be a place for an overriding council and point out some of the outstanding difficulties. Attempts over the past thirty years have shown that such councils do not enjoy wide and continuing support. There is no single successful example of such a council either in the United Kingdom or the United States.

An informal Presidents' Conference Committee has been found, in both countries, to be the best vehicle for developing co-operative or complimentary policies between a small or large number of organizations on matters of mutual interest.

A Parliamentary and Scientific Committee is functioning in London with some success. It appears worthy of study as a type of vehicle for assisting such " composite authorities " as our national and provincial governments in Canada.

Finally, these notes give some of the highlights only of this valuable and interesting document. They do not pretend to be a complete review. It is hoped that they are sufficiently complete to show that there is some very sound thinking concerning professional associations available in this supplement and that it is as applicable to conditions in Canada today as for conditions in the United Kingdom thirty years ago.

The *New Statesman* for 1917 is not now readily available. There are, at least, two copies in Canada, one is in the Parliamentary Library at Ottawa, and the other in the University of Toronto Library.

The Institute has been given a few photostat copies. Those who wish to read the complete text may borrow a copy through the Institute's library.

U.S. ENGINEERS PROGRAM OF CONTROL FOR GERMAN INDUSTRY ADOPTED BY ALLIED CONTROL COUNCIL

SIMILAR RECOMMENDATIONS FOR JAPAN IN PREPARATION

At the request of the U.S. Departments of War and State to formulate technological, non-political recommendations for the industrial disarmament of aggressor states, the National Engineers Committee of the Engineers Joint Council, representing five national engineering societies in the United States, is preparing a suggested program to eliminate the industrial war potential of Japan, it was recently announced by Col. Carlton S. Proctor, Chairman of the Committee for this study and report.

The Committee's report, embodying a suggested program based on engineering, industrial and economic factors, is expected to be completed in June. It follows a similar report for the permanent demilitarization of Germany submitted in September, 1945, and recently accepted and announced by the Allied Control Council in Berlin.

16 Committees of Specialists

Col. Proctor stated that sixteen working committees composed of American engineering and technological specialists in their respective fields, all of them highly placed in American industry, are cooperating in the preparation of the report and the recommendations which are now well along toward completion. The program will deal with the limitation of metal products, chemicals, power, mineral resources and other elements of war-making potential.

The study is under the direction of Col. Proctor, Dr. Harry S. Rogers, President of the Brooklyn Polytechnic Institute, and Sidney D. Kirkpatrick, editor of McGraw Hill Publications.

The Engineers Joint Council is a committee of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and the American Institute of Chemical Engineers. These societies comprise a national membership of about 85,000. Malcolm Pirnie, Past President of the American Society of Civil Engineers, is Chairman of the Council and Robert M. Gates, Past President of the American Society of Mechanical Engineers, is Vice Chairman.

Study Follows Acceptance of German Plan

" The acceptance in principle and in its main essentials by the Allied Control Council of the National Engineers' program for the industrial disarmament of Germany, lends additional significance and importance to a similar plan for curbing the war potential of Japan," said Col. Proctor. " The German plan rigidly restricts or entirely prohibits German industry adaptable to war purposes, but curbs are selective in order to provide for the normal requirements of the country's peacetime economy and to avoid a disastrous economic vacuum.

" The plan now being developed to render Japan militarily impotent is based on the same principles. It is impossible to forecast as yet, until all the reports of the task committees are submitted and analyzed, the exact extent to which Japan should be industrially restricted or in precisely what respects. Her situation is somewhat different from that of Germany. But the program is expected to include complete prohibition of such war-making potential as warships, planes, munitions, certain heavy industries, and limiting others, but at the same time encouraging recovery of Japan's normal economy by not curtailing capacity in peaceful occupations. Data is now being gathered in this country and in Japan.

Non-Political Service by Engineers

" The engineering profession in the United States has welcomed the opportunity for public service in the industrial disarmament of aggressor states by making recommendations wholly non-political in their nature and based solely on the experience and jugment of top ranking men in engineering and industry. We have been informed that weight was attached to the program proposed by the Committee for Germany because of the non-political nature of its recommendations and their solid basis of technological, engineering and industrial experience. We venture to hope that the report as to Japan may be similarly received."

Colonel Proctor stated that the National Engineers program for Germany was submitted originally to Washington and to the United States Military Government for Germany. But its recommendations proved acceptable not only to the American group of the Control Council but also to Russia, Great Britain and France, and the plan promulgated by the Allied Control Council on March 28 giving effect to the Big Three decision at Potsdam last summer is backed by all four nations.

The Allied Control Council also has approved recently a law providing for continuing control of scientific research in Germany in order to prevent its utilization for purposes of aggression and to direct permitted research along peaceful lines.

The Committee based its recommendations for Germany on carefully gathered engineering data and economic and industrial statistics, but left the determinaton of the specific methods of control to the authorities charged with that function. It will follow the same principle in connection with Japan.

European Plan

Without anticipating the form or contents of the report on Japan, where conditions differ from those in Germany, the program for postwar Europe is significant. It had these objectives:

To so limit German basic industrial capacity as to make it impossible for her ever again support a major war effort.

To leave in Germany a minimum capacity in war-related activities, such as metalworking, chemicals, power, etc., to permit her to produce, for her own needs, enough to maintain a living standard not greater than the average of the rest of Europe (excluding Britain and Russia).

To physically remove from Germany presently installed factories and equipment above her minimum internal needs and transfer them as reparations to nations which suffered under Hitler so that these nations may build an industrial economy freed from traditional dependence upon Germany for heavy equipment.

To encourage Germany, by not limiting capacity in certain "peaceful" occupations such as agriculture, textiles, furniture and woodwork, building materials and construction (under license as to types of construction), to channel her working population into activities not dangerous to peace so as to rebuild a healthy internal economy.

In accordance with these objectives, the four-power Allied Control Council set forth in definite terms, by industries, how much capacity Germany may keep under the Potsdam agreement, and how much capacity is to be destroyed or used for the stimulation of greater industrialization of the rest of war-shattered Europe with the equipment and tools of German factories which had been built primarily for production of armaments or were easily adaptable to that purpose.

How Capacity is Curtailed

The Control Council's program leaves Germany a total industrial capacity with which to produce approximately 75 per cent of her 1936 industrial output (figured at 1936 prices), or perhaps between one-third and one-fourth her war production level.

However, the 75 per cent is not evenly distributed through the German economy. In the basic industrial fields essential to any war machine, the Council left only slightly more than half the 1936 capacity. For those industrial activities which cannot easily be distorted to a war effort, the plan leaves capacity sufficient to produce an estimated average of 95 per cent of the 1936 volume. Additionally, some industrial fields are not limited at all, thus providing potential expansion in "harmless" pursuits for workers forcibly displaced by curtailment of Germany's traditionally large heavy industry production.

14 Commodities Prohibited Entirely

Basic determination of the Control Council in response to its first assignment—to make Germany impotent to support a war effort—is the flat prohibition in the program of future German production of fourteen commodities which are vital to war. These are: Synthetic gasoline and oil, synthetic rubber, synthetic ammonia, ball and taper roller bearings, heavy machine tools of specified types (not yet defined), heavy tractors, primary aluminum, magnesium, beryllium, vanadium produced from Thomas Slags, radio-active materials, hydrogen peroxide above 50 per cent strength, specified war chemicals and gases, and radio transmitting equipment. In all these categories, the program would make Germany dependent upon licensed imports for her minimum peaceful economic needs.

In addition the Big Three decreed that Germany was to be prohibited from making arms, ammunition and implements of war of all kinds, and from producing either military or non-military types of aircraft or sea-going vessels.

A second category of industry comprises those types of production which must be provided for, to permit any kind of self-sustaining German economy beyond the discarded Morgenthau plan, but which, unless strictly limited could be diverted by another Hitler to support a future war effort. The key "controls" here are built around limitations on steel, chemicals, power and machine tools.

Steel Capacity

Germany's metallurgical and metal-working activities, under the program, will be geared to the limits of a steel production of 5,800,000 ingot tons annually from 7,500,000 tons of capacity. This compares with estimates of German war production as high as 28,000,000 tons of ingot.

Similarly, annual consumption of non-ferrous metals is also fixed as follows: Copper, 140,000 tons; zinc, 135,000 tons; lead, 120,000 tons; tin, 8,000 tons, and nickel, 1,750 tons.

Chemical Production

Production capacity for making basic chemicals (nitrogen, phosphate, calcium chloride, sulphuric acid, alkalis and chlorine) will be slashed to 40 per cent of the 1936 plant. However, 70 per cent of the 1936 capacity is to be retained for production of chemicals for building supplies, consumer goods items, plastics, industrial supplies and other miscellaneous chemical products. Germany's pharmaceutical industry will be maintained at 80 per cent of its 1936 production, and capacity will be kept to produce 36,000 tons of dyestuffs and 185,000 tons of synthetic fibers.

Machine Tools and Machinery

For machine tools, only 11.4 per cent of the 1938 capacity (enough to produce about 12,000 tools a year) will be allowed to remain in Germany, and the Council plans additional restrictions on types and sizes of tools which may be produced in plants that are kept.

Germany's vast stockpile of machine tools which were built for war and which have been estimated at 4,000,000 tons of metal, will largely be declared surplus and made available to other nations as reparations through other sections of the program limiting capacity to be retained in industries using machine tools and machinery.

Metallurgical Equipment

Thirty-one per cent of the 1938 capacity is to be retained in the heavy engineering industries making metallurgical equipment, heavy mining machinery, material handling plants, boilers, turbines, prime movers, heavy compressors, turbo blowers and pumps. In the fields of construction equipment, textile machinery, consumer goods equipment, engineering small tools, food processing equipment, woodworking machines and other similar machines and apparatus, 50 per cent of 1938 capacity will be kept. The same percentage will be kept of Germany's 1938 capacity to produce electrical equipment (industrial and domestic), except heavy power equipment which is to be cut back to 30 per cent of 1938, or to a total annual value of reichsmarks 40,000,000 (1936 value). Heavy electrical equipment is defined as generators of 6000 kw. and over, transformers of 1500 kva and over, and high tension switchgear.

Transportation

Similarly, in transport the program calls for strict limits. Capacity will be retained to produce 40,000 passenger cars, 40,000 trucks and buses, 4000 light road tractors, 10,000 light motorcycles. No new locomotives will be allowed but plant capacity is to be retained to rehabilitate existing stocks in order to produce a pool of 15,000 rail engines by 1949. Sufficient capacity is authorized for annual production of 30,000 freight cars, 1350 passenger coaches and 400 luggage vans.

The Council lumped broadly into a third category of industrial activity, those occupations which will have little or no limitation on either capacity or production, so that Germans displaced by deindustrialization policies in the heavy machinery and metal lines can find useful work helping to rebuild their nation.

In these industries, the Council's plan is, in effect, more a floor for production than a ceiling. For some of these fields, the Council has programmed a level of German production which actually is a goal; others are simply open-ended to permit the Germans to expand them within the limits of available resources and energy.

Coal Production

Coal production will be given positive assistance by the Council to maximize output, with a minimum goal set at 155,000,000 tons (hard coal equivalent) annually by 1949. This includes 45,000,000 tons, at least, for export. Potash production likewise will be given free reign to develop without limitation.

Textile Program

The program asserts that the Germans, to support the level of economy planned by the Council, will need to redevelop their textile industry so that it will be processing 665,000 tons annually of fiber by 1949. Also, 113,000,000 pairs of shoes will be required annually, an average of 1.7 pairs per capita.

Freedom of Construction

The Council has programmed no goal for the construction industry. Germans are to be left free to rebuild their country, subject only to a licensing system on structures, to the limit of available resources All existing capacity in the building materials industries will be kept in Germany to provide incentives in this field of activity. Capacity will be retained to produce 8,000,000 tons of cement annually.

Agricultural Machinery

To permit maximization of agriculture in the peacetime German economy, the program calls for retention of capacity for the annual production of 10,000 light agricultural tractors annually. Existing capacity, estimated at 80 per cent of the 1938 levels, is to be retained for production of other agricultural equipment subject only to restrictions on the type and power of equipment turned out.

Pulp and Paper

The program asserts the need in the German economy for processing 2,129,000 tons of paper pulp annually, and capacity for this purpose will be retained.

Rubber Production

The Council plans to leave in Germany capacity to process 20,000 tons of reclaimed and 30,000 tons of crude rubber annually.

Capacity will be retained to produce precision instruments of total value of reichsmarks 340,000,000 (1936 value), of which approximately one-third will be manufactured for export.

No limitation is placed on the following industries: Furniture and woodwork, flat glass, bottle and domestic glass, ceramics, bicycles, motorbicycles under 60cc. In these fields, the only limit on the Germans will be their own energies and available resources.

Total value of exportable production included in various segments of the Council's program is calculated to be three billion reichsmarks (1936 value) annually. The Council included in its plan a decision to limit approved imports to not more than this amount; this compares with German imports of 4.2 billion RM in 1936.

Two-Year Program

Putting the Control Council's industrial program into effect is expected to take about two years At Potsdam, the Big Three directed that the physical removals of surplus plant be completed within two years of the decision on Germany's peacetime level of industry.

Occupation forces at present are at work tagging every industrial facility in Germany which hasn't been wrecked by war, listing each for retention or as available for reparations. This task is expected to take another month or six weeks, after which it will be possible to determine how much reparation Germany is able to make from physical plant.

National Engineers Committee

For the program of disarmament of Japan, the Committee is Colonel Carlton S. Proctor, Chairman; Dr. Harry S. Rogers, Sidney D. Kirkpatrick, Dr. H. Foster Bain, Dr. R. E. Zimmerman, and Charles W. E. Clarke.

The National Engineers Committee (making the report for German industrial disarmament) consisted of: Robert E. McConnell, New York, chairman; Dr. Harry S. Rogers, vice-chairman, president of Brooklyn Polytechnic Institute; Thomas F. Barton, commercial vice-president, General Electric Company; Colonel Carlton S. Proctor, consulting engineer, New York; Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research, Pittsburgh, and Dr. Clyde E. Williams, director, Battelle Memorial Institute, Columbus, Ohio.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held in the Board Room of the Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, on Saturday, May 18th, 1946, convening at ten o'clock a.m.

Present: President J. B. Hayes (Halifax) in the chair; Vice-President R. A. Spencer (Saskatoon); Councillors C. W. Carry (Edmonton), C. S. Clendening (Lethbridge), G. J. Currie (Halifax), J. G. MacGregor (Calgary), S. C. Montgomery (Trail), Kenneth Reid (Victoria), P. M. Sauder (Strathmore), representing the Association of Professional Engineers of Alberta, Stewart Young (Regina), representing the Association of Professional Engineers of Saskatchewan, and General-Secretary L. Austin Wright.

The following members of the Kootenay Branch were also present—J. V. Rogers, secretary-treasurer, A. H. W. Busby, J. P. Coates and Ernest Mason, of Trail, and R. Pollard and Ernest Smith of Nelson.

The president expressed his pleasure at seeing councillors from so many branches. This was perhaps the best western representation that had ever been gathered for a regional meeting of Council. He urged councillors and guests alike to participate in all discussions.

Mr. Montgomery, on behalf of the new Kootenay Branch, also welcomed the out-of-town visitors. He expressed the branch's appreciation of their assistance in inaugurating the organization.

Community Planning—The general secretary explained that this subject had been placed on the agenda for the purpose of gathering from the western branches any ideas that would help the Institute's committee to develop a programme. He stated that just before starting this western trip, he had spent half a day with R. L. Dobbin, chairman of the committee, in Peterborough. Mr. Dobbin had asked him to bring the subject up on every occasion in order to obtain ideas.

He referred to the proposal which was before Council many months ago to re-establish the Town Planning Institute or some other organization for the same purpose. He explained that there had been discussions with representatives of the Royal Architectural Institute of Canada as well as with groups of interested engineers, out of which certain tentative proposals had been submitted.

Mr. Stewart Young commented on the difficulty of getting engineers to take an active interest in the technical side of community planning. All engineers were interested in the subject generally, but very few were making it even a minor part of their professional activity. Contrasting with this he referred to the interest being taken by architects who, because they were largely self-employed, could divert their attention to the subject very quickly.

He described the work of the American Planning Association and was of the opinion that the work of this organization might be very helpful to Canadians and, as a matter of fact, it might be used as a substitute for a Canadian Planning Institute. He referred to the difficulties of financing and organizing a Canadian Institute. He agreed that there were phases of planning that were special to Canadian communities.

Mr. Young stated that the City of Regina had engaged a consultant to do some work for that city. This consultant, himself, was an architect but the local committee which was in control of the situation was made up largely of engineers. Mr. Young referred to the situation in Vancouver in which he said that city was very fortunate. It had done a great deal of planning and had, in the city organization, engineers who were competent to do the job.

Mr. Reid described the activities in Victoria which had resulted in the formation of a Town Planning Commission, made up largely of public-spirited citizens, including one engineer and a land surveyor.

Dean Spencer agreed with the previously expressed opinion that community planning was largely an engineers' job. He stated that there had been some demand at the University from engineers who wanted to know about the subject. He inquired as to whether or not it would be helpful to arrange a special course of lectures for municipal engineers in each province with the idea that the interest in the subject and the technical knowledge of it might be increased.

In the discussion which followed, the idea was evolved that instead of calling the engineers together to take a course at the universities, it might be better to call them together for a provincial meeting at which the subject could be discussed in great detail. It might be that out of such a conference a request would arise for special courses such as Dean Spencer had mentioned.

Mr. Young supported this idea but expressed his disappointment that extramural lectures already given at some universities had been associated with the Department of Architecture rather than with Civil Engineering.

The president described conditions in Halifax where a City Planning Board had been established under the chairmanship of an engineer. A basic plan for the city had been prepared and he was confident that the engineer was still the driving force in the organization.

Mr. Smith explained that in his work as district engineer, Department of Public Works of British Columbia, he had many contacts with community planning. He stated that he had no jurisdiction inside the limits of incorporated municipalities but that the plans for a great many subdivisions had been submitted to him for study and recommendation. He had found many instances where very bad planning prevailed. He was hopeful that the Institute would take an active part in the subject right across Canada as some strong organization's support was required in order to get the best results, both in enabling legislation and in construction.

Mr. Coates, as engineer for the City of Trail and the Municipality of Tadanac, explained the unusual problems that came to his attention. There had been some demand from the citizens for a replanning of the city and some efforts had been made along that line. However, the problems, because of the topography of the country and the nature of the soil, were perhaps the most difficult in Canada and, so far, a final and satisfactory plan had not been developed. As an indication of the difficulties he mentioned that some of the streets had grades as high as forty-five per cent. He thought that the Institute might provide leadership in many parts of Canada that would be very helpful to a large number of municipalities.

Mr. Carry supported the thought that a conference of interested engineers, on a provincial basis or on the basis of the four western provinces, might be helpful. He was confident that employers would be quite interested in seeing that their engineers participated in such a gathering.

At this point Mr. Young introduced a resolution giving certain instructions to the Institute's Committee on Community Planning. The resolution was seconded by Mr. Sauder, and was subjected to considerable discussion. Eventually, the president appointed a committee consisting of Messrs. Young, Spencer and Sauder, to reword the resolution for presentation at the afternoon session.

The meeting adjourned for lunch at twelve o'clock and reconvened at one forty-five p.m. with the president in the chair.

In response to the president's request, Mr. Stewart Young presented the following resolution for which the committee had been appointed:

> THAT the Committee on Community Planning be requested to investigate ways and means of holding provincial or other conferences of municipal engineers and other interested persons to organize through them refresher courses on community planning at Canadian universities, and other activities in this field.

Upon being presented to the meeting, the motion was carried unanimously.

At this point the president invited the vice-president, Dean Spencer, to take the chair, explaining that as this was a regional meeting in the western zone it was his wish, and he knew also the wish of the meeting, that the senior officer in the west should preside for at least a portion of the meeting.

Harry Bennett Educational Fund—The general secretary presented as a progress report some information which had been sent to him by the committee. This indicated that the campaign for funds was going well in several branches.

Dean Spencer inquired as to any decision that had been made as to the form in which assistance would be given to students. The general secretary stated that the terms of the Trust Deed controlling the fund were very broad and that it was possible for the money to be used for almost anything of an educational nature, but that at the commencement it was figured that loans to students would be the principal form of the activity.

In response to an inquiry from Mr. Montgomery, the general secretary stated that it was intended to have only the one drive for funds and that it would not be an annual event.

The Engineer in the Civil Service—The general secretary gave an outline of the work of the committee in relationship to the presentation of a brief before the Royal Commission. Dean Spencer inquired as to the best means by which this information could be circulated widely and it was agreed that every means should be adopted to bring the work of the committee to the attention of the membership. This was emphasized in view of the fact that all the members did not know of the many years of constructive effort in this cause that the Institute had expended and it was only fair to the organization that the members should have an appreciation of what had been done, particularly in view of the fact that it now appears that some improvement in salary conditions is about to be realised and of the committee's opinion that this result has been achieved, at least partially, because of the Institute's continued interest.

The general secretary also reported on an exchange of correspondence and interviews that had taken place in 1944 between the Institute and the Civil Service Commission of British Columbia, relating to a revision of the salaries of the Public Works Department of that province. The general secretary reported that up until the present time the committee had considered these contacts as confidential and therefore had given no publicity to them. Information was now being presented to this western meeting as it was thought the western branches should be informed of the Institute's participation in the recent revision of salaries for the province.

The general secretary emphasized that the Institute had stated to the Commission that the whole scale was too low, particularly for the more senior appointments, and was not able to agree with the ruling that the salary of the chief engineer had to be less than that of the deputy minister. The Institute had felt that the special training and experience required of a chief engineer should be appraised entirely apart from the salary paid to someone else for entirely different qualifications.

A very general discussion followed the secretary's statements, in which appreciation was expressed of the Institute's assistance to the Commission.

Committee on Professional Interests—Mr. Currie, as a member of the committee, reviewed the recent activities of the committee in relationship to a resolution and memorandum from the Toronto Branch. He outlined in some detail the steps taken some time ago by the committee to study the national situation involving the Institute's relationship with sister societies which had resulted in a statement from the committee which had been approved by Council.

He reported that after the Toronto resolution had been submitted by Council to the committee the situation had been studied again, and that the committee reported that it found no reason to change the policy which it had recommended previously. He stated that a reply along this line had been presented to the Toronto Branch at the April meeting of Council and that it had been accepted without adverse comment at that time. He emphasized the desirability which had been expressed at the Toronto meeting of giving a wide circulation to the reply of the committee. He thought that members with inadequate information might readily misunderstand the Institute's position and adversely criticize it for that reason, but at the same time he was confident that if they were fully informed they would agree with the policy.

Dean Spencer emphasized the difficulty of understanding the situation thoroughly inasmuch as there were many factors to be considered and he thought it was necessary to study all the material quite carefully before having the necessary basis for a decision. He urged councillors to participate in the discussion so that a proper dissemination of knowledge within this group might be possible.

Mr. Young inquired as to Appendix A of the minutes of the April meeting and stated that it was a very informative report and should be made available to all members. Mr. Currie replied that this was to be printed in the *Journal*.

Dean Spencer described the situation now existing in Saskatchewan whereby there was a common membership between the Association and the Institute with the same officers providing the executive of the branch and the council of the Association. He stated that the Council of the Association was unable to understand why a similar arrangement could not be developed across Canada thereby eliminating many of the points over which friction had developed.

Joint Committee on Legislation—The general secretary presented a progress report on the case of the Association of Architects of the Province of Quebec versus Brian R. Perry. He explained that the appeal was progressing and that it was possible it would be heard before the end of May. As the courts close at that time it would have to come up in the fall if they are not successful in getting it in the spring session. He explained the Institute's interest in the case and described how the joint committee on legislation was made up of three members of the Corporation of Professional Engineers of Quebec and three from the Institute. This committee was studying the appeal and providing joint co-operation between the two groups. The Institute was interested particularly because of its national character and the fact that the decision in this case would be of real concern to engineers in the other provinces. He stated that the joint committee was prepared to carry the appeal to the Privy Council, if necessary.

Dean Spencer referred to the service which Mr. Perry had rendered to the profession in fighting this case at great personal sacrifice to himself. It was agreed that this meeting should reaffirm the Institute's strong support of Mr. Perry and that it go on record as appreciating the self-sacrifice which he had made in the interests of all engineers.

At this point President Hayes reassumed the chairmanship of the meeting.

Engineering Education (Conference of Deans)—The general secretary referred to a conference of deans of engineering which was to take place in Toronto on May 28th, which had been arranged in association with the Universities Conference taking place at that time. He explained that certain organizations such as the Dominion Council, the Canadian Institute of Mining and Metallurgy, the Chemical Institute of Canada, and the Engineering Institute had each been invited to send a delegate to a meeting with the deans, to take place the day previous to the deans conference. The object of this meeting was to discuss engineering education so that the deans might have the opinions of the representatives before concluding their deliberations. In accordance with the decision of the April Council meeting, the president had asked Vice-President Sisson of Toronto to attend the session as the representative of the Institute.

Dean Spencer outlined the situation which the deans of engineering were discussing. He referred to the interest which was exhibited in many places on the subject of engineering education and at the same time he described some of the difficulties which prevented immediate changes in the courses in accordance with the many proposals which were being received. He referred to the work of the Society for the Promotion of Engineering Education and thought that an organization of this kind or a branch of the American organization might be useful in Canada. He referred to the report made by this society on engineering education and explained that it had been completed only after many years of study and consultation with thousands of practising engineers.

Dean Spencer mentioned that the feeling was developing among engineers that the courses should be changed to provide more humanities which would mean a reduction in the amount of teaching of technical subjects unless the course was lengthened. He thought the humanities were becoming of increased usefulness as engineers accelerated the development of moving from technical to administrative positions. He emphasized the difficulties which had to be faced in dropping any of the technical subjects and thought that a society formed specifically to study education would be able to make a real contribution to the solution of the problems. He believed that, as far as the present was concerned, the deans jointly would have to study the situation and to consult with non-teaching members of the profession as well. He did not think that at the moment a joint committee consisting of professional educationalists and engineers outside of that group should be established. The problem was primarily one for the educationalists who, of course, would have to keep in mind the requirements of the employer.

The president thanked Dean Spencer for his interesting and informative statement and agreed that at least for the moment there appeared to be no need for establishing a joint committee.

Sixtieth Anniversary, 1947—The president reminded Council that the next annual meeting of the Institute would mark the completion of sixty years of service. He stated that at the Toronto meeting it had been agreed that some special ceremony should be inaugurated to mark the occasion.

Mr. MacGregor thought that the anniversary might be used as a special means of publicity on behalf of the profession, making available in some form a lot of information on the work of the engineer so that the layman might have a better idea of the significance and the importance of engineering and the engineer.

The president thought that Mr. MacGregor's proposal was an excellent one and recommended that it be kept in mind by Headquarters and by the local committee.

The general secretary read an invitation from the Toronto branch that the 1947 annual meeting be held in that city. It was moved and seconded and carried unanimously that the invitation be accepted.

The general secretary stated that following the decision at the Toronto Council meeting he had interviewed the manager of the Royal York Hotel with regard to dates and found that the hotel was booked very solidly until 1948, but that he had been able to secure two dates reasonably close to the time usually set for the annual meeting. These were Friday and Saturday, April 18th and 19th. It was moved and seconded and agreed unanimously that these dates be approved by Council subject to their acceptance by the Toronto branch executive.

National Construction Council of Canada—A letter from the National Construction Council which dealt with the control of building materials was presented. It pointed out that the decision of the federal government to hand back to each municipality responsibility for distribution of these materials had resulted in some unfortunate developments. The letter pointed out that it had been suggested that the control should be transferred to some neutral organization and the National Construction Council asked the Council of the Institute to consider whether or not it thought the National Construction Council was a suitable medium for this service.

There was considerable discussion in which it was pointed out that the control of building construction was a provincial matter and not a federal one and that the National Construction Council, as presently organized, was not in a position to handle it. To build up a proper organization was a very complicated undertaking and the Council of the Institute believed it should be approached with considerable caution.

Eventually it was agreed that a special committee be appointed by the president to investigate the subject and to report back to Council.

A second letter from the National Construction Council was presented in which inquiry was made as to the desirability of establishing acceptable standards for building materials. The letter quoted a communication from the Canadian Standards Association and asked the Institute's opinion as to what action should be taken. This, too, was referred to the above mentioned committee.

Proposal from Chemical Institute of Canada—A letter from Dr. R. R. McLaughlin, president of the Chemical Institute of Canada, was presented. In this Dr. McLaughlin reported that the Canadian Manufacturers Association had arranged for its annual meeting in June a session on research. As a part of the programme it had been arranged by Dr. McLaughlin and the manager of the C.M.A. to have a series of speakers representing the professional technical organizations who would tell something of the aims and objects of each society, particularly in reference to its interest in research work. Dr. McLaughlin's letter was an inquiry to see if the Institute would join with the others in accepting the invitation. The president thought the proposal was an excellent one and that an opportunity to tell the members of the C.M.A. something about the Institute should not be neglected.

After further discussion it was agreed unanimously that the invitation be accepted and the general secretary was instructed to communicate with vice-president Armstrong in Montreal and with Louis Trudel at Headquarters in order that the details might be completed.

Sir John Kennedy Medal—The general secretary asked Council for instructions with regard to awarding the Sir John Kennedy Medal in 1946. He pointed out that the regulations intended that the medal should be presented not oftener than once every two years and that it had been presented in 1945. However, in view of the fact that on two or three occasions the medal had not been awarded he pointed out that the average period of time was well over two years. In the light of these circumstances he inquired as to whether or not Council would be agreeable to the award being made in 1946 for presentation at the sixtieth anniversary in 1947.

Messrs. Carry, Young, MacGregor, Montgomery and the president all expressed themselves as favouring a 1946 award and eventually it was moved and carried unanimously that this procedure be followed.

At the conclusion of the agenda there was a very general expression of appreciation of the kindnesses and hospitality of the officers of the Consolidated Mining and Smelting Company of Canada Limited. This was resolved in the form of a motion by Dean Spencer, seconded by Mr. Carry as follows, to be presented to Mr. R. W. Diamond, vice-president and general manager of the company.

" The president and officers of The Engineering Institute of Canada who have come to Trail for the inauguration of the Kootenay Branch and for a regional meeting of Council, are deeply appreciative of the many kindnesses afforded them by Mr. Diamond and his staff which have contributed so materially to the success of the meetings.

" Mr. Diamond's personal hospitality on so many occasions, in which he was so gracefully supported by Mrs. Diamond, provided the highlights of the meetings, marking the occasion so clearly in the minds of all that it will be long remembered.

" The Council of the Institute hopes that the activities of the new Kootenay Branch will be an additional expression of appreciation of the splendid support that has been received."

It was the unanimous opinion of the councillors that the minutes should record officially their appreciation of the kindnesses and hospitality of the members of the Kootenay Branch which had made their visit such a success, and accordingly the following minute was prepared.

The out-of-town members of the council attending the inaugural meeting of the Kootenay Branch and the regional meeting of Council in Trail wish to record their gratitude to the officers and members of the branch for their excellent hospitality and their many kindnesses. It is seldom that councillors have such splendid opportunities to see an industry and to know the local members of the profession. The well arranged programme and the many personal courtesies shown to the visitors by so many individuals have made this a happy and memorable occasion. It is the wish of all that the new branch may flourish and render a real service to the community. The personnel now associated with it is the guarantee of its success. The visiting members were proud to be associated with them in the inaugural ceremonies of the twenty-seventh branch of the Institute.

Mr. Rogers expressed the pleasure that it had given to the officers of the branch to have so many out of town visitors in Trail. On behalf of the branch he thanked them for the support which they had given to the first meeting of the new branch.

The Council rose at five forty p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered and the following elections and transfers were effected:

Members

Borrowman, Murray Leroy, B.Sc. (Civil), Queen's, constrn. foreman, McColl-Frontenac Oil Co., Ltd., Winnipeg, Man.
Broadhurst, Eric Bertram, mtce. engr., lead smelting dept., Consolidated Mining & Smelting Co., Ltd., Trail, B.C.
Brown, Hugh Carey, B.Eng. (Elect.), McGill, sales engr., Canadian Westinghouse Co., Limited, Montreal, Que.
Burns, Stuart L., B.Sc. (Mech.), Queen's, Donald Inspection Limited, Montreal, Que.
Lambert, Arthur Alexander, B.A.Sc. (Civil), B.C., asst. to chief engr., West Kootenay Power & Light Co., Ltd., South Slocan, B.C.
Masse, Gaston W., B.Sc. (Elect.), McGill, genl. supt. and elect. engr., gas and elect. dept., City of Sherbrooke, Sherbrooke, Que.
Moline, Gustav Adolph Alexander, B.Sc. (Mech.), Univ. of Colorado, chief engr., Canadian Westinghouse Co., Limited, Hamilton, Ont.
Ross, Joseph Hope, B.A.Sc., Toronto; R.M.C., design and sales engr., McGruer, Fortier, Meyers Ltd., Montreal, Que.
Simpson, John Raymond, B.Sc. (Civil), Leeds Univ., England, recently with Dept. Public Works, British Guiana, as dist. engr., Victoria, B.C.
Slater, Arthur Evan Cross, B.Sc. (Elect.), Univ. of Manchester, elect. engr., Polymer Corporation Ltd., Sarnia, Ont.
Szymanski, Michal Bernard, Civil Engr., Univ. of Warsaw, Poland, stress engr., Fairchild Aviation, Montreal, Que.
Tessier, Joachim desRivieres, B.A.Sc., C.E., Ecole Poly., real estate and insurance broker, Quebec City, Que.
Tindale, William J., chief engr., West Kootenay Power & Light Co., Ltd., South Slocan, B.C.
Todd, William Lawrence, B.Eng. (Mech.), McGill, Cornwall, Ont.
Tomlinson, John Windows, B.Sc. (Elect.), Manitoba, chief engr., Manitoba Power Commission, Winnipeg, Man.
Williams, Sidney Elton (studies leading to B.Sc., Forestry, Toronto), res. mgr., St. Lawrence Paper Mills Co., Ltd., Three Rivers, Que.

Juniors

Bardsley, Leonard Walter, B.Eng. (Elect.), McGill, Hillcrest Works, Toronto Transportation Commission, Toronto, Ont.
Bjarnason, Johannes, B.Eng. (Mech.), McGill, technical director, Okra Ltd., Reykjavik, Iceland.
Comtois, Paul-Emile, B.Sc. (Mining), Laval, Lieut., R.C.E., Quebec City, Que.
Coote, Alexander Harcus, B.Eng. (Mech.), McGill, Lieut., (A/E), R.C.N.V.R., Pointe Claire, Que.
Elliott, Thomas Campbell, B.Sc. (Chem.), Alberta, instrument engr., Calgary Refinery, Imperial Oil Limited, Calgary, Alta.
McCaffrey, Keith Allan, B.Sc. (Mech.), Queen's, student, test course, Canadian General Electric Co., Ltd., Peterborough, Ont.
Soicher, Percy Arthur, B.Eng. (Mech.), McGill; M.Sc., Michigan, Lieut., R.C.E.M.E., Montreal, Que.
Young, Harold Randolph, B.Eng. (Civil), McGill, res. engr., C. D. Howe Co., c/o Commonwealth Construction Co., Winnipeg, Man.

Transferred from the class of Junior to that of Member

Lee, John Douglas, B.Sc., Queen's, M.Sc. (hydr. & san. engrg.), Iowa, asst. prof. civil engrg., Queen's University, Kingston, Ont.
Valiquette, Francis Pierre, B.A.Sc., C.E., Ecole Poly., town mgr. Bourlamaque, Que.

Transferred from the class of Student to that of Member

Ferguson, Robert Norman, B.Eng. (Mech.), McGill, asst. to chief engr., Canadian Celanese Limited, Drummondville, Que.
McGee, Leonard Davidson, B.Eng. (Elect.), McGill, mgr., sales and field instalns., Cresswell-Pomeroy Limited, Montreal, Que.
MacKenzie, John James, B.Sc. (Elect.), Manitoba, engr. dftsman., Schumacher MacKenzie Limited, Winnipeg, Man.
Neil, Charles Hamilton, B.Sc. (Mech.), Queen's, asst. steam supt., Consolidated Paper Corporation, Three Rivers, Que.

Transferred from the class of Student to that of Junior

McColl, Bruce John, B.Sc. (Mech.), Queen's, asst. to supervisor, design office, Canadair Limited, Montreal, Que.

Admitted as Students

Balderson, William Thomas, B.A.Sc., Toronto, dial equipt. engr., Northern Electric Co., Montreal, Que.
Browning, Philip Raymond, Manitoba, 176 Jemima Ave., Winnipeg, Man.
Butt, A. M., N.S. Tech. Coll., Halifax, N.S.
Cook, Lloyd Arnold, B.Sc. (Physics), Queen's, apprentice, Westinghouse Electric, Hamilton, Ont.
Davies, William Edward, McGill, 3747 de l'Oratoire Ave., Montreal, Que.
Daye, James Robert, N.B., Hampton Station, Kings Co., N.B.
Gray, Robert John, Alberta, 609 Belmont St., New Westminster, B.C.
Hicks, Robert Laing, B.A.Sc., Toronto, test student, Canadian General Electric, Peterborough, Ont.
Hope, Robert John Stephen, B.A.Sc., Toronto, dial equipt. engr. Northern Electric Co., Montreal, Que.
Houlding, John Draper, B.A., Western Ontario, engr., electronics divn., Westinghouse Co., Hamilton, Ont.
Innis, William Herbert, New Brunswick Nashwaaksis, N.B.
Klein, Samuel Harold, McGill, 362 Fairmount Ave. W., Montreal, Que.
Leger, Adrien Ralph, Laval, Gaspesian Sulphite Co., Ltd., Chandler, Que.
Ludwick, Alexander Peter, B.C., 1515 Renfrew St., Vancouver, B.C.
Moran, John Reid, B.C., 7 Lotus St., Victoria, B.C.
Murray, Donald, M., N.B., 329 St. John St., Fredericton, N.B.
Noble, D. W., Chaleur Inn, Dalhousie, N.B.
Perttula, F. A., Geraldton, Ont.
Pottruff, Walter Allen, B.Sc. (Elect.), Manitoba, 235 Kingsway Ave., Winnipeg, Man.
Ross, J. B., McGill, 23 Cote Ste. Catherine Road, Outremont, Que.
Scovil, John Henry, N.B., Beaverbrook Residence, Fredericton, N.B.
Smith, Ronald Stewart, Mt. Allison, Sackville, N.B.
Stewart, Murray Edgar, Alberta, 10955-79th Ave., Edmonton, Alta.
Swyers, Harry, Mt. Allison, Bonavista, Nfld.
Thibault, Robert, Laval, 293-18th St., Quebec, Que.
Yan, Cecil, Manitoba, 394 Mountain Ave., Winnipeg, Man.

Students at Queen's University

Campbell, J. G.	**Jones,** W. G.
Carrothers, W. D.	**McDonald,** C. A.
Francis, W. E.	**Runge,** J. F.

Students at University of Toronto

Davidson, R.	**Nicoloff,** P. C. F.
Fiander, L. O.	**Paterson,** R.
Lowrie, G. F.	**Seddon,** J. H.
Martin, J. H.	**Sentance,** A. P.
McMurdo, H. G.	**Temple,** P. B.

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

ALBERTA

Junior to Member

McManus, Ralph Norman, B.Sc. (Civil), Alberta, lecturer in civil engrg., Univ. of Alberta, Edmonton, Alta.

Student to Junior

Campbell, Donald Kilgour, B.Sc. (Civil), Alberta, engrg. asst., City Engineer's office, Edmonton, Alta.
Kennett, Douglas Arthur, B.Sc. (Civil), Sask., jr. engr., P.F.R.A., Erskine, Alta.

SASKATCHEWAN

Member

Carss, Harold Wallace, B.Sc. (Civil), Sask., city engr., Swift Current, Sask.

Student to Junior

Boyle, William Eric, B.Sc. (Mech.), Sask., instructor, Regina College Univ. of Sask., Pense, Sask.
Sturdy, Ferris Durnin, B.Sc. (Mech.), Sask., instructor, Regina College, Univ. of Sask., Regina, Sask.

NEW BRUNSWICK

Junior

Holohan, E. J., Civil Aviation Dept., Dept. of Transport, Moncton, N.B.

NOVA SCOTIA

Member

Blackburn, Gerald Allen, B.Eng., N.S. Tech., Research and Development Branch, Regional Reconstruction Council, Dept. of Reconstruction, Halifax, N.S.

Student to Member

Dean, Maurice Ferguson, B.Eng. (Civil), N.S. Tech., Maritime Engineering Consultants Ltd., Halifax, N.S.

QUEBEC

Student to Member

Maclure, James Hubert Crocker, B.Eng. (Civil), McGill, engr., engine, pump and elect. dept., Canadian Fairbanks-Morse Co., Ltd., Montreal, Que.

Personals

Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.

News of the Personal Activities of members of the Institute

C. S. Clendening, M.E.I.C., was recently appointed councillor of the Lethbridge Branch for the Institute to complete the current term as a result of the resignation of C. S. Donaldson.

Originally from Walkerton, Ont., Mr. Clendening studied at the University of Toronto Faculty of Applied Science and spent four years with the C.E.F. in World War I.

Previous to service overseas he was employed as transitman in connection with the Detroit tunnel and as recorder for the Geodetic Survey of Canada in 1909. He was concrete inspector for Smith, Kerry & Chase in Ontario and at their City of Winnipeg plant, and later office draughtsman and transitman for the Grand Trunk Pacific railway. In 1914 he was resident engineer for the Pacific Great Eastern Railway. Returning in 1919 as an engineer to the Grand Trunk Pacific Railway he remained two years, after which he went to Lethbridge as resident engineer for the Lethbridge Northern Irrigation District. He was located at Diamond City, Alta., as manager in 1932 and returned to Lethbridge as project manager in 1940 where he is still located.

Mr. Clendening joined the Institute as an Associate Member in 1921, becoming a member in 1940. He was councillor for the Lethbridge Branch in 1934 and 1935.

J. W. Porteous, M.E.I.C., is the newly-elected chairman of the Edmonton Branch of the Institute. Born at Galt, Ont., he graduated as a B.Sc. in electrical engineering at the University of Alberta in 1928 and, in 1932, received his M.Sc. He attended the Canadian Westinghouse Company student course in 1928 and the following year he was demonstrator at Syracuse University.

He returned to the University of Alberta, Edmonton, Alta., in 1930 as a lecturer in the electrical engineering department and was connected with the construction of the 1,000-watt transmitter for radio station CKUA. He is now associate professor at the university.

Mr. Porteous joined the Institute as a Student in 1929, transferring to Junior in 1934 and to Member in 1944.

W. D. Brownlee, M.E.I.C., of the Electro Metallurgical Company of Canada, Welland, Ont., is the newly elected chairman of the Niagara Peninsula Branch of the Institute.

Born at Collingwood, Ont., he received the degree of B.A.Sc. from the University of Toronto in 1931, and that year was associated with municipal engineering in Midland, Ont., entering the Ontario Department of Highways in 1932 as instrumentman. From 1933 to 1937 he was resident engineer and locating engineer for the Ontario Department of Northern Development on highway construction and location. With the Department of Highways he was resident engineer on highway construction in 1937 and 1938, and acting resident engineer with the Civil Aviation Branch of the Department of Transport of Canada in 1939 and 1940 on airport construction. He accepted his present position as engineer in 1940.

Mr. Brownlee joined the Institute as a Member in 1943.

L. O. Cass, M.E.I.C.

L. O. Cass, M.E.I.C., has been elected chairman of the Saint John Branch of the Institute.

Born in Springhill, N.B., he received a B.Sc. degree in civil engineering from the University of New Brunswick in 1939 and entered the Department of Highways of New Brunswick as office engineer and instrumentman.

The same year he transferred to the New Brunswick Hydro Commission as chief of party on transmission line location. He went to Montreal, where he was employed by T. Pringle & Son, consulting engineers, as draughtsman and field engineer and later to the Foundation Company of Canada as assistant to the group superintendent of construction at St. Paul l'Ermite, Que. Transferred to Shipshaw, Que., by the company, he was area engineer there in 1941 and 1942, when he joined E. G. M. Cape & Co. of Montreal as field engineer on the construction of the naval ordnance depot at Dartmount, N.S.

Mr. Cass has been with the National Harbours Board at Saint John, N.B., since 1944 when he became assistant engineer. Joining the Institute as a Student in 1939, he transferred to Member in 1944.

H. T. Miard, M.E.I.C., has been named secretary-treasurer of the Lethbridge Branch of the Institute.

Mr. Miard is from Coal Creek, B.C., attended schools in Fernie, B.C., and graduated in civil engineering from the University of British Columbia with a B.A.Sc. degree in 1933.

On graduation he was associated with the Big Bend Highway construction as rodman, levelman and instrumentman and, in 1937, was junior engineer on that project. In 1939 he was engineer in charge of the east section, Big Bend Highway. In ensuing years he was resident engineer for airdrome construction or development projects for the Civil Aviation Division of the Department of Transport of Canada in southern Alberta and southeast British Columbia, such as the development of the Lethbridge airport, the construction of the Pearce Relief airdrome, and the Claresholm S.F.T.S. airdrome. In 1942 he was named senior assistant engineer in the office of the district airway engineer of the Department of Transport and has been located since then in Lethbridge, Alberta.

Mr. Miard joined the Institute as a Member in 1942.

K. W. Salmon, Jr.E.I.C., recently named secretary-treasurer of the Saint John Branch of the Institute, is from Wolfville, N.S.

Graduating from the University of New Brunswick in electrical engineering with a B.Sc. degree in May 1941, he immediately enlisted in the Royal Canadian Navy as engineer officer, training on a turbine cruiser. He has been in charge of machinery in three Canadian naval ships and was employed in electrical overseeing of naval refits and in the training of engine room personnel.

He is with the New Brunswick Telephone Company Limited at Saint John. He joined the Institute early this year as a Junior.

Dr. F. W. Gray, M.E.I.C., retired from the Dominion Steel and Coal Corporation in June 1945, and is now residing in Victoria, B.C. He has served that corporation, its predecessors and affiliates from 1904 until his retirement, since 1927 as assistant general manager at Sydney, N.S.

Born in Yorkshire, he graduated in coal mining from Sheffield University, England, and after early experience in coal mines in Great Britain, he came to Canada in 1904 and has devoted the ensuing years to coal mining enterprises, principally in Nova Scotia. Unprecedented fire fighting and mine rescue appliances were introduced into eastern Canada by Dr. Gray at the commission of the Dominion Coal Company and his research has caused him to be called upon in western Canada areas on several occasions.

He has been awarded the Leonard Medal of the Engineering Institute, the Barlow Memorial Prize of the Canadian Institute of Mining and Metallurgy, the honorary degree of Doctor of Laws from Dalhousie University, and more recently the Julian Smith Medal of the Engineering Institute. A member and executive officer of numerous technical societies, he was councillor of the Institute for the Cape Breton Branch in 1942.

Dr. T. B. Williams, M.E.I.C., has been appointed commissioner for petroleum and natural gas in British Columbia with the Department of Lands at Victoria, B.C. He was previously petroleum engineer with the department, located at Dawson Creek, B.C.

Alex. Gray, M.E.I.C., has retired from the position of port manager at Saint John, N.B.

Coming to Canada from Scotland in 1905, he was appointed assistant engineer with the Dominion Coal Company and in 1906 entered the service of the Grand Trunk Railway as an engineer. In 1911 he joined the Public Works Department and was employed in connection with the storage of water on the Ottawa river and subsequently as engineer in charge of the Saint John harbour. In 1927 the Saint John Harbour Commission appointed him general manager and chief engineer and he continued as port manager under the National Harbours Board, established in 1936, until the Board regretfully accepted his recent resignation.

Mr. Gray was councillor of the Institute in 1919, 1920 and 1921.

Russell Yuill, M.E.I.C., succeeds Mr. Gray as port manager at Saint John. Mr. Yuill has lately been filling the position in an acting capacity, having been transferred from the National Harbours Board's head office engineering staff.

Born in Truro, N.S., and a graduate in engineering of Mount

Allison and McGill Universities, he has been employed in the Dominion public service since 1914, first in the Department of Mines and from 1915 to 1936 in the Department of Railways and Canals, when he was transferred to the staff of the National Harbours Board. Seconded to the Department of Munitions and Supply at the commencement of the war shipbuilding programme in 1940, he served as director and assistant director general of shipbuilding until 1944. He has been associated with the Saint Lawrence River development, with railway construction, and with construction and operation of Hudson Bay terminals and investigations of other projects in all parts of Canada. In 1945 he was appointed Federal Government representative on the Committee on Resources and Railways, Province of British Columbia.

During World War 1 he served overseas with the Royal Canadian Engineers.

E. H. Parmelee, Affiliate E.I.C., retired from his position as Eastern district manager at Montreal of the Ferranti Electric Limited, Toronto, Ont., after twenty-five years association with the company. He had previously represented Canada Wire & Cable Company in Winnipeg, and for several years was associated with both firms until his appointment in 1926 as manager of the Montreal office of Ferranti.

Noel N. Wright, M.E.I.C., succeeds Mr. Parmelee as acting manager of the eastern district for Ferranti Electric Limited. He has been associated with Ferranti since 1928, with an interval of about two and one-half years when he served with the navy as deputy-director of the signal division (wireless section) with the rank of lieutenant-commander. He returned from war duty on February 1st last.

Norman A. Eager, M.E.I.C., who was chairman of the Hamilton Branch of the Institute in 1945, was recently appointed general manager of the Burlington Steel Company Limited, Hamilton, Ont., and was also elected to the Board of Directors. He entered the firm as assistant sales manager in 1940 and in 1944 was appointed sales manager. He is a graduate of McGill and Cornell Universities, with B.Sc. and M.C.E. degrees.

J. A. Shaw, M.E.I.C., general electrical engineer of the Canadian Pacific Railway for 31 years, retired recently on pension. Supervision of the design and erection of the million dollar heating plant for the Toronto Terminals which includes Union Station and the Royal York Hotel, was one of Mr. Shaw's major achievements in the 42 years he has been with the C.P.R. Last year he directed the application of a fluorescent lighting system to a passenger coach, the first time this had been done in Canada, as part of a modernization programme.

A graduate in science from McGill University, he entered the Canadian Pacific as assistant electrical engineer at Angus Shops in 1904, was appointed to the same position for eastern lines three years later, became electrical engineer at Angus Shops in 1908, and since 1915 has held his present post. He is a past-president of the Canadian Railway Club of Montreal.

J. W. Hughes, M.E.I.C., of Toronto, will succeed Mr. Shaw. He directed installation of modern electric equipment on the C.P.R.'s bascule bridge at Sault Ste. Marie, in 1914 and supervised building of machinery for the diesel-electric tug and coal car in operation between Prescott and Ogdensburg. He started as engineer in the electrical department at Angus Shops in 1907 and has been electrical engineer for the eastern lines for 31 years. He is a past-president of both the Canadian Railway Club of Montreal and the Toronto Railway Club.

L. A. Duchastel, M.E.I.C., has received the appointment of employment supervisor for the personnel department of Shawinigan Water and Power Company. Mr. Duchastel, who recently resigned as secretary-treasurer of the Montreal Branch of the Institute after six years service, is a graduate of Ecole Polytechnique, Montreal. Joining the Shawinigan Water and Power Company in 1934, after seven years with the Shawinigan Engineering Company Limited, he was first in the department of development and later transferred to the power sales division of the commercial distribution department, where he became manager in 1943, remaining until his recent appointment.

J. P. Carrière, M.E.I.C., has been appointed city manager and engineer for the City of Hull, Que. On his retirement from the Canadian Army with the rank of colonel in 1945 he returned to the Department of Public Works of Canada, being appointed to the chief engineer's staff at Ottawa, Ont., where he was located at the time of his recent promotion.

J. K. Davidson, M.E.I.C., is now chief engineer of Orange Crush Limited and will be in charge of engineering connected with the company's proposed modernization of its plants across Canada. He had been development engineer with Mainguys Limited of Montreal, Que., since early 1945. During the war he was sent to Melbourne, Australia by the Electric Reduction Company of Buckingham, Que., to construct and manage an associated plant for the production of phosphorus and allied chemicals for munitions. Associated with the Electric Reduction from 1932, he has been assistant manager and chief engineer. He is a graduate of St. Andrew's University, Scotland.

John A. Mackenzie, M.E.I.C., has been transferred by the Canadian Pacific Railway from Toronto to Saint John, N.B. as district engineer. In Toronto he was assistant engineer on maintenance of way for eastern lines.

Wm. Rodger, M.E.I.C., recently elected a fellow of the Royal Society of Arts, discloses that the invitation to membership had been issued to him twenty-five years ago as a result of a paper he presented in 1915 before the Canadian Railway Club. Inadvertently mislaid and forgotten, the invitation came to light some months ago when a reply resulted in his election as a fellow. Mr. Rodger remarks that the secretary at that time was G. K. Menzies, now C.B.E., who is on the list of executives of the society. Mr. Rodger, a life member of the Institute, is chief draughtsman with the Nova Scotia Department of Mines.

W. G. Enouy, M.E.I.C., of the H. H. Robertson Co. Ltd., has been appointed sales manager and is located at the head office in Hamilton He was previously manager of the branch office in Montreal, Que.

G. H. Richards, M.E.I.C., city engineer of the city of Brantford, Ont., was unanimously elected president of the Grand Valley Group of Engineers at the annual dinner meeting in Brantford, on May 16th. Mr. Richards served the group last year in the capacity of secretary-treasurer.

I. S. Patterson, M.E.I.C., has been appointed manager of the new Winnipeg district office of the English Electric Company of Canada Limited of St. Catharines, Ont. Mr. Patterson is a graduate in electrical engineering from the Nova Scotia Technical College with fifteen years experience in the electrical manufacturing industry. He recently resigned his position as chief executive officer of the Wartime Bureau of Technical Personnel, Ottawa, after four years service with the Department of Labour.

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

J. W. Hughes, M.E.I.C.

I. S. Patterson, M.E.I.C.

J. M. Carrick, M.E.I.C., has been in consulting practice since September 1945 in Winnipeg, Man. He was formerly with the Canadian Pacific Railway at Winnipeg as designing engineer.

David Boyd, M.E.I.C., has received the appointment of works manager, general engineering division of the John Inglis Company Limited at Toronto. An engineering graduate of McGill University, he has a long and successful record on production of equipment such as manufactured by John Inglis Company. He has been active in development of welded pressure vessels and fabricated steel. He was awarded the Gzowski Medal of the Institute in 1936. During the war his services were requisitioned by the government, as general manager of Victory Aircraft Limited, Malton, Ont.

T. M. Moran, M.E.I.C., is now in Vancouver, B.C., having accepted the vice-presidency of the B.C. Power and B.C. Electric Railway Company Limited. Prior to his new appointment he was connected with The Aluminum Company of Canada Ltd., Dominion Rubber Company Limited, and latterly with Stevenson & Kellogg Limited, management engineers, as vice-president.

H. A. Cooch, M.E.I.C., vice-president in charge of sales and a director of the Canadian Westinghouse Company Limited, recently was elected president of the Hamilton Chamber of Commerce which is now in its one hundred and second year of continuous operation in the community.

Neville Beaton, M.E.I.C., became associated in April with the Brompton Pulp and Paper Company Limited as resident manager in charge of its Red Rock division, where he is responsible for the sulphate and groundwood mills and the associated woods operations. For the previous eighteen months he had been assistant to the vice-president in charge of Canadian operations for the Marathon Pulp and Paper Company Limited, Toronto, Ont.

V. W. G. Wilson, M.E.I.C., is now head of the engineering and design division, Dominion Road Machinery Company, Limited, Goderich, Ont. During the war he was employed by the army engineering design branch, Department of Munitions and Supply, on tank design. Before the war he was divisional superintendent in charge of sand foundry, Aluminum Company of Canada, Toronto, Ont. Mr. Wilson graduated from McGill University in 1926 with a B.Sc. degree and in 1926 received the degree of S.M. from the Massachusetts Institute of Technology.

O. F. Bush, M.E.I.C., is now in Talara, Peru, South America, associated with the International Petroleum Company on a construction project, and expects to be away from Canada for three years. He has served two years with the R.C.N.V.R., released as a lieutenant (E) in 1945.

C. W. Bickers, M.E.I.C., has severed his connection with the Ford Motor Company of Canada at Windsor, Ont., and is now plant engineer with Kaiser-Frazer Corporation, Willow Run, Mich.

R. H. Moore, M.E.I.C., has accepted employment with the Falconbridge Nickel Mines Limited at Falconbridge, Ont. He was formerly on the staff of Babcock, Wilcox and Goldie McCulloch Limited, Galt, Ont.

P. B. Hughes, M.E.I.C., who has been discharged from the R.C.N.V.R., with the rank of lieutenant commander (E), is now in Toronto. He is lecturer in the department of civil engineering, municipal and structural, at the University of Toronto.

M. A. Matheson, M.E.I.C., is now in Lima, Peru, having been appointed general sales manager for International Petroleum Company.

M. D. Stewart, M.E.I.C., until recently a lieutenant with the 5th Coy. R.C.E. at Valcartier, Que., has been appointed city engineer for Sudbury, Ont. Prior to his enlistment in 1941 he had been connected with Hugh C. MacLean Publications, Toronto.

J. J. Crawford, M.E.I.C., formerly assistant to the technical director of Howard Smith Paper Mills, is now in India as engineer in charge of pulp mills operated by the Orient Paper Mills, Limited. He is also engaged in the construction of a new plant which will double the capacity. Mr. Crawford's trip directly from Montreal to Karachi, India, in a Liberator bomber, involved 11,000 miles and was accomplished in approximately fifty-five hours, which the air force reported as a record.

Capt. A. C. Davidson, M.E.I.C., who has been overseas with the R.C.E., has now returned to Canada.

J. D. Chisholm, M.E.I.C., has accepted the position of works manager of the Cherrier Works of Canadian Arsenals Limited, Montreal. During the war he was with the shell filling division of Defense Industries Limited and at its termination was production manager of all shell filling plants operated by D.I.L. until his recent appointment.

R. W. Willis, M.E.I.C., has recently accepted the position of chief engineer, structural steel division, of John T. Hepburn Ltd., of Toronto, Ont. He was formerly structural designing engineer with the Standard Steel Construction Company at Port Robinson, Ont.

E. W. Henselwood, M.E.I.C., until recently with the Q.M.G. Branch, N.D.H.Q. at Ottawa with the rank of lieutenant colonel, is now employed by the Canadian General Electric Company at Toronto, Ont., as engineer in the generator section of the apparatus department.

G. O. Vogan, M.E.I.C., has accepted the position of hydraulic engineer with the Canadian and General Finance Company, Limited, Toronto, Ont. He was chief engineer with the Fred Mannix & Company Limited, general contractors, Calgary, Alta., since 1945, when he transferred from Wartime Merchant Shipping in Montreal where he was manager of the production division.

J. J. Samson, M.E.I.C., is now located at Coaticook, Que., where he will be in charge of municipal services. He has been maintenance and construction engineer for the Brown Corporation at LaTuque, Que.

R. P. Ring, M.E.I.C., who has recently been released with the rank of lieutenant (E) from the R.C.N.V.R. industrial relations department at Queen's University, Kingston, Ont., has accepted a position with Moore Business Forms Limited at Mount Dennis, Ont., to study plant methods and organize a manufacturing control department.

Howard Elgin Armstrong, M.E.I.C., who served overseas for two years with 8th Fd. Park Coy., R.C.E., is now working with the Department of Reconstruction.

E. J. Bartley, M.E.I.C., has left the Navy and returned to civilian employment in Cornwall, Ontario.

J. G. G. Belle-Isle, M.E.I.C., who served with the R.C.A.F. during the war, has returned to the Bell Telephone Co. of Canada in Montreal.

A. I. Bereskin, M.E.I.C., served overseas with the R.C.E. on construction work with the rank of captain and is now doing survey work with the Province of Saskatchewan.

W. A. Bickell, M.E.I.C., has retired from the R.C.E. after serving at the Directorate of Works & Construction at Ottawa, and is now in the contracting business in Vancouver.

Edgar Richard Bishop, M.E.I.C., has returned from the R.C.A.F. to the Canadian Westinghouse Co. Ltd., in Hamilton.

E. C. Hague, M.E.I.C., who spent more than five years overseas with the R.C. Signals is now re-established in civil life in Montreal.

R. T. Harland, M.E.I.C., who was with the R.C.A.F. section of the Cdn. Gov't Joint Staff in Washington, U.S.A., is now back in civil life in Winnipeg.

M. A. P. Harrigan, M.E.I.C., has left the Navy and is now employed in Montreal.

James Rowan Hartney, M.E.I.C., who served with the R.C.A.F. during the war, is now with the Imperial Oil Co. Ltd.

Ernest Allan Harvey, M.E.I.C., has retired from the R.C.A.F. and accepted a position at Canadair Ltd., Montreal.

J. Laird Hemphill, M.E.I.C., who served in the Royal Navy, is now with John Inglis Co. Ltd., in Toronto.

G. R. S. Henry, M.E.I.C., who served overseas with the R.C.E.M.E., has returned to the British American Oil Co. Ltd., in Montreal.

G. S. G. Henson, M.E.I.C., has retired from the R.C.A.F. and returned to the Winnipeg Electric Co.

Alfred Halsten, M.E.I.C., has been discharged from the R.C.N.V.R. and is now with the B.C. Electric Railway in Vancouver.

Philip B. Hughes, M.E.I.C., has been discharged from the R.C.N.V.R. and has accepted a position on the staff of the University of Toronto.

George Edward Humphries, M.E.I.C., who served overseas for several years with the R.C.E., has now gone into private practice in Ontario.

Brete Cassius Nowlan, M.E.I.C., who served overseas in the R.C. Sigs., has now returned to the Bell Telephone Co. in Montreal.

G. W. O'Neill, M.E.I.C., who served in Canada as a major in the R.C.E.M.E., has returned to the Manitoba Bridge & Iron Wks. Ltd.

B. L. Phomin, M.E.I.C., who was on works services in the R.C.E., is now with the Department of Public Works of Canada at Toronto.

J. M. Pope, M.E.I.C., has retired from the R.C.A.F. and is now at Baie Comeau, P.Q. with Ontario Paper Company.

Russell E. Potter, M.E.I.C., who was in the R.C.A.F., has returned to his position as chief engineer of the City of New Westminster, B.C.

D. O. D. Ramsdale, M.E.I.C., has retired from the R.C.N.V.R. and is now with the English Electric Co. at Kirkland Lake, Ont.

J. T. Rose, M.E.I.C., served in the works services of the R.C.A.F., and has returned to his former position in Winnipeg.

G. W. Rowe, M.E.I.C., has retired from the R.C.A.F., and is now with the Manitoba Department of Public Works at Winnipeg.

R. A. Rule, M.E.I.C., who served in the Directorate of Works and Construction as a major in the R.C.E., has now taken over the operation of A. E. Rule, Ltd., in Toronto.

B. H. Russell, M.E.I.C., formerly with the R.C.A.F., is now in the engineering department at Fairchild Aircraft Ltd., Longueuil, Que.

Richard Lear Bartlett, Affiliate E.I.C., has retired from the Army after four years overseas and is now with Heaps Engineering Co., in New Westminster, B.C.

C. B. Huyck, Affiliate E.I.C., who served in his second war as a major in the R.C.E.M.E., has set up in private business in Vancouver.

W. R. Binks, Jr.E.I.C., discharged from the technical branch of the R.C.A.F. in October last, has since been with the Ontario Department of Highways as an engineer assistant in the soils branch.

R. W. Franklin, Jr.E.I.C., has accepted a position with J. Gordon Turnbull, Inc., consulting engineers of Cleveland, Ohio, as structural engineer in connection with a factory being built in Lindsay, Ont. He had been with the Water Resources Branch of the Department of Mines and Natural Resources of Manitoba.

E. L. Miller, Jr.E.I.C., is in Pietermaritzburg, South Africa, with the Aluminum Company of South Africa. He was with the Demerara Bauxite Company in 1942 and with the Jamaica Bauxite Company in 1944.

W. A. McDougall, Jr.E.I.C., who was released from the Army in February, as a lieutenant, is in the employ of Canadian Bridge Company at Windsor, Ont.

C. H. Cook, Jr.E.I.C., has accepted a position with Canadian Domestic Engineering Company Limited in Montreal.

T. F. Holmes, Jr.E.I.C., recently released from the R.C.E.M.E. with the rank of second lieutenant, is located at the University of Toronto Ajax Division, where he is an instructor in engineering drawing.

Gérard Aubry, Jr.E.I.C., has retired from the R.C.A.F. with the rank of flight lieutenant to take up a temporary position with the Quebec Department of Mines pending post-graduate studies.

William Henry Warren Ball, Jr.E.I.C., has been discharged from the Army and is pursuing post-graduate studies.

James E. Beamish, Jr.E.I.C., who served overseas in the R.C.E., has accepted a position with the B.C. Department of Agriculture.

Major Guy Beaudet, Jr.E.I.C., who was overseas with 3 Bn. R.C.E., is now with the Central Housing and Mortgage Corporation in Montreal, as branch manager.

R. S. Bleackley, Jr.E.I.C., who was in Newfoundland with the R.C.N., is now with the Bell Telephone Co. Ltd., in Toronto.

Roy Thomas Bogle, Jr.E.I.C., has retired from the R.C.E.M.E. as a major and returned to the Canadian General Electric Co. in Peterborough.

V. F. Harrison, Jr.E.I.C., has been invalided out of the army and is now on the instructional staff at Queen's University.

G. J. Hendrikson, Jr.E.I.C., has left the R.C.N. and is now with the B.C. Electric Railway Co. in Vancouver.

Walter Andrew Hiller, Jr.E.I.C., who was with the R.C.E., has taken employment with Burns & Co. Ltd., in Calgary.

N. F. Hach, Jr.E.I.C., has left the R.C.A.F. and accepted a position with Alliance Paper Mills Ltd., Merriton, Ont.

J. S. Haughton, Jr.E.I.C., has retired from the R.C.A.F., and is now re-established with the Dominion Bridge Co. in Montreal.

Marcel Huot, Jr.E.I.C., who served as a navigation instructor in the R.C.A.F., is now with Dominion Bridge Co. in Montreal.

J. D. Near, Jr.E.I.C., who was overseas for three years with the R.C.E., is now in the Department of Works of the City of Toronto.

W. A. Nelson, Jr.E.I.C., who served overseas in the R.C.E.M.E., has returned to employment with the Bailey Meter Co. of Montreal.

H. W. Norton, Jr.E.I.C., who served in the R.C.A.F., has accepted a position with the Dominion Engineering Co. at Lachine. P.Q.

H. A. Norton, Jr.E.I.C., was in the R.C.N.V.R., afloat, and is now with Shawinigan Chemicals Ltd. at Shawinigan Falls.

J. R. Nutter, Jr.E.I.C., has retired from the R.C.N.V.R. and accepted employment with Canadian Pacific Railway.

D. E. Palmquist, Jr.E.I.C., who was in the R.C.N.V.R., has returned to Canadian Industries Ltd., at Windsor Ontario.

G. W. Painter, Jr.E.I.C., who served overseas for four years and attained the rank of Lt. Col. in the R.C.E.M.E., has returned to his former position with Canadian General Electric Co. Ltd. in Toronto.

A. H. Pangman, Jr.E.I.C., who was a captain in the R.C.A. overseas, is now with Charles E. Frosst & Co. of Montreal.

R. E. Phillips, Jr.E.I.C., who was in the R.C.N.V.R., has returned to the staff of the University of Alberta.

John Frederick Pink, Jr.E.I.C., who was overseas for three years on special work for the R.C.N.V.R., has accepted a position in the U.S.A.

J. C. Pratt, Jr.E.I.C., served in the Navy during the war and is now with Kipp-Kelly Ltd. in Winnipeg.

J. H. Rogers, Jr.E.I.C., has returned from the R.C.N.V.R. to the Hydro-Electric Power Commission of Ontario.

Lieut. J. O. Kelly, Jr.E.I.C., is now with the Inspection Board of Canada at Ottawa, seconded from the Canadian Army. He was previously at Chemical Warfare Laboratories in Ottawa.

Wm. J. Staples, Jr.E.I.C., who has been connected with the Aluminum Company of Canada Limited at Long Branch, Ont., and Arvida, Que., is now with the Demerara Bauxite Company at Mackenzie, British Guiana.

L. J. Russell, Jr.E.I.C., has been appointed field engineer by the Horton Steel Works Limited, Fort Erie, Ontario.

William Hall Ackhurst, S.E.I.C., who served overseas as a captain in the R.C.E.M.C., has now returned to his former employment with Canadian General Electric.

Paul Chenery Anderson, S.E.I.C., who spent four years overseas and attained the rank of major in the R.C.E.M.C., has returned to his former employment with Ferranti Electric at Toronto.

Robert Gordon Baird, S.E.I.C., has been discharged from the R.C.N., and has returned to his former employment.

Frederick Arthur Bell, S.E.I.C., has retired from the R.C.N.V.R. and accepted a position with the Manufacturers Life Insurance Co., in Toronto.

Morris Maskew Beresford, S.E.I.C., who was overseas in the R.C. Signals, is now with Northern Electric Co.

V. H. Berry, S.E.I.C., has been discharged from the R.C.N. and is taking a post-graduate course at McGill.

R. S. Allison, S.E.I.C., who recently graduated in civil engineering from Queen's University, Kingston, Ont., has been employed by the Canadian Pacific Railway as a transitman and is located at London, Ont.

R. R. Smith, S.E.I.C., has left the employ of H. G. Acres and Co., Niagara Falls, Ont., and is working with the W. G. Ure, M.E.I.C., city and construction engineer, at Woodstock, Ont.

Kurt Rothschild, S.E.I.C., has received the B.Sc. degree in electrical engineering from Queen's University, Kingston, Ont., and has entered the employ of Bedard and Girard Ltd., Montreal, Que.

A. Swystun, S.E.I.C., has graduated from the University of Saskatchewan and has accepted a position with the Consolidated Mining and Smelting Company at Trail, B.C.

J. W. Lee, S.E.I.C., is located at the Queenston Generating Station, with the meter and relay department of the Hydro Electric Power Commission of Ontario.

R. W. Hale, S.E.I.C., has been appointed the Vancouver manager of Lockerbie and Hole Limited, sanitary and heating engineers, who have opened an office in that city.

P. C. Levesque, S.E.I.C., has accepted the position of district electrical engineer with the New Brunswick Electric Power Commission.

J. H. Carson, S.E.I.C., recently entered the employ of the Bell Telephone Company of Canada at Toronto, Ont., as an engineering assistant.

R. Lloyd Parsons, S.E.I.C., has been appointed by the Parsons Construction Company Limited, Moncton, N.B., as secretary treasurer and construction engineer. Mr. Parsons received his engineering certificate from Mount Allison and his bacheor of engineering degree in civil engineering from Nova Scotia Technical College in 1944. Since graduation he has been with the firm as construction engineer.

A. B. Hopkins, S.E.I.C., has accepted a position at Kapuskasing, Ont., with the Spruce Falls Power and Paper Company.

R. A. Quance, S.E.I.C., has joined the staff of Canadian Synthetic Rubber Limited, Sarnia, Ont. He is in the instrument and electrical departments.

Obituaries

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

Glenn B. Ashcroft, M.E.I.C., died on April 25th, 1946, in Sacramento, California, where he had lived for the past fifteen years.

He was born at Munson, Ohio, in 1874 and was an alumnus of Baldwin University at Berea, Ohio, an of the Case School of Applied Science at Cleveland, Ohio, receiving there the degrees of B.S. and C.E. in 1900 and 1905 respectively. He spent more than forty years in engineering, architecture, contracting and manufacturing activities in Canada, the eastern and western United States, principally California where he has been identified with prominent engineering and architectural projects, and where he has made a study of local history, botany and geology, to the benefit of the museum at Sutter's Fort in Sacramento.

He was connected with the construction of the drydock at Baltimore, Md., and with railway surveys in Ohio, Indiana, Illinois, Michigan and Wisconsin. He was inspector of structural steel for bridges and buildings in Philadelphia, Buffalo. Montreal, San Francisco, and for structures erected by the Government of the Dominion of Canada, the Province of New Brunswick, and the Mexican Railways, and was connected with the steel inspection department of the Osborn Engineering Company of Cleveland, Ohio, at their Montreal office and was located in Montreal for some time as district representative for the DeLano Osborn Engineering Company of Toronto.

Mr. Ashcroft was contractor for the construction of stores, residences, hotels, plants in California and Pennsylvania, and was in charge of engineering design for warehouses, schools, plants, theatres, hotels, factories, garages and hospitals in California. He personally designed and supervised the construction of seven hotels and rooming houses in San Francisco and vicinity during the period of reconstruction after the earthquake and fire of 1906 and was chief enineer and secretary of a general contracting company which undertook the construction of twenty large structures after the same crisis. He has been general plant and sales manager for Clay Products at San Francisco, and director and vice-president of Fard's Federated Factors of that city, and was associated there with H. Meyers, Architect, for several years.

In 1930 he joined the California State Department of Public Works, division of architecture, as associate construction engineer, and at the time of his death was senior structural engineer.

Mr. Ashcroft became an Associate Member of the Institute in 1904 and a Life Member in 1940.

A. Irwin Cunningham, M.E.I.C., president of the Chaguaramas Terminals Company of Trinidad, B.W.I., died suddenly in Montreal on May 15th last.

Born in Westmount, Que., in 1893, and a graduate in civil engineering of McGill University, Montreal, in 1914, he served for four years with the Canadian Siege Artillery in World War I. On his return in 1919, he was employed by the St. Maurice Lumber Company at Three Rivers, Que., as field engineer, going in 1922 to the Parklap Construction Corporation as field engineer at the power house of the Sherman Island Hydro Electric Division at Glens Falls, N.Y., and in 1923 to the Moreau Manufacturing Corporation of Glens Falls as resident engineer.

Returning to the St. Maurice Lumber Company paper mill he was in charge of construction for the next three years and in 1928 became resident engineer for the New Brunswick International Paper Company at Dalhousie, N.B. He accepted the post of vice-president and general manager of Merritt-Chapman and Scott Limited, general contractors, Montreal, in 1930, and joined the Aluminum Company of Canada as construction superintendent at Arvida, Que., in 1935, transferring in 1936 to the Ontario Paper Company Limited at Baie Comeau, Que., as general superintendent of construction and later as managing engineer.

In 1937 he returned to the Aluminum Company of Canada Limited as construction manager and was appointed to the presidency of the Chaguaramas subsidiary in 1943.

Mr. Cunningham joined the Institute in 1914 as a Student, becoming an Associate Member in 1925 and a member in 1940.

C. H. McL. Burns, M.E.I.C., industrial engineer, died on May 20th, 1946, in Toronto.

Born at Amherst, N.S., in 1889, he attended schools in Truro, N.S., and studied engineering at Mount Allison University at Sackville, N.B. In 1911 he entered the employ of Canada Iron Corporation, Saint John, N.B., as assistant to the mechanical engineer and the following year become chief resident engineer with the Maritime Coal Railway and Power Company Limited of Nova Scotia.

He went to Philadelphia in 1920 as designing engineer with the Link-Belt Company and in 1924 was appointed engineer in charge of plant changes. Later connections were with the International Nickel Company of Canada at Copper Cliff, Ont., as designing engineer in 1928, with the Dodge Manufacturing Company Limited in Toronto as chief engineer in 1929, and he was inspector for the Ontario Power Service Corporation on the power development project at Abitibi Canyon, Ont., in 1931 and 1932. Mr. Burns then spent several years in private consulting practice and in 1935 joined Canada Foundries and Forgings Limited, Welland, Ont., as assistant manager in charge of operation and maintenance of drop forging and heavy forging plants.

In 1941 he was with Wartime Merchant Shipping Limited, Montreal, and the same year accepted the post of assistant to the manager of munitions, Ottis Fensom Elevator Company Limited, Hamilton, Ont. He entered the trades and industry branch of the Ontario Department of Planning and Development as director late in 1944.

Mr. Burns joined the Institute in 1920 as an Associate Member, transferring to Member in 1937. He was chairman of the Niagara Peninsula Branch in 1941.

L. M. Duclos, M.E.I.C., died in December 26th, 1945, at Woodstock, N.B., where he had been division engineer with the Canadian Pacific Railway.

Mr. Duclos was born at Ottawa, in 1890, and studied engineering at Acadia University. Entering the employ of the Canadian Pacific Railway in 1911, he was successively chainman, rodman, inspector, and transitman. Returning to the Canadian Pacific Railway after overseas service in World War I, he was senior instrumentman with the Grand Trunk Railway in Montreal, and in 1922 to 1925 was transitman at Ottawa. He was transferred to North Bay as assistant engineer in 1926 and to Sudbury, Ont., as division engineer in 1938. His appointment in the same capacity to Woodstock was in 1943.

He joined the Institute as a Junior in 1921, becoming an Associate Member in 1926 and a Member in 1940.

Rodolphe Emile Joron of Chicoutimi died in June 1945.

He was born at Valleyfield, Que., in 1888 and attended Ecole Polytechnique, Montreal, receiving a B.A.Sc. degree in civil engineering in 1909. He qualified as a mining engineer in 1911 and as a provincial land surveyor in 1914. He was assayer and surveyor for the Nova Scotia Mine at Cobalt, Ont., in 1909, and was with the Hollinger Mine at Porcupine in 1910. The following year he was engineer on the municipal development of West Crescent Heights, Westmount, Que., and from 1912 to 1914 he was employed in the engineering department of the Chicoutimi Pulp Company and associated companies, particularly connected with the location of the Roberval-Saguenay railway and municipal work. In 1914 and 1915 he was in charge of the construction of the water and sewer system and roads at Chandler, Que., when he joined the St. Lawrence Pulp and Paper Company as manager of their interests at Chandler. In 1916 he was responsible for location surveys for the Kenogami reservoir and the next year became associated with the interests of Mr. J. E. D. Dubuc, in charge of engineering. In 1922 he established his private practice in Chicoutimi as civil engineer and provincial land surveyor.

He became an Associate Member of the Institute in 1925, and a Member in 1940.

W. H. Ross, M.E.I.C., died on April 16th, 1946, at his home in Regina.

Born at Menstrie, Scotland, in 1881, Mr. Ross came to Canada at the turn of the century, followed correspondence courses in locomotive and stationary steam engineering, made varied engineering contacts in western Canada and registered in Saskatchewan as a professional engineer in 1931.

From 1915 to 1919 he was employed at Holy Cross Hospital Calgary, on building and installation of cold storage, heating and electrical systems. With the Burns Company Limited of Calgary in 1919 and 1920, he was chief engineer, and with Canadian Fairbanks Morse Company at Winnipeg, Man., he was sales engineer for the following eight years, with charge of diesel engine sales and installations. He also laid out and supervised plants and distribution systems at numerous points. Since 1928 Mr. Ross has been with the Dominion Electric Power Company, located at Regina and Estevan where he was general superintendent, responsible for power installation and distribution systems, diesel plants and transmission lines. When the organization was taken over by the Saskatchewan Power Commission in 1945, Mr. Ross became superintendent of diesel power plants for the Province.

He became an Associate Member of the Institute in 1938 and a Member in 1940.

Robert Charles Mold, Affiliate E.I.C., died on May 1st, 1946, at his home in Toronto, Ont.

Born in England in 1901, he was educated there and on his arrival in Canada was employed as draughtsman and junior fire protection engineer by the Grinnel Company from 1917 to 1923, when he became inspector for the sprinkler risk department of the Canadian Fire Underwriters Association.

With the H. G. Vogel Company (Canada) Limited in Toronto, from 1929 to 1936, he was district representative, contractor and superintendent of outside work involving installations in large buildings and mines, and later he was manager of their Montreal office. Entering the employ of the Associated Factory Mutual Fire Insurance Companies of Boston, Mass., in 1936 as an inspector, he was transferred to their Toronto office in 1937 as resident inspector. For the past eight years he has been the Canadian representative for the Blackstone Mutual Fire Insurance Company of Providence, R.I.

Mr. Mold became an affiliate of the Institute in 1936.

Lieut. James Finloy Ross, R.C.N.V.R., S.E.I.C., was killed in action in the Far East on July 30th, 1945.

Born at Mulgrave, N.S., in 1920, he enlisted in 1941 from Mount Allison University where he studied aeronautical engineering. Choosing the Fleet Air Arm, his training required exceptional exactitude. He trained at St. Vincent, England, and Grosse Isle, Michigan, and graduated at Pensacolo, Florida. After graduation he completed operational duties in European theatres, thence to North Africa, India, Ceylon, then the far east. Lieut Ross was twice mentioned in dispatches; in January 1945 he took part in the air blows which resulted in the destruction of Germany's greatest battleship, the *Armiral Von Tirpitz*. His second mention came posthumously in November 1945 for outstanding skill and courage in air operations against Japan.

Lieut Ross became a student member of the Institute in March, 1941.

News of the Branches

Becouse of the poper supply situotion it has been necessory to reduce considerobly the amount of spoce usuolly devoted to News of the Bronches. We beg the indulgence of the branch news editors if they find thot we hove mode liberol use of the blue pencil on their reports.—Editor.

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

EDMONTON BRANCH

W. W. Preston, Jr.E.I.C. - *Secretary-Treasurer*

The highlights of the activities of the Edmonton Branch during its fiscal year, May 1st, 1945, to April 30th, 1946, were reported to the Branch annual meeting held in the Macdonald Hotel on April 24th. In the business session after dinner the different officers and committee chairmen gave the following reports: councillor's report by C. W. Carry, chairman's report by F. R. Burfield, secretary-treasurer's report by W. W. Preston, auditor's report by D. Ross, membership report by J. E. Cranswick, program report by J. W. Porteous, rehabilitation report by C. W. Carry, foundation soils report by R. M. Hardy, summary of correspondence re the Young Engineer including an outline of the Harry F. Bennett Educational Fund by the secretary, and finally the report of the nominating committee by the chairman.

The names of the officers elected appear at the front of the *Journal* except for the auditors, D. Ross and C. A. Stollery.

The retiring chairman thanked his executive for their cooperation and gave the chair to Professor J. W. Porteous, the chairman-elect.

The meeting then continued as a smoker at which refreshments were provided, an innovation at Branch gatherings. The attendance was higher than at recent annual meetings, there being 44 members present.

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During the western visit of the President J. B. Hayes, the Edmonton Branch held an informal general meeting, to which ladies were invited, on Monday, May 13th, 1946, in the Macdonald Hotel. The meeting, which opened with refreshments preceding dinner, was entertained with vocal solos by Miss Noreen Bristow accompanied by Mrs. Bessie Campbell-Bowen. A general sing-song was led by G. F. Mudgett.

The three visiting officials made short addresses. G. J. Currie brought greetings from Halifax.

President Hayes spoke of the alternating influence of employers on employees, and of labor on management. He deplored the current strikes and hoped that administrators will not seek revenge if opportunity arises. "Our urgent need", he said, "is to produce things we lack." He challenged the engineering profession to show the leadership during the recovery. Mr. Hayes also told of Halifax's experiences during the war.

General Secretary, Dr. L. Austin Wright, reviewed headquarter's activities.

Mr. E. Nelson expressed the thanks of the audience to the three distinguished guests. Attendance was 79 members and visitors.

Those sitting at the head table included the acting chairman, F. R. Burfield, and Mrs. Burfield; President Hayes and Mrs. Hayes; General Secretary Dr. L. Austin Wright; Councillor G. J. Currie; Mrs. J. W. Porteous, wife of the Branch Chairman; Hon. N. E. Tanner and Mrs. Tanner representing the Provincial Government; J. G. Dale, Registrar of the Association of Professional Engineers of Alberta, and Mrs. Dale; E. O. Lilge, vice-chairman of the Edmonton Branch C.I.M.M., and Mrs. Lilge; and G. A. Gaherty, president of the Calgary Power Company.

During the afternoon of May 12th the visitors went on a motor trip, inspected the meteorological offices at the Municipal Airport, and had tea at the home of Mrs. J. W. Porteous. Next day the Edmonton executive entertained the officials at luncheon in the University of Alberta cafeteria banquet room, while Mrs. Burfield entertained Mrs. Hayes and the wives of the executive members. After a tour of the University the visiting officials spoke to the class of freshmen engineers who registered in January, 1946, and will complete their course during the summer.

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 Engineering Institute and the Toronto Section of the American Institute of Electrical Engineers took place on Friday, April 26th, 1946, at the Westinghouse Auditorium, with about 175 persons in attendance. The meeting was conducted jointly by A. R. Hannaford, M.E.I.C., and Arthur Frampton of the A.I.E.E.

Dr. G. D. McCann, the speaker, was introduced by E. M. Coles as being associated with the Westinghouse Electric Corporation, Pittsburgh, in research work on lightning problems. He has collaborated in the development of such instruments as the automatic cathode-ray oscillograph, fulchronograph, electronic surge-duration recorder and a photographic surge recorder.

The speaker's subject **Lightning** and how lightning "detectives" are trapping split-second discharges to provide data for the construction of better protective devices on power systems. The results of lightning research in the field and laboratory have provided engineers with a better basis for designing power lines so that they will not be put out of service by lightning strokes.

Dr. McCann said that twenty years ago service was disrupted at least temporarily by nearly every one of the 50 lightning strokes that normally hit a 50 mile power line each year. Today, power lines of this length can be designed with lightning protection equipment that will not be put out of service more than once every five to ten years.

The address, which was illustrated with coloured slides, also dealt with the relation between lightning and other electrical conditions, global variations in thunderstorm activity, the mechanism and characteristics of lightning discharge, and the effect of this natural hazard on transmissions lines. Dr. McCann compared the performance of various types of applications on power lines and overhead ground wire systems, including some of the new designs now being used for wood pole lines.

An interesting discussion period followed the address, after which Arnold Brace of Toronto moved a vote of thanks to Dr. McCann.

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On Monday, April 29th, 1946, the Hamilton Branch had the privilege of entertaining the president of the Institute, J. B. Hayes, M.E.I.C., at a dinner meeting held at McMaster University. The president was accompanied by G. J. Currie, councillor for the Halifax Branch, and Louis Trudel, assistant general secretary of the Institute.

A. R. Hannaford, M.E.I.C., chairman of the Hamilton Branch, presided at the meeting and at the conclusion of dinner called on E. P. Muntz to introduce the president. Mr. Hayes spoke on **Holifox in Wortime,** and recounted many interesting personal experiences.

The Royal Navy, said Mr. Hayes, used Halifax as one of its important bases, and the harbor of the Maritime city was host to many famous British Ships—the *Warspite, Revenge, Ramilles, Valiant,* to mention a few. The president's company was closely connected with the war against magnetic mines, and many ships were fitted with degaussing equipment by his staff.

At the conclusion of the president's address, a vote of thanks was moved by Edward Stearns.

The chairman then called on Louis Trudel, who reported on Headquarters and Institute affairs in general. Membership, he mentioned has reached a new high of eight thousand. Three thousand of these are student and junior members. Following Mr. Trudel's remarks, G. J. Currie, Halifax councillor, spoke briefly and extended the best wishes of the Halifax Branch.

It was pointed out by the chairman that the meeting, attended by forty members and guests, had representatives from coast to coast—from Halifax, Montreal, Niagara Falls, Winnipeg and Vancouver.

LAKEHEAD BRANCH

A. J. Mickelson, m.e.i.c. - *Secretary-Treasurer*
R. B. Chandler, m.e.i.c. - *Branch News Editor*

The annual dinner meeting of the Branch was held at the Village Inn, Port Arthur, on May 28th. Mr. W. C. Byers presided and reviewed the year's activities. Reports of the committees were presented by the respective chairmen. An election was held and the officers for 1946-1947 were duly elected. The sister professions, medical, dental and legal were represented at the meeting. Mr. Byers introduced the new chairman, Mr. W. H. Small, who spoke briefly.

A sound film "The Building of the Golden Gate Bridge" was shown, which film was loaned to the Branch by the Bethlehem Steel Export Corporation.

Resolutions of appreciation were tendered the chairman and retiring officers for service during the year.

LETHBRIDGE BRANCH

H. T. Miard, m.e.i.c. - *Secretary-Treasurer*

G. E. Elkington, m.e.i.c., chief engineer and general manager of the East Kootenay Power Company at Fernie, B.C., spoke on **Power Supply in the Crow's Nest Pass Area,** at a dinner meeting of the Lethbridge Branch, held in the Marquis Hotel on Friday evening, May 3rd. C. Little introduced the speaker.

Mr. Elkington gave an interesting address, illustrating it on a large map of the area served by his company, and on a straight line electrical diagram, and with moving pictures.

The district is a very difficult one in which to develop power as the valleys, with the exception of that of the Kootenay River, are narrow, there is no pondage, and the streams are swift and turbulent, besides being "the best ice factories in the world." The mountain ranges run north and south, and although Aberfeldie is only 15 miles west of Fernie, the transmission lines between the two places are 52 miles long.

The Company has three generating plants—Aberfeldie near Wardner, Elko, the main plant, and Sentinel. Power is distributed as far west as Moyie, as far north as Kimberley and as far east as the fifth meridian. The Company generates a total of about 120 million kilowatt hours a year, most of which is used by industries.

Kimberley produces over a million and a half tons of ore annually. In the Coal Mines supplied by the Company, nearly three million tons are dug. The lumber mills market almost 40 million board feet. The Summit Lime Works, Machine Shops and Brewing Companies are also customers, as well as various cities and towns.

The future of his company depends on Canada's success in competing in world markets and the company's ability to meet larger power requirements. With an expanding market, the company will have to find more sites or depend on steam.

Mr. Elkington concluded his address by showing three reels of his own moving pictures. These showed various phases of power line construction and maintenance, and included many beautiful scenes in color of the East Kootenay Power Company office in Fernie, the various plants, the operator's attractive homes, lawns and gardens at the Elko and Aberfeldie stations, and many beautiful scenes of mountains, rivers and lakes in the East Kootenay which proved, as Mr. Campbell said in moving a vote of thanks, that although it is a difficult area in which to transmit power, it is a lovely place to live.

Chairman P. E. Kirkpatrick was in charge of the meeting. R. S. Lawrence led the community singing with A. L. H. Somerville at the piano, and A. Branch gave two humorous recitations.

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The Lethbridge Branch had the pleasure of entertaining President J. B. Hayes, Councillor G. J. Currie of Halifax, and General Secretary Dr. L. Austin Wright on the afternoon and evening of May 14th.

Following a cocktail party, twenty-eight members and guests attended a banquet in the Marquis Hotel. Brown's trio entertained with dinner music and R. S. Lawrence led the community singing.

The chairman introduced the president's party and also Councillor MacGregor and Mr. MacMillan of Calgary and Mr. Gaherty of Montreal. Councillor Clendening extended the Branch's official welcome to the visitors.

Councillor Currie brought best wishes from the Halifax Branch and from the Association of Professional Engineers of Nova Scotia.

Mr. Hayes said he had had a wonderful opportunity to see Canada. Speaking on the labour situation he said increased production is necessary to aid the world and advance our country. Engineers should by good leadership and by good fellowship with labour lead the world out of its present slough of despondency.

Mr. Hayes spoke of wartime Halifax. He described the large number of searchlights and anti-aircraft units stationed in the city, the harbour filled with large powerful battleships, the work of de-gaussing ships, and he gave a humorous account of his experiences as Chief Air Raid Warden.

Dr. L. A. Wright gave a brief report on Institute affairs. He complimented the Lethbridge Branch in the successful meetings it was having due to the inclusion of affiliates. He believed the good fellowship shown was an asset to the Institute.

Chairman P. E. Kirkpatrick expressed the appreciation and enjoyment the Branch had had in having the President, Mr. Currie and Dr. Wright as visitors. Councillor MacGregor of the Calgary Branch expressed his thanks for the entertainment and invited the Branch to attend the Calgary Branch's meeting with the President on June 3rd. Mr. J. M. Campbell expressed the Branch's appreciation of the talk given by Mr. Hayes and the report given by Dr. Wright, and complimented Dr. Wright on the fine work he is doing as the general secretary.

LONDON BRANCH

A. L. Furanna, m.e.i.c. - *Secretary-Treasurer*
J. C. Keppy, m.e.i.c. - - *Branch News Editors*
J. W. Kirk, jr.e.i.c. - - -

In recognition of the annual visit of the president of the Institute, the London Branch held a dinner for members and their wives on May 2nd.

Approximately fifty people sat down to dinner at the London Hunt Club, following which an informal business meeting was held.

Mr. J. H. Johnson, branch chairman welcomed those in attendance and then called on members of the branch to introduce the following guests: President and Mrs. J. B. Hayes, Assistant General Secretary, Mr. Louis Trudel, and Halifax Branch Councillor, Mr. G. J. Currie.

Mr. Trudel spoke at some length on matters concerning the Institute at large. He made mention of the continuing growth in membership and responsibilities, and the resulting heavy increase in expenditures to satisfactorily carry out the work of the Institute. To meet these new conditions the Executive have found it necessary to ask the membership for approval to increase annual fees.

Mr. Hayes gave a very interesting and enlightening account of the work of the Nova Scotia Light and Power Company during war years. In his free and easy manner, he related many inspiring experiences that he and his associates had been faced with in giving full co-operation to the armed forces and particularly the naval services.

Mr. G. J. Currie who is travelling with the president on his tour, brought greetings from the Halifax Branch.

Before the meeting closed an opportunity was given to each person present to personally thank the guests for visiting the branch.

The chairman of the London Branch, J. H. Johnson, took the presidential party over to Belmont, where they went through the plant of the Borden Company. Left to right: J. H. Johnson, President Hayes, G. J. Currie, L. Trudel.

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.

The members of the Montreal Branch were given the rare opportunity Thursday evening, May 30th, of hearing at a special out-of-season meeting the eminent European engineer, Professor Gustave Magnel, head of the department of civil engineering of the University of Ghent and consultant to the Belgian Government, discuss recent **Developments In Reinforced Concrete,** and expound the principles and advantages of pre-stressed concrete.

The professor told the members who overcrowded the hall that shortages of building material especially steel made it imperative to find methods of using concrete more advantageously. A method known as prestressing of concrete has been evolved, which reduces greatly the amount of steel and concrete required, and also often reduces the cost of the structure.

As an example the speaker showed that it is possible to build a railroad bridge of 66 ft. span using a concrete slab 2 ft. 8 in. thick without any steel at all, as compared with the normal reinforced bridge which would require a slab of 3 ft. 7 in, thick and 11.4 sq. in. reinforcing steel per foot width of bridge. The principle involved here is that the concrete slab is entirely under compression by forces acting on the ends of the beam. Thus the tensile stresses on the underside of the slab caused by the bending moments of the dead and applied loads are more than compensated for. It is precisely the same forces that make it possible for a librarian to carry a stack of books horizontally (like a beam) from one shelf to another by pressing the books together. If she spreads her arms slightly the books separate and the whole "beam" collapses.

In a practical bridge it is not usually feasible to apply the necessary compressive stresses by external forces. And so thin (3/16 in. dia.) high tensile (200 tons per sq. in.) steel wires are threaded through the concrete, and after the concrete has set the wires are drawn tight with the aid of hydraulic jacks and finally locked into position. It is interesting to note that in a bridge 66 ft. long the wires are stretched 4 in. before locking to give the required tension and also to overcome the shrinkage and creep of the concrete and of the steel.

The distribution of the wires in the slab is important. About half the wires are made to run horizontally near the lower surface of the slab. The remaining wires are placed in such a manner that they are near the underside of the beam at the centre, i.e., the point of maximum bending moment, and at the neutral axis at the ends. This is done to prevent tensile stress on the upper side of the beam differing from ordinary reinforcing bars which bend upward to take care of shearing stresses.

It is not necessary that the concrete slab be free from vertical cracks. In fact the Canadian Army Engineers built a bridge in Belgium during the war which was constructed of concrete blocks about 1½ ft. long. Thus it is evident that shear stress need not be considered when designing with prestressed concrete.

During the discussion period that followed the lecture the Professor pointed out that the use of prestressed concrete slabs for continuous beams was not yet fully investigated and that consequently he could not recommend its use at the present time.

Prof. Magnel, in addition to slides, presented a film especially prepared for his students. This film reviewed the principles by animated diagrams and then showed how tests on prestressed concrete were conducted in his laboratory and what results were obtained.

J. F. Brett, the chairman, adjourned the three hour meeting after Brian Perry thanked the speaker on behalf of the members and of the Institute.

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr.e.i.c. - - *Secretary-Treasurer*
J. L. McDougall, m.e.i.c. - *Branch News Editor*

On April 30th President James B. Hayes visited the Niagara Peninsula Branch at a dinner meeting held in St. Catharines, Ont.

In the absence of J. H. Ings, chairman, W. D. Browlee, vice-chairman, conducted the meeting, welcoming many out-of-town guests.

Among those present at the head table were Dr. A. J. Grant, past president, Louis Trudel, assist. general secretary, accompanying the president, W. R. Manock, vice-president, G. J. Currie, councillor from Halifax, Paul Buss, councillor, and J. R. Dunbar, councillor of the Hamilton Branch.

Introducing the president, J. B. Hayes, to the branch members, P. Buss explained something of the president's duties as engineer in charge of public utilities at Halifax, both before and during the war years.

For his address the president dealt in greater detail with some of the many tasks confronted and accomplished by his staff in meeting emergencies at a wartime port—mentioning how several almost impossible demands were overcome through the combined efforts of his department and the civilian population.

W. R. Manock at the close of the address thanked the president after which L. Trudel outlined to the members some of the highlights at headquarters during the past year.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - *Branch News Editor*

S. W. Fairweather, vice-president of the Canadian National Railways in charge of research and development, addressed the Ottawa Branch at a noon luncheon on April 18 at the Chateau Laurier. He spoke on **The Canadian National's Contribution to the War Effort,** and said that, although the railways had many headaches, they met all problems with a high degree of efficiency and on the whole carried on quite successfully. It was a different story during the first Great War.

German opinion at the commencement of the recent World War was that one of the great weaknesses of Canada's war effort would be in the realm of transportation. This opinion was successfully challenged by Canada's railways for if the war demonstrated one thing it demonstrated that no other means of land transportation could have undertaken the work that they did and dealt with it so successfully.

Having been exposed to the blighting effects of the depression of the 30's, it was almost a miracle that they were able to maintain a resiliency which enabled them to expand rapidly where required without loss of efficiency at least to a point where they could carry on effectively.

Speaking more particularly of the Canadian National Railways, Mr. Fairweather said that within one week after the outbreak of war stock was being collected and allocated for the improvement and expansion of necessary services. It was fairly obvious, of course, that Halifax would be a port of great importance. Served as it was by a single line of the railway, with round houses inadequate and shop facilities in many places obsolete, it looked to be "a pretty tough job to take heavy traffic over that line".

In the west on account of the possibility of invasion by the Japanese, the railway had to hold itself in readiness to transport troops to Prince Rupert and into northern Alberta. United States military authorities in particular looked to the railway to meet this possibility.

"The war has amply demonstrated that the railways are a prime necessity", concluded Mr. Fairweather. "It is a thought that is very easy to let slip. This attitude of forgetfulness is due to the fact that the railways are a planned economy, intended for long time service."

J. H. Irvine, chairman of the Branch, presided. Commander C. P. Edwards, Deputy Minister of Transport, proposed the vote of thanks.

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At the last regular noon luncheon of the Ottawa Branch for the spring season, a sound film entitled: "No Keener Blade" was shown through the courtesy of the Canadian Liquid Air Company of Montreal. This picture was produced in technicolor and told the dramatic story of the use of oxygen in industry. It began with a re-enacting of the momentous scene in 1774 when Joseph Priestley discovered oxygen, its smooth-flowing sequences moving through early experiments with the gas in connection with the "burning" of steel to its present widespread use in industry.

The use of mass production methods were shown whereby many sheets were cut at the same time to the shape of a master pattern, the whole process being practically automatic and not requiring the constant attention of an attendant. Norman Cuke, of the Canadian Liquid Air Company, Montreal, introduced the film and explained some of the processes involved.

J. H. Irvine, chairman of the Ottawa Branch, presided. There was a good attendance.

SAGUENAY BRANCH

H. R. Fee, m.e.i.c. - *Secretary-Treasurer*

Mr. G. F. Todd, landscape architect of Montreal, addressed the Saguenay Branch on Thursday, April 25th, on **Parks for Use of the People.** Mr. Todd described the various types of parks, from playgrounds for small children to national park reserves, and by means of slides he described some of the parks in Eastern Canada.

A number of slides were shown of St. Helene's Island Park in Montreal, which has accommodated as many as 115,000 people in one day. Of particular interest were the beach which had been built with sand brought in on barges, and the fort originally constructed in 1815. This fort had been allowed to deteriorate, and considerable work was involved in its reconstruction. By means of information from various sources, including the Dominion Government Archives, it was possible to rebuild the fortifications approximately as they had been originally built, including the underground fortifications.

The speaker also described the Beaver Lake in Mount Royal Park, and showed slides of the beaver dam which was discovered during the excavation of the Lake. This dam was buried under five feet of silt, and the logs used in its construction were found to be in excellent condition, but deteriorated rapidly when exposed to the atmosphere.

A number of slides were shown of the Quebec Battlefield Park and St. Foy Park in Quebec, with an outline of the historical significance and points of interest, and the various monuments which had been erected.

Mr. Todd closed his talk with a description of a park just outside Saint John, N.B., which is used very extensively by the public.

B. E. Bauman was chairman of the meeting, and R. A. Lemieux moved a vote of thanks to the speaker.

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Mr. M. Laflamme, lighting service engineer of the Montreal branch of Canadian General Electric, addressed a joint meeting of the Engineering Institute and The Chemical Institute of Canada, on Ma · 28th on the subject **Magic of the Spectrum.**

Mr. Laflamme, with an elaborate supply of equipment, demonstrated his paper throughout, first showing how the "cold light" of the firefly could be produced chemically. He then explained the spectrum, including the ranges above and below the visible spectrum, and demonstrated the mixing of the primary lights of green, blue, and red to produce various colours. The effect of sodium vapour and mercury vapour lamps on the visible spectrum was illustrated, showing that objects will reflect only those colours which are contained in the light source.

The speaker then demonstrated the ultra-violet, or black light, showing its effect on various florescent materials, explaining the principles of the florescent lamps, as well as the sun lamp and germicidal lamps.

In the infra-red range the speaker demonstrated the drying lamp and the heat lamp.

Mr. Laflamme closed his talk with a demonstration of polarized light, indicating the practical applications, including the analysis of stress in metal shapes by means of replicas in plastic placed between polarizing screens.

WINNIPEG BRANCH

David Hunter - *Secretary-Treasurer*
V. W. Dick - - *Branch News Editor*

The presidential party arrived in Winnipeg on Wednesday, May 8th, on their Western trip, and were met on their arrival by members of the executive of the Winnipeg Branch. After lunch the president visited the University of Manitoba where he met the members of the Engineering Faculty, and made a tour of the laboratories and draughting rooms.

Wednesday evening, an executive dinner meeting was held at the Royal Alexandra Hotel with the presidential party as guests, at which the visitors brought to the executive the latest information on the Institute's programme and policies. Members of the Engineers' Wives Association entertained Mrs. Hayes while Mr. Hayes was occupied with his presidential duties.

Thursday noon, a general luncheon meeting was held at the Hudson's Bay Company to afford members of the Winnipeg Branch the opportunity to meet the president and to hear the latest developments in Institute affairs.

G. R. Fanset, branch chairman, presided, and others at the head table included President J. B. Hayes; G. J. Currie, councillor, Halifax Branch; Dr. L. Austin Wright, general secretary; Dr. E. P. Featherstonhaugh, past president; D. M. Stevens, councillor, Winnipeg Branch; H. L. Briggs, chairman, Electrical Section; E. M. Scott, chairman, Students' Section; T. L. Storey, vice-chairman; and C. P. Haltalin, past-chairman.

Dr. Featherstonhaugh introduced President Hayes, who spoke briefly on the present situation between labor and management with strikes and dissention, which was stopping production and upsetting the reconversion plans, and expressed the opinion that engineers fitted both ways into the situation, and could help bring both sides closer together, and lead them back into production.

The president then gave a very interesting account of war activities in Halifax which, due to the necessity of secrecy, were unknown to the rest of the country. Such activities included everything from blackout arrangements to degaussing of ships as protection against magnetic mines, over 1600 ships, from battleships to mine sweepers, being taken care of during the war period.

The chairman next introduced Mr. Currie, who conveyed the very best wishes of the Halifax Branch and the Association of Professional Engineers of Nova Scotia to the Winnipeg Branch. Mr. Currie spoke briefly and mentioned that the Halifax Branch had the pleasure of entertaining a large number of Institute members from all over Canada, who had been stationed in Halifax during the war.

D. M. Stevens then presented the Winnipeg Branch Student prizes, donated each year for the best thesis submitted by students of the University on civil and electrical subjects. Prizes were awarded to Ralph Morris, fourth year civil, for his thesis on "Railway Water Supply", and to D. M. Maxwell, fourth year Electrical, for his thesis on "The Amplidyne Generator".

The Chairman then introduced Dr. Wright, who gave a brief resume of the years activities at Headquarters, and outlined Council's immediate programme. Dr. Wright closed by inviting as many members as possible to attend the Annual General Meeting in Toronto, next February.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Architectural Composition:
John Beverley Robinson. N.Y., Van Nostrand, 1908. 234 pp., illus. cloth. (Presented to the Library by A. T. Turner-Bone, M.E.I.C.)

Atlas of Canada Project; a Preliminary Survey:
Prepared by Benoit Brouillette. Ottawa, Canadian Social Science Research Council, 1945. 77 pp., paper.

Basis of Sheet Metal Drafting:
W. H. Hedley. Toronto, N.Y., Lond., Longmans, Green, c1945. 118 pp., illus., cloth.

Building an Engineering Career; 2d ed:
Clement C. Williams. N.Y., Lond., McGraw-Hill, 1946. 309 pp., illus., cloth.

Calculus for Practical Engineers in a Simple, Quick Engineering Way; 2d ed:
Alois Cibulka. Houston, Texas, Clarke & Courts, c1244. 100 pp., illus., paper.

Concrete Construction; Method and Cost:
Gillette, Halbert P. and Charles S. Hill. N.Y., Myron C. Clark, 1908. 690 pp., illus., cloth. (Presented to the Library by A. T. Turner-Bone, M.E.I.C.)

Hydro-Electric Handbook:
William P. Creager and Joel D. Justin. N.Y., Wiley; Lond., Chapman, 1927. 897 pp., illus., buckrum. (Presented to the Library by A. T. Turner-Bone, M.E.I.C.)

Industrial Organization and Management:
Lawrence L. Bethel and others. N.Y., Lond., McGraw-Hill, 1945. 798 pp., illus., cloth.

Practical Design Handbook for Engineers:
Alois Cibulka. Houston, Texas, Clarke & Courts, c1945. Variously paged, illus., paper.

Rock Excavation; Methods and Cost:
Halbert Powers Gillette. N.Y., M. C. Clark, 1904. 376 pp., illus., cloth. (Presented to the Library by A. T. Turner-Bone, M.E.I.C.)

Symposium on Magnetic Particle Testing:
American Society for Testing Materials. Philadelphia, A.S.T.M., c1945. 122 pp., illus., paper.

Towers and Tanks for Water-Works; 3d ed:
J. N. Hazlehurst. N.Y., Wiley; Lond., Chapman, 1907. 325 pp., illus., cloth.

PROCEEDINGS, TRANSACTIONS, ETC.

American Institute of Consulting Engineers:
Proceedings of the Annual Meeting, 1946.

American Society for Testing Materials:
1945 Supplement to A.S.T.M. Standards including Tentatives; Part II—Nonmetallic Materials—Constructional.

TECHNICAL BULLETINS, ETC.

merican Institute of Steel Construction:

Code of Standard Practice for Steel Buildings and Bridges; Rev. 1945. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted, and Arc-Welded Construction); Rev. 1946.

merican Iron and Steel Institute; Steel Products Manual:

Section 1—Pig Iron and Ferroalloys.—2—Carbon Steel Semifinished Products.—4—Carbon Steel Structural Sections.—8—Hot-Rolled Carbon-Steel Bars.—9—Cold-Finished Steel Bars and Shafting.—10—Hot-Rolled Alloy Steels.—11—Carbon Steel Sheets.—12—Hot-Rolled Carbon-Steel Strip.—14—Tin Mill Products; Tin Plate, Terne Plate, Black Plate.—15—Hot-Rolled Carbon-Steel Wire Rods.—16—Carbon-Steel Wire.—17—Flat Steel Wire.—18—Steel Tubular Products.—19—Railway Track Materials. —20—Wrought Steel Wheels.—25—Tool Steel Tolerances.—21—Concrete Reinforcement Bars.

sphalt Institute. Construction Series:

. . . A-2-a—Specification for Hot-Mix, Hot-Laid, Asphaltic Concrete Paving (Dense Graded Aggregate Type). C.S. No. 73.
. . . A-2-b—Specification for Hot-Mix, Hot-Laid, Asphaltic Concrete Paving (Graded Aggregate Type). C.S. No. 74.
. . . Inspection of Hot-Mix, Hot-Laid, Asphaltic Concrete Paving. C.S. No. 75.
. . . Highways of To-morrow—Recommended Thickness Requirements. C.S. No. 76

anada. Department of Mines and Resources. Surveys and Engineering Branch. Dominion Water and Power Bureau.

Water Resources in Canada, 1945. (Bulleting No. 2177).

odes of Practice Committee: British Standard Code of Practice:

CP(B) 526—Centralised Domestic Hot Water Service.—CP(B) 536—Calcium Sulphate Plastering.— CP(B) 537—Structural Recommendations for Load-Bearing Walls.—

lectrochemical Society: Preprints:

89-14—Uranium and Radium in the Postwar Period, S. C. Lind.—89-15—Corrosion Studies on Electrolytic Chromium, Norman Hackerman and D. I. Marshall.—89-16—Economic Factors in Operation of Cylindrical Chlorine Cells, L. P. Wenzell. P. J. Stuber, and S. Cottrell.

arvard University. Graduate School of Engineering. Reprint Series:

No. 414—Microwave Impedance Measurements with Application to Antennas; Part I, D. D. King; Part II, Ronald King and D. D. King. (Reprinted from Journal of Applied Physics, August 1945). . . . No. 415—Conversion Diagrams for Triode Tube Mixers, Harry Stockman. (Reprinted from Journal of Applied Physics, October 1945). . . . No. 416—Transient Performance of Propellers and Ships During Backing and Reversal, Reinhold Rudenberg. (Reprinted from Journal of the Franklin Institute, v240, 1945, pp., 193-227 and 347-378).

llinois. State State Water Survey Division:

Bulletin No. 36.—Ground Water Supplied in Northern Cook and Northern Dupage Counties.

nstitution of Mechanical Engineers. Advance Papers:

Experiment in the Use of a Standard Limit System, John Loxham.

ondon Advisory Committee for Rubber Research (Ceylon and Malaya):

Report of Conference on Post-War Preparation and Packing of Rubber, P. J. Burgess, Chairman.

ational Research Council:

Release No. 5—Radiant Heating Project at the National Research Laboratories, Ottawa.

orth-East Coast Institution of Engineers and Shipbuilders. Advance Papers:

Application of Light Alloys to Superstructures of ships, W. Muckle.

hio State University. Engineering Experiment Station. Circular:

No. 48—Ohio's Water Resources, C. V. Youngquist.

uebec (Prov.). Department of Mines. Division of Mineral Deposits:

Mining Properties and Development in Abitibi and Temiscamingue Counties during 1944, W. N. Ingham. In 3 parts. (French and English issues).

U. S. Department of Commerce. National Bureau of Standards:

Hot-Rolled Carbon Steel Structural Shapes. (Simplified Practice Recommendation R216 -46.

PAMPHLETS

Office Library of an Industrial Relations Executives; 5th Ed.

Helen Baker. Princeton University, Industrial Relations Section, 1946.

Uniform Canons of Ethics in Engineering:

Dugald C. Jackson.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

BRITISH STANDARD SPECIFICATION FOR BELL TRANSFORMERS (Excluding Transformers for Use in Mines). B.S. 832-1945:

London, British Standards Institution, 1945, 2/—.

This specification is a revision of B.S. 832-1939 and deals with bell ringing transformers having separate input and output windings for connection to low voltage circuits. It includes test requirements, maximum overall dimensions, standard capacities and output voltages, constructional details and requirements in connection with marking.

BRITISH STANDARD SPECIFICATION FOR CAST MANHOLE COVERS, ROAD GULLY GRATINGS AND FRAMES. B.S. 497-1945:

London, British Standards Institution, 1945, 3/6.

This revised and enlarged standard was prepared primarily for use in the post-war building programme and consequently was drawn up to facilitate mass production. The number and types of manhole covers, etc., have been reduced to a minimum, and adequate testing procedure has been provided in order to minimise the risk of accidents. Three grades of manhole covers and frames, and three types of gratings and frames have been provided. Manhole covers and frames:—(A) Heavy duty for use in carriageways. (B) Medium duty for use in footpaths, verges, carriage drives and cycle tracks. (C) Light duty for use in domestic premises or other places where they will not be required to carry wheeled traffic. Gully gratings and frames:—(A) Heavy duty for use in main roads. (B) Medium duty for use in roads on which there is no expectation of heavy vehicles or fast traffic. (C) Kerb type covers and frames for setting into footpaths and verges.

BRITISH STANDARD SPECIFICATION FOR WIRE ROPE SLINGS & SLING LEGS. B.S. 1290-1946.

London, British Standards Institution, 1946, 3/6.

This standard is alternative to and comparable with B.S. 781 for chain slings. The standard components for the slings are taken from B.S. 482 (hooks for cranes and slings), B.S. 302 (wire ropes for cranes), B.S. 462 (thimbles for wire ropes), and B.S. 781 (chain slings, rings and links). The illustrations of standard slings are to scale. To render the standard as nearly as possible self contained, extracts from B.S. 482 and B.S. 462 are reproduced at the end of the publication.

BUILDING AND ENGINEERING CAREER; 2d ed:

By C. C. Williams. N.Y., London, McGraw-Hill; Toronto, Embassy, 1946. 309 pp., illus., diagrs., charts, tables, 8¼ x 5½ in., cloth, $3.00 (in Canada).

An orientation text for engineering freshmen which gives him the engineering vocabulary and mode of thinking. The author discusses what engineering is and how to study it, gives something of its historical background and calls attention to modern achievements. Contents:—Part I—Vocations and Professions; The Profession of Engineering; Objectives of Engineering Education; How to study Engineering—General Procedure; How to study Engineering Suggestions. Part II—Machines and Structures; Heat and Electrical Energy; Transportation and Communications. Part III—Achievements in Chemical, Civil, Electrical, Mechanical and Mining Engineering and Metallurgy; Social and Economic effects of Engineering.

HOW TO EVALUATE SUPERVISORY JOBS:

Albert N. Gillett. Deep River, Conn., National Foremen's Institute, 1945. 141 pp., loose-leaf, charts, fabrikoid, 81½ x 11 in., $7.50.

An executive and supervisory appraisal manual divided into three parts. Part I—Job analysis, rating, and evaluation of supervision method; Part II—Detailed description of a definite plan by which management can determine the weak and strong points of the individual occupying the supervisory position; Part III—Blank forms which may be used by the reader for running his own tests. The manual contains a wealth of illustrative material.

(Continued on page 393)

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their May 1946 copy to headquarters.

On account of difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

May 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 July meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

A Member shall be at least twenty-seven years of age, and 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, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, 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 before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

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.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, 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 attainment 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

BROCKENSHIRE—WILLIAM, of 44 Wyandotte St., East, Windsor, Ont. Born at Midland, Ont., March 29, 1914. Educ.: B.Eng. (Arch.), Detroit Institute of Tech 1939; 1935-36, (summers), layout, sash dept., Truscon Steel Co.; dftsman., Carter-Halls-Aldinger; with Constrn. Co., as follows: 1937-40, dftsman., 1940-42, estimator; 1942-45, Lieut., R.C.E.; and at present, estimator, Allan Construction Co., Ltd., Windsor, Ont.

References: G. G. Henderson, J. M. Wyllie, W. R. Mitchell.

BUCKLE—CHARLES WILFRID, 444 Lynas Road, Eburne, B.C. Born at Bilton, Yorks, Eng., May 12, 1888. Educ.: 1898-05, Arnold House Coll., Blackpool, Eng., (Cambridge Univ., Jr. Certificate); 1907-08, chainman & field dftsman., National Trans. Rly., Kenora, Ont.; with Can. Northern Pacific Rly, as follows: 1913-14, office engr. & asst. chief dftsman., 1914-17, asst. engr., constrn. Blue River to Albreda Summit, grading, tunnels, trestle bridges, etc., 1917, (6 mos.), asst. engr., hydraulic dredge fill, Vancouver; 1918-20, Lieut., Canadian Exp. Force, Canadian Engineers; 1921-32, private commercial business; 1933-37, asst. engr., Vancouver Civil Airport; with Dept. Public Works, as follows: 1937-42, asst. engr. i/c Fraser River survey, design & constrn of control works, bank protection, dykes, jetties, etc., 1942-45, engr. i/c, removal ripple rock Seymour Narrows, B.C., 1935, (6 mos.), engr. i/c, triangulation & Bathymetric surveys Kootenay Lake in connection with investigation Columbia River by Int. Joint Board (in progress), and at present, asst. engr., B.C. & Yukon District, New Westminster, B.C.

References: F. G. Goodspeed, K. W. Morton, C. E. Webb, W. R. Bonnycastle, W. E. Keyt, W. A. Bickell, J. H. A. Steven, F. O. Mills.

DeBLOIS—HOWARD CRAWFORD, Shawinigan Falls, Que. Born at Tweed, Ont., Jan. 12, 1913. Educ.: Graduate, R.M.C., 1934; M.A. (Honors in Mech. Sciences) Cambridge Univ., 1936; 1937-44, Officer in Searchlight Company in British Army in England, same in Egypt, Engr. Officer I/C Army constrn. in Malaya, roads, camps, barracks, gun emplacements, etc., rose from Lieut. to Major, i/c similar work in Ceylon as Major; 1945 to date, engr., Consolidated Works, Canadian Industries Limited, Shawinigan Falls, Que.

References: A. S. Holder, I. R. Tait, H. K. Wyman, A. B. McEwen, W. McG. Gardner, J. R. Donald.

EBERTS—HERMANN LIVINGSTON, of Westmount, Que. Born at Montreal, July 4, 1905. Educ.: Graduate, R.M.C., 1927; B.A.Sc., (El.), McGill, 1929; R.P.E., Quebec; with Montreal Tramways, as follows: 1931-33, asst. elect. engr., power dept., 1933-38, asst. to genl. mgr., 1938-42, elect. supt., autobus dept.; 1942-44, facty. mgr., Small Electric Motors, Leaside, Ont. (war plant, Radar & Asdic equipt.); 1944 to date, sr. engr., Stevenson & Kellogg Ltd., Montreal, Que.

References: J. E. Dion, J. Lefort, G. H. Kimpton, W. R. Simmons, C. A. Peachey.

GREEN—KENNETH WILSON, 408 Rosedale Ave., Winnipeg, Man. Born at Winnipeg, Man., Dec. 10, 1916. Educ.: B.Sc., (Elect. Engrg.), Manitoba, 1944; 1936, (summer), machinist apprentice, C.N.R.; 1944-46, Lieut. (E), R.C.N.V.R.

References: E. P. Fetherstonhaugh, N. M. Hall, J. Gordon, G. H. Herriot, A. E. Macdonald.

HENDERSON—JOHN CHARLES, 717 Eglinton Ave., W., Toronto, Ont. Born at Toronto, Ont., Jan. 10, 1919. Educ.: B.A.Sc., Toronto, 1944; 1942-45, R.C.E.M.E.

References: G. R. Lord, R. W. Angus, E. A. Allcut, C. R. Young, G. H. W. McKee.

LAIRD—WILLIAM DOUGLAS, 3193 The Blvd., Westmount, Que. Born at Winnipeg, Man., Sept. 17, 1916. Educ.: B.Sc., (Civil), Manitoba, 1940; course in internal combustion engines, M.I.T.; 1939 (summer), dfting., Cowin & Co., 1940, (7 mos.), dfting., Shawinigan Engrg. Co.; 1940-45, R.C.A.F., 2 yrs. as Engr. Officer; 1945 to date, project engr., on gas turbine testing, and research, Turbo Research Limited, Winnipeg, Man.

References: E. P. Fetherstonbaugh, R. E. Heartz, J. B. Challies, C. A. Antenbring, A. E. Macdonald.

LAPHAM—CHARLES STANLEY, of Ocean Falls, B.C. Born at Bournemouth, Eng., Sept. 19, 1910. Educ.: 1945 graduate of special electrical course at the N.S. Tech. Coll., given to selected personnel in the Navy qualifying them for commissioned officer. (Course approved by Council as meeting requirements for Junior.); 1930-31, exploration & constrn., hydro-electric dam, West Kootenay Power & Light Co., Ltd.; 1936 to date, constrn., operation, mtce., and at present class "A", elect. journeyman, Pacific Mills Limited, Ocean Falls, B.C.

References: F. H. Sexton, G. H. Burchill, P. A. Frattinger, C. W. E. Locke.

MAGILL—EDWARD STAIRS, of Winnipeg, Man. Born at Halifax, N.S., Dec. 18, 1907. Educ.: B.Sc., (Civil), Manitoba, 1933; R.P.E., Manitoba; 1933-37, few engrg. jobs were available, majority of period spent on numerous small jobs not connected with engrg.; 1937-45, asst. prof. of civil engrg., Univ. of Witwatersrand, Johannesburg, S. Africa; 1946 to date, asst. professor of civil engrg., Univ. of Manitoba, Winnipeg, Man.

References: A. E. Macdonald, G. H. Herriot, W. F. Riddell, N. M. Hall, E. P. Fetberstonbaugh, D. M. Stepbens, W. A. Trott.

MAYBERRY—FREDERIC COATES, 10 Earl Haig Ave., Toronto 6, Ont. Born at Stratford, Ont. June 4, 1896. Educ.: Toronto, 1913-14; Assoc. A.I.E.E.; R.P.E., Ontario; 1913-14, (summers), Canadian National Ex. as elect. apprentice; 1915-19, Lieut., Overseas: 1919-20, dftsman., Toronto Hydro-Electric System; 1919-20, hospitalized for war disability; 1921 to date, with Canadian National Exhibition, as electr. & asst. to elect. supt., elect. supt., asst. works mgr., assisted in design of elect. instlns., i/c of design, operation & extensive development of primary distribution system, etc., and at present asst. mgr.

References: O. W. Titus, M. J. C. Lazier, D. M. Fraser, W. T. Holgate, H. L. Dowling.

MILLER—HERBERT BEVERLEY, of 130 S. College Ave., Sarnia, Ont. Born Oyen, Alta., March 25, 1921. Educ.: B.Sc., (Chem. Engrg.), Alberta, 1942; 1941 (summer), instru'man., Dept. of Transport, Alberta; 1942-43, shift analyst, under chem. supvr., Alberta Nitrogen Products Ltd., Calgary, Alta.; 1943 to date, with Imperial Oil Limited, Sarnia refinery, and at present, chem. engr., inspection dept., Sarnia, Ont.

References: G. L. Macpberson, P. Warkentin, F. F. Dyer, C. P. Sturdee, C. F. Davison.

NOWAKOWSKI—ZYGMUNT JAN, 20 Sbrewsbury St., Stratford, Ont. Born at Szczecin, Stettin, (at present Poland), Feb. 6th, 1902. Educ.: Leaving Certificate, Divn. No. 1, Higher Techn. State Educational Institute for Mechanical Affairs, Stettin, 1924; Member, Assn. Polish Engrs. in Canada, (educational qualifications guaranteed by the Assn.); 1925-26, asst. to facty. supt., H. Ceglielski, Poznan, Poland, (machine tool mfrs.); with Samolot Aircraft Mfg. Co., Lawica, Poland, as follows: 1926-27, dftsman., 1927-28, jr. designer, 1928-29, sr. designer, 1929-30 supvr., development shop, 1930-31, asst. mfg. supt.; 1931, genl. foreman Grakona, (tool mfg. Co.), Bydzoszcz, Poland; with Polish States Aircraft Factories (P.Z.L.), Warsaw, Poland, as follows: 1932, asst. to tech. mgr., 1933-34, supt. of assembly shop, 1935-37, chief methods engr., 1937-39, prod. control supt.; 1939-40, tech. advisor to C/Airforce, Royal Bulgarian Air Ministry, Sofia, Bulgaria; 1940-41, tech. supt., French General Electric, Souilly, Paris, France; with Massey-Harris Ltd., aircraft divn., Weston, Ont., as follows: 1942, tool designer & chief tool designer, 1943, asst. chief engr.; 1943 to date, prod. mgr., Canadian Wooden Aircraft Ltd., Stratford, Ont.

References: G. A. Mokrzycki, M. Lazier, J. K. Angerman, W. Czerwinski, C. H. Klawe, C. S. Gorowski.

RICHARD—ALFRED O., 549-18th Ave., Lachine, Que. Born at St. Johns, Que., May 27, 1888. Educ.: I.C.S., (Mech. & Civil Engrg.), 1907-14; 1910-13, mech. dftsman., Montreal Loco. Works Ltd.; 1914-16, chief dftsman., Can. Liquid Air

Co.; 1917-20, asst. chief tool designer, Peter Lyall & Sons; 1921-23, mech. dfting., checking & estimating, Montreal Loco. Works Ltd.; 1924-25, asst. chief tool designer & checker, Chrysler Corp. Detroit; 1925 to date, designer, Dominion Bridge Co., Lachine Que.

References: R. S. Eadie, R. H. Findlay, G. H. Midgley, G. Martin, G. G. Clarke, P. G. Brault, K. O. Whyte, W. L. Laing, J. Smith, C. H. Timm.

SORENSEN—ERIC EDGAR, 384 Earl St., Kingston, Ont. Born at Red Deer, Alta., Jan. 27, 1920. Educ.: B.S.c, (Chem. Engrg.), Queen's, 1942; R.P.E., Ontario; 1940-41, (summers), underground miner, Brittain Beach Mines, B.C.; labourer, Atlas Steels, Welland, Ont.

References: D. S. Ellis, A. Jackson, R. A. Low, L. T. Rutledge, J. D. Lee.

WARREN—MARK PROSPERE, 921 St. Joseph Blvd., Montreal, Que. Born at Montreal, Aug. 19, 1919. Educ.: B.Eng. (Met.), McGill, 1942; 1940-41, (summers), smelter work, Noranda Mines; International Nickel; 1942-43, hull & mech. outfitting, United Shipyards Ltd.; 1943 to date, Lieut., R.C.E.M.E., Overseas, and now returned.

References: R. DeL. French, G. A. Leonard, C. M. McKergow, G. J. Dodd, E. Brown.

FOR TRANSFER FROM JUNIOR

KENNEDY—DORWIN ELMORE, of Ottawa, Ont. Born at Toronto, Ont., Sept. 4, 1916. Educ.: B.A.Sc., (Civil), Toronto, 1940; R.P.E., Ontario; 1940-43, jr. engr., design, estimating, economic studies, etc., canals, dams and Water control structures in general, hydraulic dept., H.E.P.C., Ontario; 1943 to date, forest products engr., strength testing of timber, research projects, responsible as an asst. for supervision of laboratory assistants who perform mech. & physical tests, compute & compile results, Forest Products Laboratories, Dept. of Mines & Resources, Ottawa. (Jr. 1942).

References: E. B. Hubbard, R. F. Legget, G. R. Lord, T. A. McElhanney, R. H. Self, W. E. Wakefield.

PAINTER—GILBERT WALTER, 3 duMaurier Blvd., Toronto, Ont. Born at Montreal, Que., Oct. 13, 1909. Educ.: B.Eng. (Elect.), McGill, 1933; R.P.E., Ontario; with Canadian General Electric, as follows: 1934-35, test course, Peterboro, 1935, engr., switchgear engrg. dept., 1936, engr., AC-DC engrg. dept., 1936-41, rly. & traction engr., head office, Toronto; 1941-46, R.C.E.M.E., with rank of Lieut. Colonel, (Commander Army Troops, R.C.E.M.E.); at present, transportation specialist, Toronto dist., Canadian General Electric Co., Ltd., Toronto, Ont. (Jr. 1936).

References: C. E. Sisson, W. E. Ross, W. E. P. Duncan, W. L. Sagar, C. V. Christie, R. DeL. French.

FOR TRANSFER FROM STUDENT

COOK—KENNETH GILBERT, 48 Stratford Road, Que. Born at Montreal, Que., Mar. 9, 1915. Educ.: B.Eng. (Mech.), McGill, 1938; 1938-42, estimating, expediting, Canadian Car & Foundry Co. Ltd., Montreal; 1942-46, R.C.E.M.E., with the rank of Captain; and at present production engrg., Cresswell-Pomeroy Ltd., Montreal, Que. (St. 1936).

References: C. M. McKergow, A. R. Roberts, R. DeL. French, T. M. Moran.

GOODFELLOW—HODGSON, Major, M.B.E., R.C.E.M.E., 144 Broadway Ave., Ottawa, Ont. Born at South Shields, Eng., June 15, 1915. Educ.: B.Sc., (Mech.), Sask, 1940, Graduate Member, Inst. M.E., Great Britain; 1935-39, (summers), rodman, chainman, instru'man., and resident engr., West Val Marie Dam, P.F.R.A.; 1940-46, R.C.E. & R.C.E.M.E., Overseas, and at present, responsible for preparation of repair & mtce. instructions on all engr. plant & constrn. equipt., Vehicle Mtce. Group, D.M.E., N.D.H.Q., Ottawa, Ont. (St. 1939).

References: E. C. Mayhew, C. J. Mackenzie, R. A. Spencer, I. M. Fraser.

HAND—DENNIS HERBERT, Captain, R.C.E.M.E., 208 Laurier Ave., W., Ottawa, Ont. Born at Minnedosa, Man., Dec. 31, 1919. Educ.: B.Sc., (Elect.) Manitoba, 1942; Service Design Engr. for Army Radar, attached to Directorate of Armament Development, N.D.H.Q. (Army) Capt. & Tech. Staff Officer Grade III, Ottawa, Ont. (St. 1942).

References: E. P. Fetherstonhaugh, LeS. Brodie, N. M. Hall, H. P. Cadario, A. E. Macdonald, C. A. Manson.

KER—WALTER ALLAN, of Victoria, B.C. Born at Vancouver, B.C., June 22, 1917. Educ.: B.A.Sc., B.C., 1945; 1946 to date, asst. engr., Water Rights Branch, Dept. of Lands, Parliament Bldgs., Victoria, B.C. (St. 1944).

References: J. N. Finlayson, A. Peebles, W. L. Kent, E. Davis, R. C. Farrow.

KIRKLAND—WILLIAM DALTON, of Edmonton, Alta. Born at Edmonton, Alta., Sept. 5, 1915. Educ.: B.Sc., (Elect.), Alberta, 1937; R.P.E., Ontario; with H.E.P.C. of Ontario, as follows: 1938, (6 mos), constrn. dept.; 1938-45, elect. engrg. dept., dfting, checking elect. diagrams for large transformer & generating stns., studies in operation & design of automatic control equipt., distribution stn. engrg. including preliminary design, etc.; 1946 to date, elect. engr., general design, etc., City of Edmonton Power Plant. (St. 1937).

References: W. I. McFarland, D. A. Hansen, E. W. Bowness, J. W. Porteous, H. E. Brandon, E. C. Higgins.

L'HEUREUX, LION JOSEPH JEAN, of Gravelbourg, Sask. Born at Gravelbourg, Sask., March 2, 1919. Educ.: B.Eng. (Physics), Sask., 1944; 1941-42, (summers), asst. to plant engr., Purity Dairy, Saskatoon; jr. engr., Alaska Highway; 1944-46, Tech. Officer in Signal Corps, with rank of Lieut., commuuication work, especially design work for Canadian Army, Ottawa, Ont. (St. 1943).

References: N. B. Hutcheon, I. M. Fraser, R. A. Spencer, E. K. Phillips.

MacFADYEN—ALLAN BURT, 9 Humewood Drive, Toronto 10, Ont. Born at Sunderland, Eng., Feb. 27, 1917. Educ.: B.Sc., (El.), Manitoba, 1942; 1937-41, (summers), Hudson's Bay Mining & Smelting, Flin Flon, Man.; 1942-45, Royal Canadian Corps of Signals. (St. 1942).

References: E. P. Fetherstonhaugh, N. M. Hall, G. H. Herriott, W. F. Riddell, A. E. Macdonald.

MENDELSOHN—ALBERT, of Ste. Agathe des Monts, Que. Born at Montreal, Que., March 21, 1917. Educ.: B.Eng. (Mech.), McGill, 1939; 1936-37-38, (summers), fireman, power house, Laurentian San., Ste. Agathe, Que.; lathe hand, iron work, Algoma Steel Corp., Sault Ste. Marie, Ont.; 1939-40, jr. fuel engr., Algoma Steel Corp., Sault Ste. Marie; 1940 to date, R.C.E.M.E., present rank, Major. (St. 1937)

References: E. Brown, R. DeL. French, C. M. McKergow, A. R. Roberts, C. Stenbol.

MIKKELBORG—GORDON HODGSON, of Baie Comeau, Que. Born at Zealandia, Sask., Dec. 9, 1912. Educ.: B.Sc., (Mech.), Sask., 1943; 1943-46, Lieut., R.C.E.M.E., E.M.E. Corps; and at present, development engr., Quebec North Shore Paper Co., Baie Comeau, Que. (St. 1942).

References: E. K. Phillips, N. B. Hutcheon, I. M. Fraser, R. A. Spencer, W. E. Lovell.

NATHANSON—SOLOMON, 2520 Kings Highway, Brooklyn 29, N.Y. Born at Montreal, Que., July 30, 1917. Educ.: B.Eng., (Civil), McGill Univ., 1939; M.Sc., (Civil Engrg.), M.I.T., 1940; 1940-45, British Air Commission, Washington, D.C.; 1946 to date, designer, structl. steel & concrete for bldgs., Charles Mayer, New York. (St. 1938).

References: G. J. Dodd, R. DeL. French, E. Brown, R. E. Jamieson, C. C aig.

SANSOM—RALPH THOMAS, 39½ Bonaccord St., Moncton, N.B. Born at Campbellton, N.B., Sept. 23, 1913. Educ.: B.Sc., (El.), N.B., 1935; 1936-37, instru'man., Dept. Public Works, N.B.; 1937-40, asst. el. engr., Campbellton Electric Light Dept.; 1940-43, Signal Officer, North Shore, N.B. Regt.; 1944-46, Capt. Saskatoon Light Infantry; and at present, asst. engr., signal dept., Canadian National Railways, Moncton, N.B. (St. 1935).

References: V. C. Blackett, E. O. Turner, J. Stephens, J. H. T. Morrison, A. F. Baird.

STONE—JOHN GORDON, Baie Comeau, Que. Born at Moncton, N.B., July 4, 1918. Educ.: B.Sc., (Civil), Queen's, 1941; 1941-42, (10 mos), instru'man., i/c party on re-alignment of track, etc., dfting. & genl. office engrg., Canadian National Railways, Ottawa, Ont.; 1942-46, R.C.E.M.E., Overseas, with rank of Captain; at present, asst. mech. supt., mill dept., Quebec North Shore Paper Co., Baie Comeau, Que. (St. 1940).

References: D. S. Ellis, A. Jackson, R. A. Low, L. S. McGregor.

THOMPSON—GEORGE WILBERT, 62 Second Ave., Ottawa, Ont. Born at Barrie, Ont., Nov. 13, 1917. Educ.: B.Sc. (Chem.), Queen's, 1941; 1941, (5 mos.), chemist on research work, Welland Chemical Works, Niagara Falls, Ont.; 1941-46, R.C.E.M.E. Overseas, with the rank of Lieut., and at present Major, with the appointment of D.A.D.M.E., N.D.H.Q., Ottawa, Ont. (St. 1941).

References: J. W. Bishop.

LIBRARY NOTES

(*Continued from page 391*)

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

A.S.T.M. STANDARDS including Tentatives, 1945 Supplement:

Part I—Metals. 397 pp.
Part II—Nonmetalic Materials—Constructional. 229 pp.
Part III—Nonmetalic Materials—General. 503 pp.

American Society for Testing Materials, Philadelphia 2, Pa., 1945-1946, illus., diagrs., charts, tables, 9⅝ x 6 in., cloth, $4 per Part ($2.50 to A.S.T.M. Members).

This supplement to the 1944 book of A.S.T.M. Standards brings it up to date by giving all the changes or additions accepted during the year 1945. Two hundred and fifteen standards are included, some sixty of which appear for the first time. The supplement appears, like the original work, in three volumes.

JOB EVALUATION METHODS:

By C. W. Lytle. Ronald Press Co., New York, 1946. 329 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $6.00.

The author presents an analytic approach to the subject. The procedure of job analysis and evaluation is separated into functional steps as indicated by the chapter headings, in order to compare and select methods and characteristics to fit any given set of conditions. The application of evaluation to office and supervisory positions is considered, and there is a special chapter on merit rating.

HACKH'S CHEMICAL DICTIONARY (American and British Usage), third edition completely revised:

Edited by J. Grant. Blackiston Company, Philadelphia and Toronto 1944; 1946 printing with changes and additions. 925 pp., illus., diagrs., charts, tables, 10 x 6½ in., cloth, $8.50.

This standard encyclopedic dictionary, based on recent chemical literature, covers not only the terms used in general chemistry, but also the collateral vocabularies of physics, astrophysics, mineralogy, pharmacy and medicine, and pertinent terms of agriculture, engineering and industry. It gives clear, brief statements of chemical theories, rules and laws, descriptions of elements, compounds, products, apparatus, etc., and notes and names of important scientists. Much new material has been added to the present edition, including terms relating to atomic disintegration.

MATERIALS HANDLING MANUAL (II)

Edited by M. M. Williamson and G. W. Williamson. Paul Elek (Publishers) Ltd., London, E.C.1, 1945. 488 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, 30s.

This volume deals with aspects of handling applicable to all industries. The material is divided into four main divisions: continuous bulk movement, mainly horizontal, such as belt conveyors and aerial ropeways; continuous bulk movement, mainly vertical, as with elevators and pneumatic handling; continuous package handling, horizontal and vertical; intermittent movement, as earth moving, hoists and trucks. The book is intended as a guide for engineers and designers for modernizing plants or preparing new lay-outs, and is profusely illustrated with photographs, sketches and flowsheets.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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. Particular emphasis is laid at this time on the need for this service to fill the dual role of providing a general picture of employment conditions for members in the armed forces, and of making available to them specific contacts both now and at the time of their release from the services. 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 from recent graduate up required for special work on ventilation by an industrial organization with headquarters in Montreal. Salary from $200 according to qualifications. Apply to File No. 3500-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 with executive experience for position of Town Manager in progressive New Brunswick town. Good salary to right man. Apply in writing giving full details qualifications and experience. Apply to File No. 3481-V.

CIVIL ENGINEER DRAUGHTSMAN, age 25-35, for consulting engineer's office near Toronto. Applicant should have some knowledge of municipal sewerage and waterworks problems. Apply to File No. 3489-V.

ELECTRICAL

ELECTRICAL ENGINEER, graduate with some experience in electronics, age 25-35 is required by a company in Montreal at a salary of $250. Apply to File No. 3236-V.

ELECTRICAL ENGINEER with some mechanical experience, age 30-35, required for the gas division of a public utility in Western Canada, salary according to qualifications. Apply to File No. 3494-V.

ELECTRICAL ENGINEER with extensive experience as superintendent of entire electrical equipment for a townsite and paper mill in Western Ontario. Salary from $400-$500 according to experience. Apply to File No. 3497-V.

ELECTRICAL ENGINEER with experience in layouts and conduit details required for design work with a firm of consulting engineers in Southern Ontario. Salary open. Apply to File No. 3499-V.

MECHANICAL

GRADUATE MECHANICAL OR AERONAUTICAL ENGINEER with at least five years experience in aircraft, preferably in mfg., must have a fair knowledge of mechanical a c installation and be familiar with heat and ventilating installations, controls, de-icing, hydraulics and landing gear. Apply to File No. 3300-V.

MECHANICAL ENGINEER, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEER aged 30 to 35, capable of investigating maintenance and conveyors, motors and drives etc. This position includes studies toward improved plant maintenance and will also entail draughting, some routine keeping of records and allied engineering work. Salary $225 to start. Apply to File No. 3477-V.

MECHANICAL ENGINEER, recent graduate, for mechanical draughting work in paper mill in the Lake St. John area. Salary open. Apply to File No. 3478-V.

MECHANICAL ENGINEER for control work in the laboratory of a paper mill in the St. Maurice Valley with training for future supervisory work. Apply to File No. 3483-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

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

MISCELLANEOUS

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in Western Ontario. Salary would be $300 to $350. Apply to File No. 3227-V.

ENGINEER SALESMAN, fluently bilingual, not necessarily a graduate but with some good experience on truck mechanical work and some sales background, age 35-40, is required by an automobile manufacturer for work in the Montreal area. Preference will be given to ex-service men and R.C.E.M.E. and workshop experience would be useful. Salary $250 to $350. Apply to File No. 3266-V.

ENGINEERING ACCOUNTANT, young graduate age 25-35, with engineering background and taste for accounting, is required to act as assistant to the secretary treasurer of a manufacturing concern in Montreal. Apply to File No. 3272-V.

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual with some practical experience is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

TECHNICAL SALES ENGINEERS are required by an oil company in the Montreal area. Candidates must be bilingual and experience may range from recent graduate up. Salary will be $150-$250 depending on qualifications. Apply to File No. 3320-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-V.

GRADUATE ENGINEER with some construction experience, under 35, fluently bilingual, required for maintenance and construction work in a large wood working plant in Quebec, to be trained as chief engineer of plant. Apply to File No. 3484-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-V.

CIVIL OR MECHANICAL ENGINEERS from recent graduates up required for various mills by a pulp and paper firm in Eastern Canada. Salary from $200 according to qualifications. Apply to File No. 3488-V.

STRUCTURAL STEEL ENGINEER with both field and office experience for employment in various parts of Canada as owner's representative on building construction. Salary according to experience. Apply to File No. 3490-V.

DESIGNING ENGINEER preferably with pulp and paper mill experience wanted for a paper mill in Newfoundland. Salary would be from $250-400 depending on qualifications. Apply to File No. 3491-V.

INDUSTRIAL MINERALOGIST, with Ph D. or M.Sc. in geology, mineralogy, chemistry or metallurgy and knowledge of commercial processing of industrial metals, laboratory investigations and publishing of results. Must have at least five years experience with special reference to industrial minerals. Starting salary from $275 in prov. mines dept. Apply to File No. 3492-V.

GEOLOGISTS, with Ph. D. in economic or mining geology and intimate knowledge of structural geology, diamond drilling and geophysical methods. Must have at least five years practical experience, ability to publish results of original investigations and use of aerial photographs. Starting salary from $275. in Prov. Mines Dept. Apply to File No. 3492-V.

MECHANICAL OR CIVIL ENGINEERS required as assistant engineer in Meat Packing firm with plants throughout Canada. Duties to consist of general industrial maintenance work, including building construction, steam, refrigeration and electrical installations. Positions available in Western Canada at salary of $195 to $240 depending on experience. Apply to File No. 3495-V.

SALES ENGINEERS required for junior positions in an Ontario firm manufacturing and installing building specialties in industrial plants. Salary according to qualifications with good prospects. Apply to File No. 3496-V.

MECHANICAL OR ELECTRICAL ENGINEER with at least three years experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $200 according to experience. Apply to File No. 3498-V.

STRUCTURAL STEEL DESIGNER for work with a firm of consulting engineers in Southern Ontario. Salary open. Apply to File No. 3499-V.

RESIDENT ENGINEER required for a road construction contractor in Quebec. Salary $225 with board. Apply to File No. 3501-V.

CHEMICAL OR MECHANICAL ENGINEER with construction experience in the chemical field, a knowledge of hydrocarbons and at least five years experience since graduation is required by a chemical firm in Western Ontario. Salary from $250. Apply to File No. 3502-V.

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

CHEMICAL

CHEMICAL ENGINEER with some pulp and paper experience required for the technical department of a paper mill in Lake St. John area. Apply to File No. 3470-V.

CIVIL

JUNIOR ENGINEER, young graduate in civil with some experience in structural and municipal work, also overseas experience in the armed forces, age 35 or under, is required by a city in Ontario. Apply to File No. 3203-V.

CIVIL OR MECHANICAL ENGINEER, not necessarily a graduate, age 24-30, some experience in concrete and steel draughting, some sales ability, required to work with a consulting engineer and contractor in Montreal. Salary open. Apply to Box No. 3339-V.

CIVIL ENGINEER, young graduate preferred, with some experience on building layouts and piping work is required as draughtsman for an oil company in the Montreal area. Apply to File No. 3345-V.

SEVERAL CIVIL ENGINEERS, two with two or three years' experience in road construction and two recent graduates, are required for road building work in northern Quebec. Salary $2400. to $3000 a year. Apply to Box. No. 3351-V.

TWO CIVIL ENGINEERS, preferably but not necessarily graduates, are required to act as structural steel draughtsmen or checkers for a company engaged in this sort of work in Alberta. All applications should indicate education, experience and salary expected. Apply to Box No. 3365-V.

CIVIL OR MECHANICAL ENGINEER with four or five years experience in a pulo and paper company is required by a company engaged in this work in eastern Ontario. Apply to Box No. 3367-V.

CIVIL ENGINEER is required to act as assistant to city engineer, some knowledge of town services such as, water works, sewage, building inspection, parks, lighting an asset. Location Montreal. Salary open. Apply to Box No. 3385-V.

CIVIL ENGINEER with five to ten years experience in reinforced concrete design is required by a firm of consulting engineers in Montreal. Salary open. Apply to Box No. 3387-V.

TWO CIVIL ENGINEERS are required to act as senior and junior structural designer respectively with a steel company in southern Ontario. Salary open. Apply to Box No. 3389-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to Box No. 3394-V.

RESIDENT ENGINEER graduate, preferably but not necessarily bilingual with several years' experience in building construction is required for a housing project in Montreal. Several civil engineers from recent graduates up are also required. Salary open. Apply to Box No. 3402-V.

SEVERAL CIVIL ENGINEERS with experience in the design of structural steel and reinforced concrete, or who are interested in testing and research work in connection with concrete and soils are required in the engineering department of a large organization in Toronto. Salary open. Apply to Box No. 3409-V.

CIVIL ENGINEER graduate with several years experience in construction work, preferably bilingual is required by a construction company in Montreal to take charge of a project as resident engineer in Quebec. Salary open. Apply to Box No. 3421-V.

CIVIL ENGINEERS with construction experience for field work on contracts with a firm of Montreal contractors. Salary open. Apply to File No. 3437-V.

CIVIL ENGINEER, as township engineer, responsible for construction and maintenance of roads, municipal drainage etc. Must be qualified O.L.S. Required for Central Ontario. Salary $250 per month. Local private practice allowed. Apply to File No. 3441-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in the Montreal area. Apply to File No. 3446-V.

CIVIL ENGINEER with experience on foundations, steel work and erection of plant. Preferably R.P.E. in B C. Required for construction work on B.C. coast. Salary according to qualifications. Apply to File No. 3448-V.

CIVIL ENGINEERS with construction experience, age 25 up, preference R.C.E. personnel, required by building contractors in Montreal, to take charge of jobs as superintendent or office engineer. Salary from $300 according to qualifications. Apply to File No. 3458-V.

ELECTRICAL

ELECTRICAL ENGINEER with some experience with machinery and/or electrical installation work, with ability to get along with people, and interested in investing some capital, is required for executive work with a small company on the west coast for work in connection with the electrical machinery requirements and installation of lighting and power plants in the province. Salary open. Apply to Box No. 3352-V

TWO ELECTRICAL ENGINEERS with a minimum of four years' experience with commercial radio equipment are required by a firm in Montreal. Applicants must have good personality and ability to meet public. Please do not apply unless qualified. Salary open. Apply to Box No. 3395-V.

ELECTRICAL ENGINEER with experience in marine electrification is required by a consulting firm in the Montreal area. Salary open. Apply in writing to Box No. 3398-V.

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 Box No. 3415-V.

ELECTRICAL ENGINEER 5 to 10 years experience on general electrical design wiring of buildings, industrial plants and sub-stations, preferably a graduate, is wanted by a firm of consulting engineers in Montreal. Salary $250-$400 a month. Apply to Box No. 3420-V.

ELECTRICAL GRADUATE, with considerable experience in electronics and aircraft instruments and some sales ability, age 30 to 40, required for firm handling aircraft equipment in Montreal area. Salary open. Apply to File No. 3434-V.

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

MECHANICAL

MECHANICAL ENGINEER, age about 35-40 with experience in thermo-dynamics, mechanical and chemical work is required to be chief engineer of a company in the Toronto area. Preference to ex-service man. Salary about $400-$600. a month. Apply to Box No. 3308-V.

MECHANICAL ENGINEER, with 4 or 5 years industrial experience since graduation, with knowledge of and interest in steam as applied to industrial equipment, and preferably some experience in ventilation work and in pulp and paper mills, is required by a company in southern Ontario. Salary $3600. per year. Apply to Box No. 3333-V.

EIGHT MECHANICAL ENGINEERS or senior draughtsmen are required for design on a large plant extension project near Montreal. Salary $200. a month and good room and board available. Apply to Box No. 3360-V.

TWO OR THREE MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

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

THREE MECHANICAL ENGINEERS with one or two years experience in draughting and design are required for a paper company on the east coast. Work will involve draughting, design of new equipment and alterations to existing plant and equipment. Salary open. Apply to Box No. 3397-V.

MECHANICAL DRAUGHTSMAN is required by a paper company in Ontario. Must have industrial plant experience including conveyors, piping and machinery layouts. Salary $200-$225 a month. Apply to Box No. 3399-V.

MECHANICAL ENGINEER with paper mill experience is required to act as assistant mechanical superintendent of a large paper mill located in a city in western Quebec. Salary open. Apply to Box No. 3400-V.

JUNIOR MECHANICAL ENGINEER, not necessarily graduate, but must have some experience of mechanical design. Preference will be given to ex-servicemen. Salary $2,400 to $2,700 depending on experience. Possibility of permanent employment located in Quebec City. Apply to Box No. 3401-V.

CHIEF ENGINEER, age 35 to 40, preferably graduate mechanical, with experience in shop and production planning, running drafting office, etc., and ability to get along with people, is required by a factory in Sherbrooke ,Quebec. Salary $5,000 to $6,000 a year. Apply to Box No. 3410-V.

MECHANICAL ENGINEER with considerable practical experience is required for general plant maintenance of production equipment for large out of town metal processing plant. Salary open. Apply in writing to Box No. 3417-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-V.

SALES ENGINEER, high calibre, graduate mechanical with metallurgical knowledge, for large industrial organization in Quebec, preferably bilingual, salary according to experience. Apply to File No. 3433-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, recent graduate, preferably bilingual, required for mechanical department in a paper mill in St. Maurice Valley, to be trained in a supervisory capacity. Apply to File No. 3452-V.

MECHANICAL ENGINEER with over ten years experience required for responsible position with an American mining corporation. Salary from $400 according to qualifications. Apply to File No. 3453-V.

ASSISTANT MECHANICAL SUPERINTENDENT to train for a senior position in a large paper mill in the St. Maurice Valley area. Must have paper or mining experience. Veteran preferred. Salary from $300 according to experience. Apply to File No. 3462-V.

MECHANICAL ENGINEER, age 35 to 45, preferably married, with good background of shop training and experience in the manufacture of farm machinery. Salary from $350 according to qualifications. Apply to File No. 3463-V.

MECHANICAL ENGINEERS, recent graduates, for training as industrial engineers, required by a paper manufacturer in Eastern Ontario. Apply to File No. 3465-V.

MECHANICAL ENGINEER with experience in machine and tool design for design work on packaging machinery, required by a manufacturing concern in Western Ontario. Salary from $275. Apply to File No. 3466-V.

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 considerable experience in plumbing, heating ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

METALLURGICAL

METALLURGICAL ENGINEER with some practical experience and desirous of entering the steel business is required to work for a large corporation in Eastern Canada. Apply to File No. 3314-V.

MISCELLANEOUS

ARCHITECTURAL DRAUGHTSMAN with enough experience to develop new types of windows, doors, trusses, steel sections etc., is required by a manufacturer in Montreal. Salary would be about $300. Apply to File No. 3212-V.

ENGINEER SALESMAN, preferably returned man under 40 with some road-building experience, is wanted by a firm engaged in the manufacture of emulsions. Apply to File No. 3250-V.

ARCHITECT, graduate, preferably, but with some reasonable experience, with good background and personality is required by a firm in Montreal. Interested in someone willing to start at the bottom with prospects of eventually becoming a partner in the firm. Apply to Box No. 3298-V.

DRAUGHTSMAN, preferably someone experienced in process piping work in food industries is required by a firm in the Montreal area engaged in consulting work. Apply to Box No. 3299-V.

ARCHITECT is wanted to undertake responsibility along general lines, such as class of work which comes under jurisdiction of a provincial Dept. of Public Works. Desirable age not exceeding forty. Apply to File No. 3301-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of high grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose photograph to Box No. 3303-V.

INSTRUMENTS ENGINEER with five years experience in aircraft construction and installation design, of which at least 2 years should have been specialized as above, is required to act as design group leader for a company in the Montreal area. Apply to File No. 3316-V.

TWO DRAUGHTSMEN with a minimum of three years draughting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V.

CIVIL AND ELECTRICAL ENGINEERS, age 30 to 40, 5 to 10 years experience, for estimating, design and general engineering for large public utility in Toronto area. Apply to File No. 3429-V.

CHIEF DRAUGHTSMAN to take charge of engineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

TWO ARCHITECTURAL DESIGNERS AND DRAUGHTSMEN, or architects with some experience in modern materials and design are required by a young progressive firm of architectural designers and engineers in Alberta. Salary will be commensurate with ability. Apply to Box No. 3331-V.

MECHANICAL, ELECTRICAL OR CIVIL ENGINEER, recent graduate who must have fluent knowledge of Spanish, preferably under 30, is required by a firm in the Montreal area for technical work in connection with production. Some travelling. Salary open according to qualifications. Apply to Box No. 3373-V.

DRAUGHTSMAN familiar with reinforced concrete and structural steel is required by a consulting firm in Montreal. Salary open. Apply to Box No. 3387-V.

CHIEF INSTRUCTOR completely bilingual, veteran, not necessarily an engineer, is required by a pulp and paper company in the province of Quebec to instruct in labour relations, etc., and to understudy personnel manager. Salary $150 a month. Apply to Box No. 3405-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Salary open. Apply to Box No. 3406-V.

GRADUATE ENGINEER with experience in structural design and detailing is required for work in bridge department of large transport company. Apply to Box No. 3407-V giving all particulars including salary expected.

ENGINEERING SALESMAN with pleasing personality, bilingual, 25 to 35 years old, not necessarily a graduate, but with some engineering background and if possible some knowledge of lubrication is required by a large company in Montreal. Salary open. Apply to Box No. 3422-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

CHIEF DRAUGHTSMAN, over 25 years of age, with intimate knowledge of construction mechanical details, piping, to take charge of about 15 draughtsmen in an industrial plant. Salary dependent on qualifications. Apply to File No. 3435-V.

QUALIFIED DRAUGHTSMAN, thoroughly capable in design and layout of industrial piping, steam, water, air etc. Salary open. Apply to File No. 3435-V.

TWO CIVIL OR MECHANICAL ENGINEERS, recent graduates, preferably ex-service men, are required by a pulp and paper company in the Province of Quebec, to be trained as logging engineers and woods operations supervisors. Previous experience in the woods an asset but not essential. Salary $200 to $225 with board and lodgings. Apply to File No. 3442-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. No. 3443-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 AND ELECTRICAL SUPERINTENDENT with experience in maintenance of mine equipment and in design and construction. Replies should outline experience and salary desired. Apply to File No. 3453-V.

GENERAL PLANT SUPERINTENDENT, or manager in complete charge, to organize and operate a shipbuilding plant in the Maritimes, with knowledge of both hulls and engines, mainly for repairs and revisions. Salary from $5,000. Apply to File No. 3454-V.

GRADUATE ENGINEERS IN CIVIL, MECHANICAL, ELECTRICAL OR CHEMICAL, from recent graduates up with 2 to 5 years general experience (including overseas service) required for petroleum refinery engineering. Salary according to qualifications. Apply to File No. 3455-V.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

SALES ENGINEER of ability, preferably graduate mechanical, with some experience in marine engineering and sales, to develop sales and applications for a heavy outboard propelling unit for use on heavy inland water transport. Salary from $300 depending on qualifications. Apply to File No. 3457-V.

FORESTRY ENGINEER graduate 25 to 35, preferably bilingual Veteran, is required by a newsprint manufacturer in the St. Maurice Valley. Apply to File No. 3462-V.

SALES ENGINEER, preferably mechanical graduate, required by a firm dealing in heavy machinery for sales activities in Eastern Canada with headquarters in Montreal. Salary from $250 according to qualifications. Apply to File No. 3467-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

Situations Wanted

CIVIL ENGINEER, M.E.I.C., P.E.Q., age 39, married, B.Sc., U.N.B., widespread experience in construction with experience in plant maintenance both in civilian and Air Force capacities. Interested in responsible position involving plant maintenance. Apply to Box No. 225-W.

CIVIL ENGINEER, age 40, McGill '29, B.Sc., married, experienced surveyor and field engineer, two years on inspection of airfield construction, location immaterial, available on short notice. Apply to File No. 741-W.

CIVIL & MINING ENGINEER M.E.I.C., R.P.E., age 45, married, seeks permanent position with large industrial concern as Maintenance and Construction or Townsite Engineer. Experienced on heavy construction, dams, shafts and tunnels, wharves, buildings, sewers, services, townsite development, general maintenance and administration. Apply to File No. 901-W.

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 Box No. 1527-W.

PLANT ENGINEER, graduate, M.E.I.C., age 42, qualified to take responsible charge of layout of plant and equipment, structural and mechanical design and organization of plant maintenance. Wide experience with chemical processes. Have successfully handled skilled and unskilled labour on construction, maintenance and plant operation. Prefer location in Ontario. Minimum salary $5000. per year. Apply to File No. 1621-W.

GRADUATE ENGINEER, B.Sc. (Mech) M.E.I.C., age 45, married. Three years experience in time and job study, factory methods and cost accounting. Fifteen years experience in construction and building maintenance; considerable experience in shop layouts and maintenance. Five years sales promotion and technical field work in plastics. Capable of handling personnel and planning. Seeks an executive position in industrial business or will assume complete administration of medium sized business in any part of Canada. Available on short notice. Apply to File No. 1642-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 37, 12 years experience in pulp and paper industry, both technical and production, also three years research in paper containers during war. Bilingual; would like to return to paper industry. Available at a month's notice. Apply to Box No. 1768-W.

CIVIL ENGINEER, age 32, married, B.Sc. in Civil Engineering U.N.B. 1938, M.Sc. U.N.B. 1944. Two years service with R.C.E. Six years experience in Canada and in tropics on construction of roads, airfields, wharves, drainage works, etc. Speaks English, some French and Spanish. Presently employed but wishes to change for a position more directly in charge of construction. Available on thirty days notice. Apply to File No. 1860-W.

MANUFACTURING EXECUTIVE, mechanical engineering graduate with twenty years experience in manufacturing, engineering, production control, purchasing, storekeeping, incentive systems, budgets, cost and general accounting is now available. Apply to File No. 1871-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C. Practical experience includes eight years in tool engineering, production engineering and works planning and nine years in plant layout, general machine design and development work of patented mechanical projects. Successful record in responsible and executive positions. Good organizer. Desires either suitable position, or development work based on own patents, with large mechanical manufacutring concern or well-established firm of consulting engineers. Apply to File No. 2502-W.

CHEMICAL ENGINEER, S.E.I.C., B.A., B.A.Sc. '44, M. Eng. (McGill), age 26, single, two years experience, desires employment in Research or production control. Prefer Quebec and particularly Montreal area. Highest references from former employers. Apply to File No. 2671-W.

STRUCTURAL ENGINEER competent to analyse stresses and to make or review designs in concrete, steel or timber; would undertake small assignments (not requiring full time services). Office in Montreal. Apply to File No. 2672-W.

CIVIL ENGINEER, M.E.I.C., A.C.I.M., age 33, married, Major R.C.E. Civil experience includes two years building maintenance, three years frame construction, three years application and sales of mechanical equipment. Six years army service mostly on engineer works services. Desires permanent responsible position, plant engineering or light construction. Travel anywhere. Apply to File No. 2674-W.

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CONTENTS

COVER PICTURE

End elevation of the Canadian National Railways vertical lift bridge over the Lachine Canal in Montreal. The bridge operator is located on the top floor of the small three storey concrete building to the left of the bridge structure. See article on page 415.

PRESENT ACHIEVEMENTS AND FUTURE DEVELOPMENTS IN AIRCRAFT GAS TURBINE ENGINES

D. G. SAMARAS

In charge of Gas Dynamics, National Research Council of Canada, Ottawa, Ont.

A paper delivered at the Semi-Annual Meeting, Detroit, Mich., June 17-20, 1946, of The American Society of Mechanical Engineers, as a contribution of The Engineering Institute of Canada.

SUMMARY—In this paper, the present status of the aircraft gas turbine engine is treated and its future development predicted.

In scope, the paper covers a general investigation of the performance of the gas turbine engine, an examination of its basic components and probable methods of improving the compressor, combustor and turbine.

Matching of the different components, as well as the problem of regulation, are outlined.

Introduction

The first machine recorded in history as using a fluid reaction force for propulsion is attributed[1] to a Greek philosopher called Archytas ('Αρχύτας) who lived twenty-four centuries ago. His "flying dove" of wood was one of the wonders of antiquity, and it is described as having consisted of a wooden figure balanced by a weight that was suspended from a pulley. It is said to have soared in the air and to have been set in motion by a current of air "hidden and enclosed" in its interior, or by compressed air escaping from a valve.

Two centuries later another Greek called Heron (῞Ηρων) looking at an emptying barrel carried on a cart, observed that a force acting opposite to the flow of the water tended to set the cart in motion. He then built several machines based on this phenomenon and the most famous of them is his "aelophile".

While the date of the appearance of the first gas turbine is unknown, the machines Heron developed, on the basis of the reaction principle, formed the basis of our present day development of gas turbines.

Eighteen centuries later, the great English astronomer and physicist, Sir Isaac Newton, reduced this phenomenon to mathematical discipline.

Because of its military value in aircraft propulsion, many countries have developed and advanced important ideas on the aircraft gas turbine, but completely independent of one another because of the secret nature of such a project.

Most of such work done in Canada in the past few years was done in the Laboratories of the National Research Council[2].

Time does not permit a complete account of the Canadian contribution to this field. Suffice it to say that, in the early stages of the recent conflict, Canadian scientists with the National Research Council were called to the United Kingdom to report on the progress they had made in the development of the gas turbine and to co-ordinate their efforts with those of the corresponding British group.

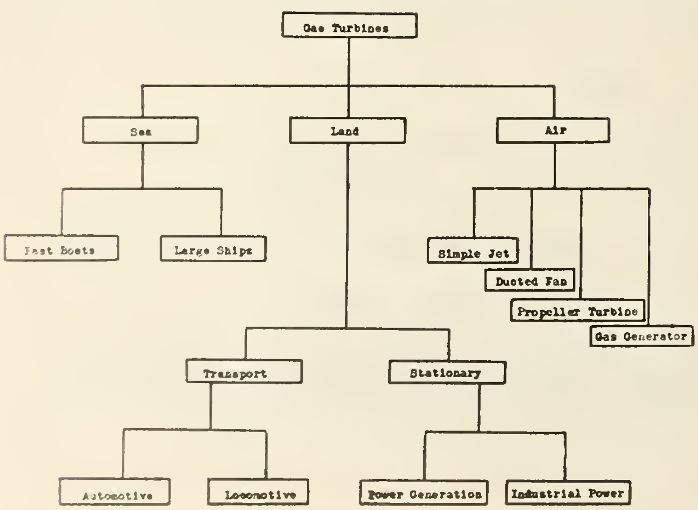

Fig. 1—Fields of application of gas turbines.

Fields of Application

The possible fields of application of gas turbine engines are shown in Fig. 1.

On land they can be used for stationary power generators or as a source of power to drive trains, trucks and automobiles.

On the sea they can be used first, in small boats such as speedboats, torpedo boats, etc., where high power units with small weight and compactness are desirable; and second, by large ships where weight and bulk are not a premium but where a low specific fuel consumption and long overhaul periods are the main desirable requirements.

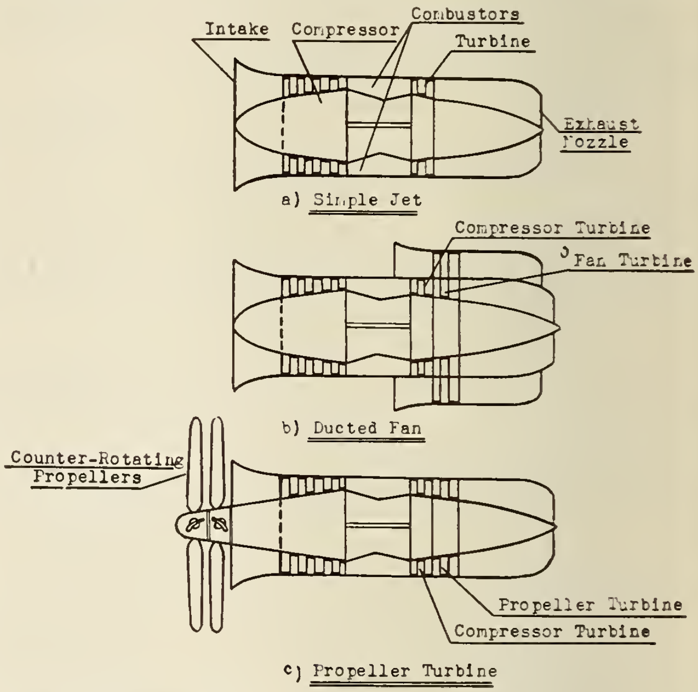

Fig. 2—Diagrammatic sketch of the three main types of gas turbines.

In the air, the following main types may be considered as fundamental:

(*a*) *The simple jet.*

A diagrammatic sketch of a simple jet is shown in Fig. 2a; it consists generally of one compressor, one or more turbines, and one or more combustors, the thrust being taken by the exhaust or propelling nozzle.

(*b*) *The ducted fan.*

A diagrammatic sketch of a ducted fan is shown in Fig. 2b; it consists generally of the main essential parts of the simple jet plus an augmentor fan driven as above or by an independent turbine.

(*c*) *The propeller turbine.*

A diagrammatic sketch of a propeller turbine is shown in Fig. 2c; it also consists of the main essential parts of the simple jet, but in addition has a propeller driven by the same as above or by an independent turbine.

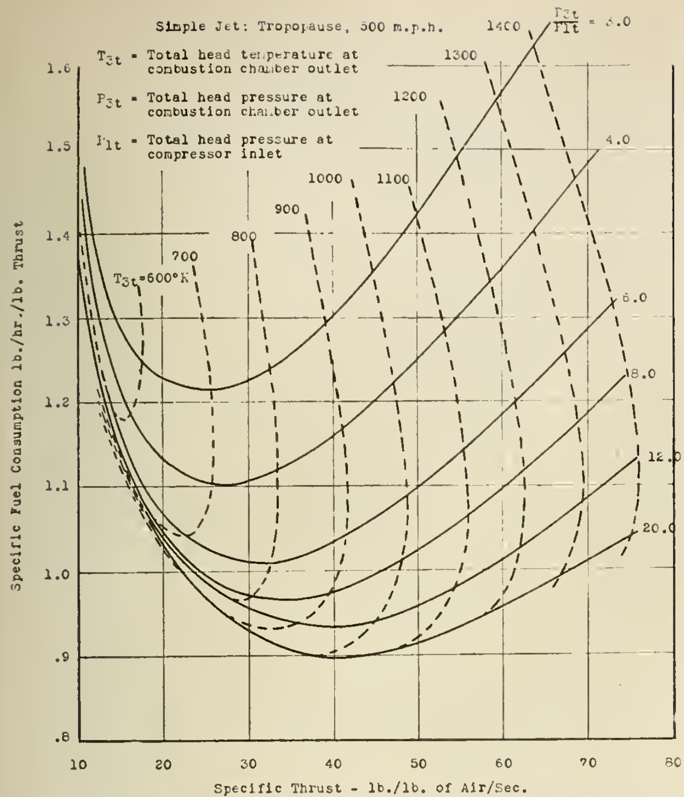

Fig. 3—Cycle performance of simple jet engines.

(*d*) *The gas generator.*

The gas generator consists of a two-stroke engine, one fan and a turbine utilizing the exhaust gases. Several combinations of this arrangement can be evolved.

The types of compressors used in the past were the centrifugal and the axial, although a diagonal type as in the Heinkel-Hirth-Oll simple jet engine may be used. No displacement compressors of the Roots or Lysholm type have been used in aircraft turbines.

To date, only axial flow single-stage or multi-stage turbines have been used.

Two main groups of combustors have been employed, the multi-chamber and the annular combustor. From many considerations, the latter is the more promising one.

It is probable that double-compound and even triple-compound units, combined with reheat and heat exchange, will be used in the future to achieve higher overall pressure ratio, thermal efficiency and ease in starting.

General Performance

Range of Suitability

For forward speeds of the order of 500 mph. and above, and high altitudes, the simple jet is superior to the propeller turbine, but as its specific fuel consumption is high, its range and endurance are rather limited.

The propeller turbine, because of its low specific fuel consumption, is suitable for all speeds up to 500 mph. Its advantages over the reciprocating engine increase with altitude and forward speed.

The ducted fan may have an intermediate place that has not yet been established.

The gas generator with its low specific fuel consumption may be used for extremely long ranges, but the recent advances in high temperature materials and blade cooling methods, tend to favour the propeller turbine.

The Simple Jet

Figure 3 shows the cycle performance of a series of simple jet engines of different design, pressure ratios, and combustion total head temperature at an altitude of 36,000 ft. and a forward speed of 500 mph.

From this it is easily seen that, as the present day pressure ratios are usually of the order of 4:1, the corresponding combustion total head temperature for maximum economy is of the order of 750 deg. K (890 deg. F), that is, more than 300 deg. C (540 deg. F) lower than the present day designs. It is also seen that this higher combustion temperature results in an increase in specific fuel consumption and the specific power output, the latter resulting in a smaller size engine.

From comparative performance calculations, it was found[3] that for a short range, high speed aircraft (fighters, racers) powered by simple jet engines, the optimum design pressure ratio was of the order of 4:1.

The Ducted Fan

Figure 4 shows the cycle performance of a series of ducted fan engines of various design, pressure ratios and combustion total head temperatures at an altitude of 36,000 ft. with a forward speed of 500 mph. and a by-pass ratio $\mu = 3$. From this it can be easily seen that as the present day pressure ratios are of the order of 4:1 for maximum economy, a corresponding combustion total head temperature of the order of 950 deg. K (1250 deg. F) is more than 150 deg. C (270 deg. F) lower than the present day practical limit. It can also be seen that such an increase in combustion temperature will result in an increase of specific fuel consumption and specific power output. Comparing Figs. 3 and 4, it will be noted that the latter curves are considerably flatter than the former. Therefore, it can be concluded that the greater specific fuel consumption resulting from an increase in temperature is less pronounced in a ducted fan engine.

Figure 5 shows the augmentation ratio of ducted fan engines as a function of the work fraction λ and the velocity ratio for a by-pass ratio $\mu = 3$.

After a lengthy investigation, it was found that the

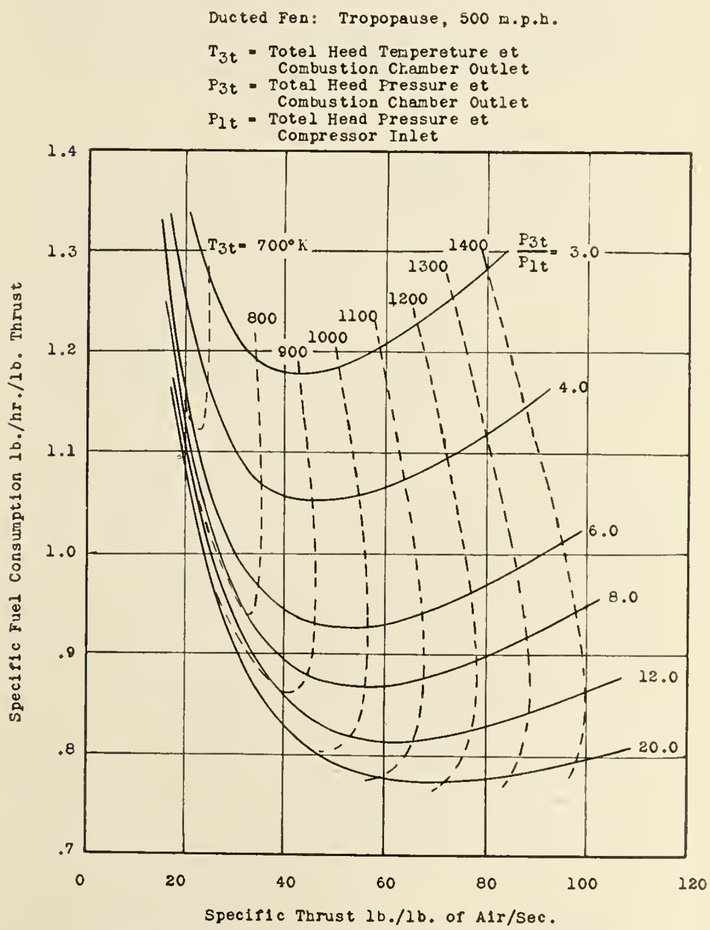

Fig. 4—Cycle performance of ducted fan engines.

mixing of the two jets resulted in little gain, although it was accompanied by a considerably lower performance at points far from the design point. From comparative performance calculations, it was found that for a short range, high speed aircraft powered by ducted fan engines, the optimum design pressure ratio was of the order of 4:1, and that for a longer range aircraft, an 8:1 design pressure ratio corresponded to the optimum.[4]

The Propeller Turbine

Figure 6 shows the cycle performances of a series of propeller turbine engines with various design pressure ratios and combustion total head temperatures at an altitude of 36,000 ft. and at a forward speed of 500 mph. From this it is seen that, for a given design pressure ratio, as the combustion temperature increases, the specific power output increases, the specific fuel consumption decreases and there is no minimum so that the curve runs asymptotically to the specific power output axis. From comparative performance calculations[5], it was found that for a long range high speed aircraft (bomber, transport) powered by propeller turbine engines, the optimum design pressure ratio was of the order of 8:1.

Figure 7 shows the envelope propeller efficiency for low weight and high efficiency multi-blade propellers for gas turbines as a function of the Mach number of the forward speed. It is well known that, owing to the absence of vibrations excited by reciprocating parts, thinner and more efficient blade profiles may be used, although there is some pessimism regarding the vibrations excited by the aerodynamic forces.

Comparative Performance

In all three modes of operation, the specific fuel consumption and specific output (both based on thrust) improved with increase in altitude and deteriorated with increase in forward speed, for forward speeds lower than the sonic velocity[6].

For maximum economy and output, the optimum combustion temperature increased while the design pressure ratio decreased with increase in forward speed.

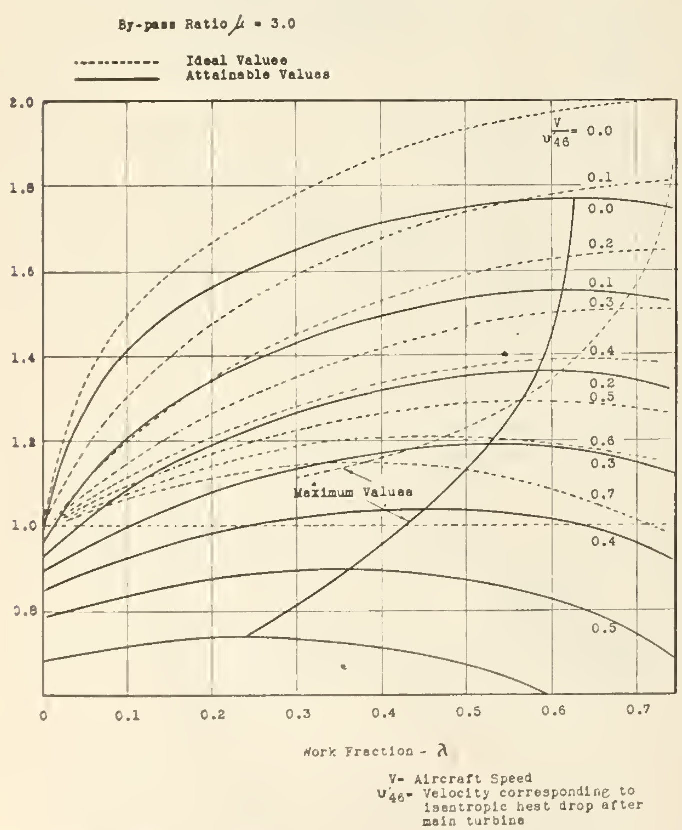

Fig. 5—Augmentation ratio of ducted fan engines.

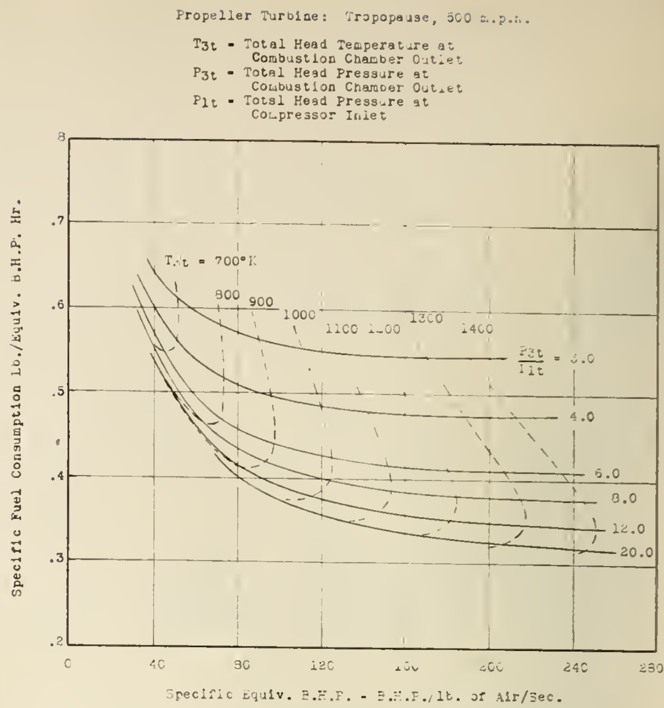

Fig. 6—Cycle performance of propeller turbine engines.

For a given pressure ratio, the optimum combustion temperature for maximum economy increased in the order of simple jet, ducted fan, propeller turbine.

Under static conditions and for a given combustion temperature, the optimum pressure ratio for maximum economy was lower for a propeller turbine than for a ducted fan and simple jet. This effect diminished with increasing forward speed. Finally for indicative reasons, Fig. 8 is presented, showing the comparative performances of a simple jet engine with centrifugal compressor and a propeller turbine with an axial flow compressor at an altitude of 36,000 ft. and a forward speed of 450 mph. From this, the superiority of the propeller turbine engine for ranges above 1000 miles is clearly indicated.

The Optimum Size of a Unit

No serious work has been done regarding the optimum size of a unit, which seems to vary with the different types of gas turbines. A pet rule in England was that the 50 lb. per sec. static mass flow represented the optimum size. While there was nothing to support this assumption, units designed or built elsewhere with considerably higher mass flows have not shown great variations in specific weight. However, the probability that the specific weight curve is flat near the optimum may be a criterion. The optimum size of a gas turbine power unit should be considered together with the aircraft in which it is to be installed. It should be remembered that this is not a problem of engine design alone.

Reheat and Heat Exchange

It is well known that reheating increases the optimum pressure ratio for output and economy. Heat exchange, however, decreases the optimum pressure ratio for economy.

For the present day design of propeller turbines, it should be noted that little is to be gained by employing pressure ratios in excess of 8:1 for no reheat and of 15:1 when reheat is used[7].

Figure 9 shows the comparative performance of propeller turbine engines cruising at an altitude of 30,000 ft. and a forward speed of 400 mph. From this it is seen that the chief advantage of reheat is that it gives an increase of specific output which varies for engines with no heat exchange, from 25 per cent for an 8:1 to approximately 55 per cent for a 15:1 design pressure ratio. In these cases, reheat has a negligible effect on the specific fuel consumption.

If heat exchange is used[7,8], it is necessary with normal pressure losses to employ a design thermal ratio of approximately $\xi = 0.25$, before better economy than that of the standard case is realized and at the same time there is a reduction in specific output. This is a consequence of the pressure losses in the heat exchanger and represents an initial penalty which has to be paid before heat exchange shows to advantage. If, for no reheat, the design thermal ratio is increased to $\xi = 0.5$, then in comparison

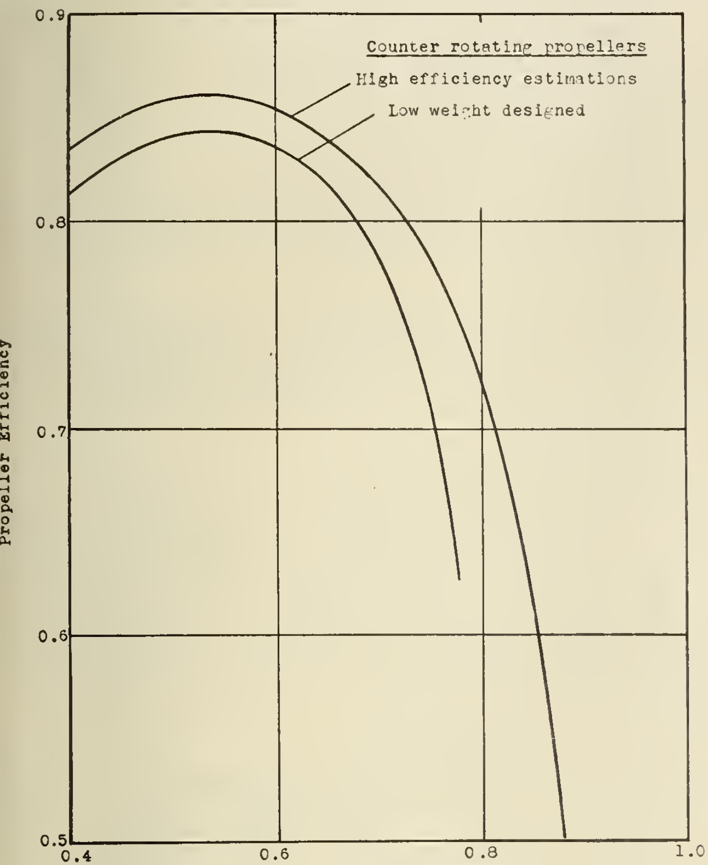

Fig. 7—Envelope curves of propeller efficiency.

with the standard case under cruising conditions, the specific fuel consumption is reduced by 13 per cent for a 4:1 and by 4 per cent for an 8:1 design pressure ratio engine. In these cases, the specific power output is reduced by 17 per cent and 11 per cent respectively.

When reheating is employed in conjunction with heat exchange, a greater temperature difference is available. This shows heat exchange to a greater advantage, for, at a design thermal ratio of $\xi = 0.5$ compared with the simple reheat case, the specific fuel consumption is now reduced by 11 per cent for the 8:1 design pressure ratio engine. It is worth noting that for this case the specific fuel consumption is down to 0.39 lb. per eq. B.H.P. hour.

From Fig. 9 it is also seen that raising the maximum allowable combustion temperature by 300 deg. C (540 deg. F) decreases the specific fuel consumption whilst increasing the specific power output by about 70 per cent relative to a similar engine operating at normal temperatures.

Owing to the much greater temperature differences available, heat exchange shows to more advantage when elevated temperatures are employed. In particular for a 4:1 design pressure ratio engine, a design thermal ratio of $\xi = 0.5$ reduces the specific fuel consumption by nearly 24 per cent for a specific output decrease of 13 per cent. Similar but less marked effects are observed with higher pressure ratio engines.

Finally, it is to be stressed that the pressure loss on the gas side of a heat exchanger is more critical than on the air side. For example, with a 4:1 design pressure ratio

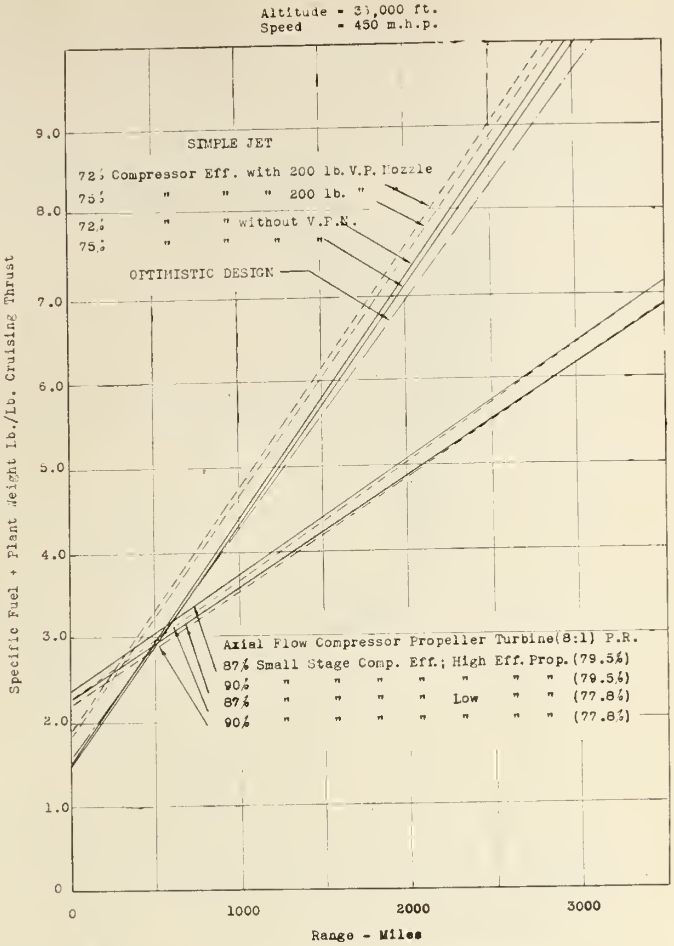

Fig. 8—Comparative performance of a simple jet and a propeller turbine.

engine, a pressure loss of one lb. per sq. in. on the gas side has twice the effect of an equal loss on the air side.

The Compressor

The Entry Duct

High efficiency of an entry duct for a high speed aircraft powered by gas turbines is very important. Systematic investigations on entry forms have been conducted in Göttingen by Dr. Küchemann and the results are published in a series of ZWB Reports entitled "der Einbau von Kühlern".

In an axial flow compressor, the entry spiders should be made of the best aerodynamic form to minimize vibrational effects and to keep the entry losses as low as possible.

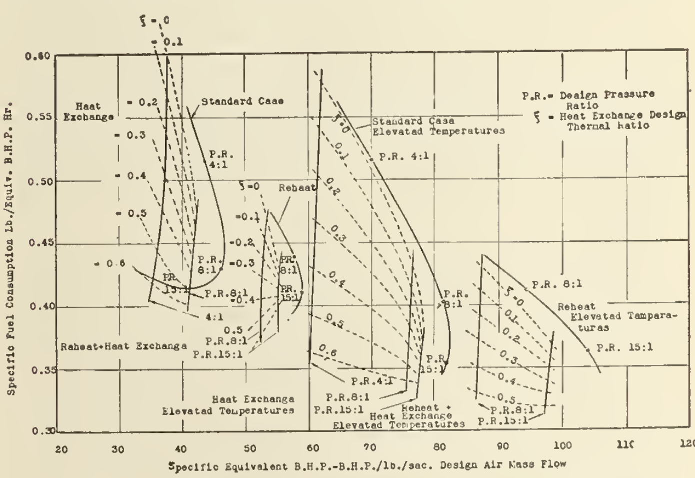

Fig. 9—Propeller turbine performance curves with reheat and heat exchange. Cruising 400 m.p.h. at 30,000 ft. Present day design.

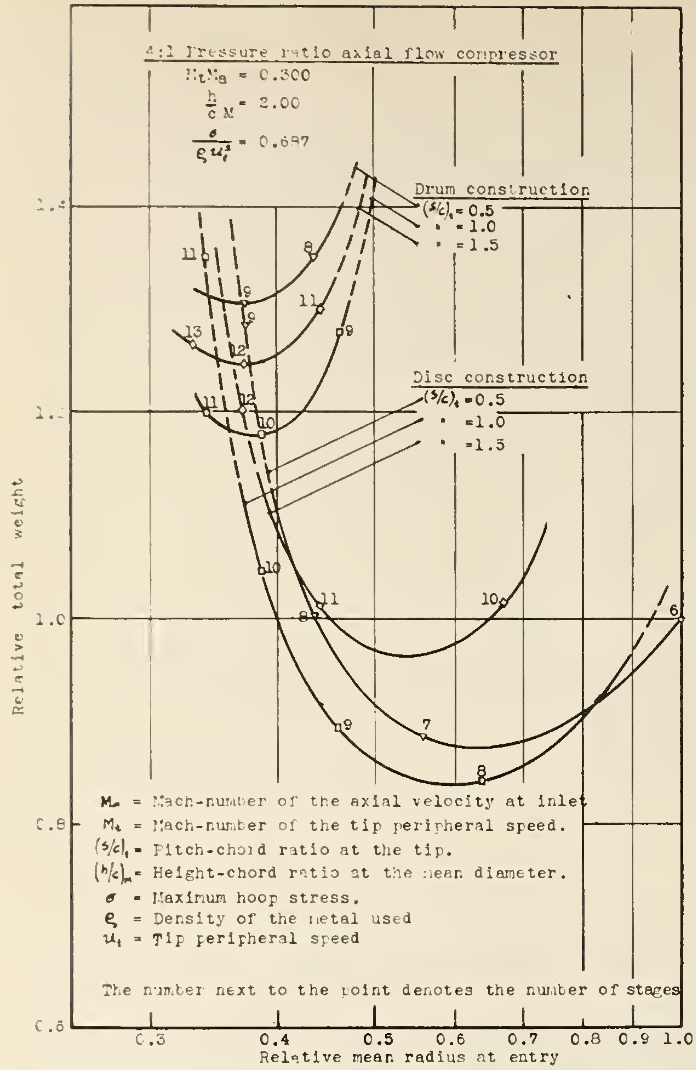

Fig. 10—Variation of weight with mean radius and pitch-chord ratio of multi-stage axial flow compressors.

It was found however that the wakes from the spiders have little effect on the performance of the compressor stages.

The number of spiders and the duct form should be such as to avoid icing troubles.

Axial vs Centrifugal Compressors

It is true that each type has its own advantages and disadvantages.

The axial has a considerably lower diameter than the centrifugal although it is considerably longer and slightly heavier.

It is well known that for a short range, very high speed aircraft powered by simple jet engines, the outside diameter of the nacelle is so critical that, for this reason alone, the axial should be adopted. Again, for long range, high speed aircraft powered by propeller turbine engines, the higher efficiency resulting in lower specific fuel consumption, gives the axial an overwhelming advantage over the centrifugal.

Before the war, the Germans developed the most efficient centrifugal compressor ever made, the so-called "D.V.L. supercharger", designed and tested by Prof. von der Nüll. Its adiabatic efficiency exceeded 80 per cent, but herein lies the greatest fallacy of the centrifugal enthusiasts: the maximum efficiencies were obtained at tip speeds of the order of 800 ft. per sec. To develop a satisfactory pressure ratio of 4:1, tip speeds of the order of 1500 ft. per sec. should be employed. Now, at these high tip speeds, the efficiencies are considerably lower, around 70 per cent and, in addition, the present day materials cannot withstand the high centrifugal and vibrational stresses. It is well known that centrifugal types have not been reliable for pressure ratios of 4:1 and above.

A systematic study of the characteristics of a large number of centrifugal compressors has shown that the optimum efficiencies cannot be realized at tip speeds higher than 1000 ft. per sec. and that the drop in efficiency with rotational speed is very steep.

The centrifugal compressor, however, has flatter characteristics than the axial and can operate in a wider range of mass-flows free from surging and choking.

Although the axial has steeper characteristics, several methods can be evolved that may widen its range of operation, such as using curved blades or other methods of design and control, i.e., compounding and variable propelling nozzles.

Another advantage of the axial compressor is freedom in designing any desirable pressure ratio.

Although no advanced design of an axial flow compressor is available today, it is definite that by using the research work from German and Swiss sources, a satisfactory design can be evolved.

Figure 8 shows a comparison of an axial and a centrifugal machine[9]. The centrifugal was the best that could be designed two years ago with rather optimistic assumptions. the axial was designed with the experience gained at that time, from the not too successful F.2 series.

Construction

Materials

The materials used today in the manufacture of axial flow compressors are mostly aluminium alloys, although in the case of high pressure ratio compressors, the last stages are made of steel. There is no reason whatsoever why the first two or three stages in a compressor should not be made of plastic materials, especially in the case where highly curved blades are used. For air-mass flows

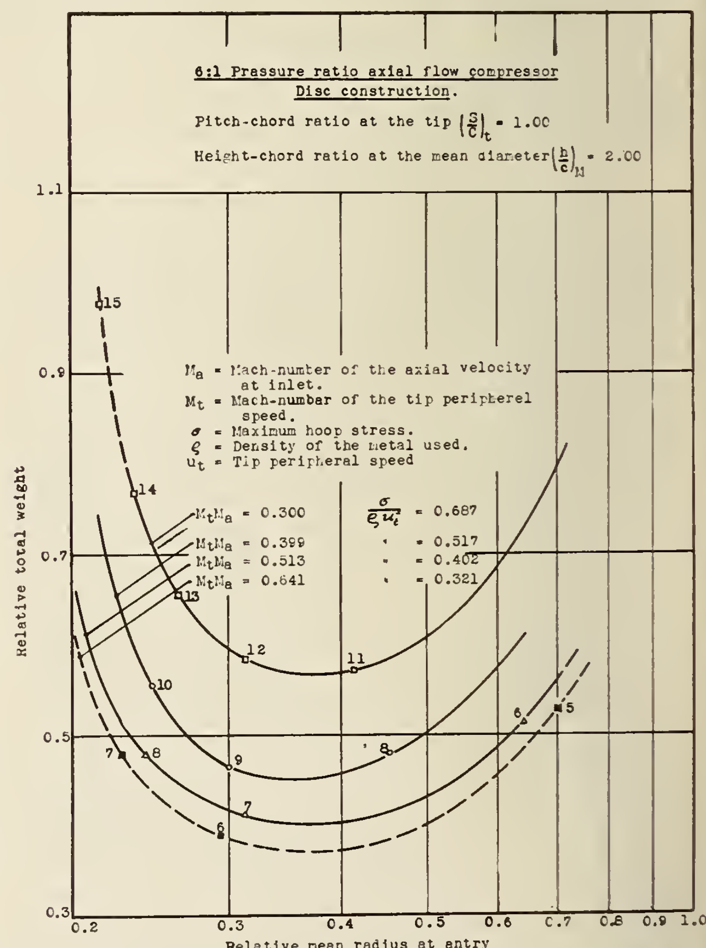

Fig. 11—Variation of weight with mean radius and Mach-number of multi-stage axial flow compressors.

of the order of 50 lb. per sec., the aluminium alloys give the lightest construction. For lower air-mass flows and pressure ratios, magnesium alloys are preferable.

Disc or Drum

It was found[10] that, in a drum construction, stress considerations prohibit the employment of the minimum number of stages possible.

For the same material and stress limitations, the disc type of construction results in a lighter compressor and a smaller number of stages. When the same tip speed is used, the disc construction compressor is nearly 30 per cent lighter than that of the drum construction. Figure 10 shows the results for a 4:1 pressure ratio compressor. The higher tip speeds which may be employed in disc construction enable a further reduction in weight and number of stages to be used. Figure 11 shows the results for a 6:1 pressure ratio compressor on a relative basis. It is seen that an increase of 45 per cent in tip speed results in a reduction of the weight and number of stages by 30 per cent.

Finally, it is to be noted that the disc construction gives greater freedom in choosing the outside diameter of the compressor.

Methods of Improving the Axial Flow Compressor

General

It has been shown that the most important disadvantages of the axial flow compressor are the relatively low pressure ratio per stage and the steep characteristics. The requirements of low weight and volume are covered by the requirement of high stage pressure ratio.

To determine the means of improving the axial flow compressor, elementary considerations are very helpful. For an axial flow machine, Euler's formula may be written as follows:

$$E = \frac{U.V_a}{g} (tg\alpha_1 - tg\alpha_2) \qquad (1)$$

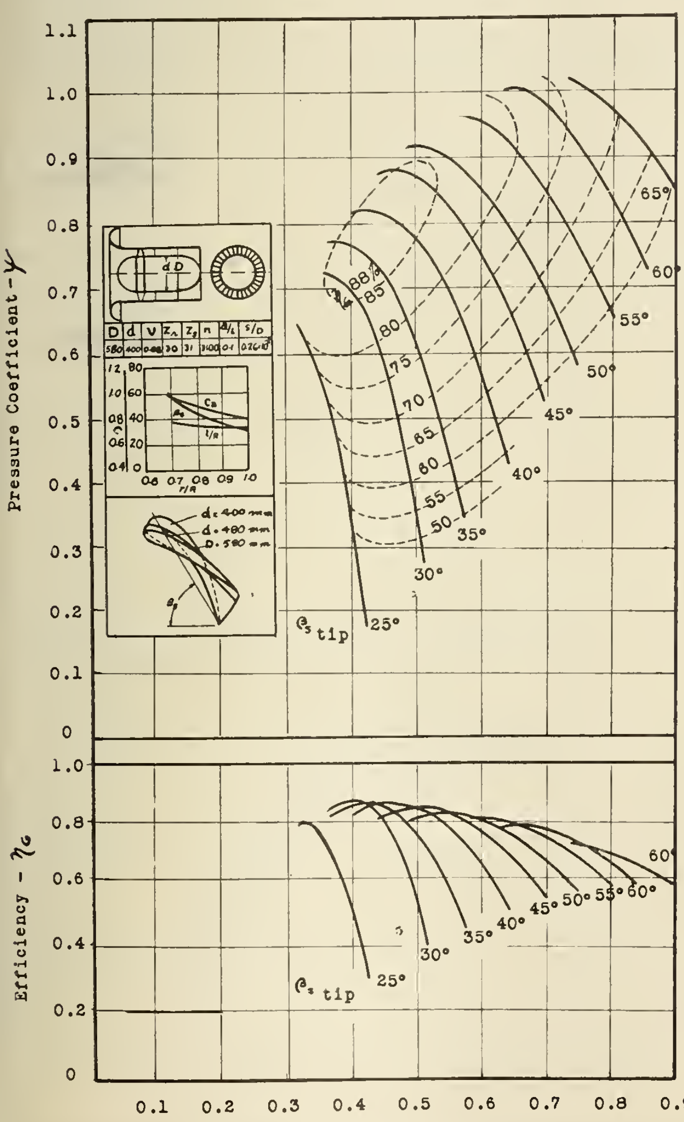

Fig. 12—Characteristics of a single stage axial flow compressor.

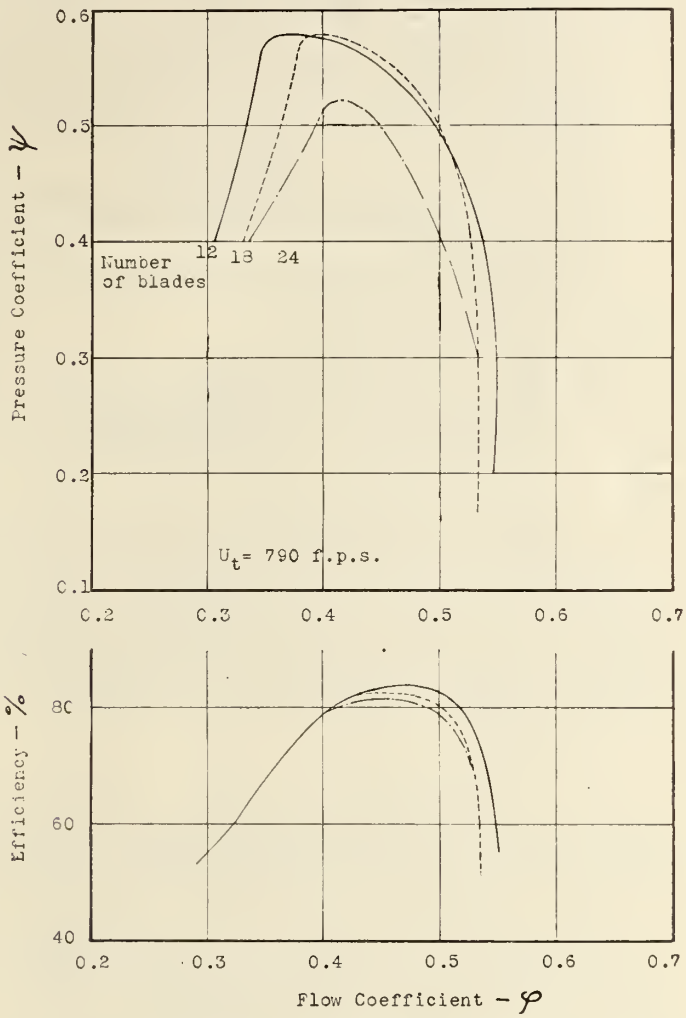

Fig. 13—Variation of the characteristics of single stage compressors with the Reynolds Number.

From the above may be observed that the work of compression per stage can be increased by one of the following methods:

(a) Increasing the peripheral velocity.

It was found that in the case of a drum construction compressor, rim speeds above 550 ft. per sec. were prohibitive. However, disc construction enables this value to be increased to 750 ft. per sec. where compressibility becomes the limiting factor.

(b) Increasing the axial velocity, compressibility is again the limiting factor.

(c) Increasing the deflection. This cannot be increased above certain limits because of the resulting separation of the flow and the subsequent stalling of the blades. There are three methods of increasing deflection:

- (i) Suction of the boundary layer at the blade roots by centrifugal action. Experimental investigation is required to show the order of the improvement.
- (ii) Using curved blades and utilizing the centri-

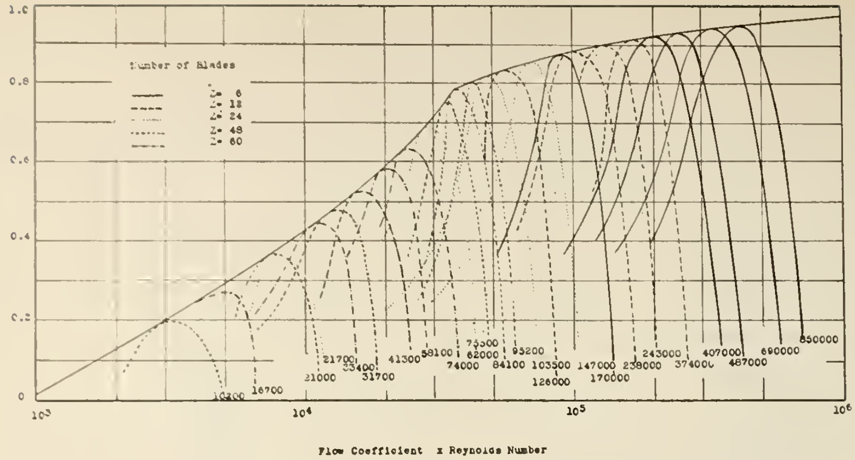

Fig. 14—Variation of the efficiency with flow coefficient for Reynolds Numbers from 8,000 to 850,000.

fugal force to compress the boundary layer and delay separation.

(iii) Using slotted airfoils.

(d) Using counter-rotating wheels. In the case of multi-stage compressors, mechanical difficulties are rather prohibitive. The characteristics of a counter-rotating compressor are slightly steeper with efficiencies of the same order.

All of the above methods refer to compressors with subsonic flow. However, some work has been done in using supersonic flows through the compressor and compressing the air by shock waves. Although some experimental work has been done by Prof. Weise in the D.V.L. and theoretical work by the author in the R.A.E., nothing spectacular has been achieved, because of the present insufficient knowledge of gas dynamics and lack of experimental facilities.

Increasing the Peripheral Velocity

As shown previously, the first method of improving the stage pressure ratio is by increasing the peripheral velocity. It was found that when the relative velocity approached that of sound, the influence of the compressibility was very important, and that before reaching the critical Mach-number, an increase of the lift coefficient was accompanied by an increase of the drag coefficient. Following a critical condition, the lift coefficient decreased while the drag coefficient increased rapidly.

If by the use of guide vanes before the rotor, a deflection is given the flow in the direction of rotation, then the peripheral velocity could be increased and even become larger than the sonic velocity without the relative reaching the sonic velocity. It can be seen that the same thing happens with the absolute velocity in the stator as with the relative velocity in the rotor. For instance, when $w_1 = c_2 < a$, a minimum value is attained when:

$$w_1^2 - w_2^2 = c_2^2 - c_1^2 \qquad (2)$$

Thus, equal division of the static pressure rise in the rotor and stator occurs which corresponds to symmetrical velocity triangles and 50 per cent reaction.

Aerodynamic Improvements

It was found that by using high camber blading, the lift and pressure coefficient could be increased.

Figure 12 shows the characteristics of a single stage axial flow compressor with high camber blading. With this wheel, 0.9 to 1.0 pressure coefficients were obtained for efficiencies ranging from 80 to 85 per cent. The outside diameter was D_o = 21.5 in. and the characteristic root parameter

$$\left(C_r \frac{C}{S}\right)_r = 2.22 \qquad (3)$$

Experiments on slotted blades have shown[11] an increased stage pressure ratio but accompanied by higher losses. It is important to know if, with such an arrangement, a decrease of the total length with the same overall efficiency will result.

Influence of Diameter Ratio

In order to keep a small outside compressor diameter for a given mass-flow area, a small diameter ratio $v = \frac{D_i}{D_o}$ should be used.

A uniform energy distribution along the blade height leads to unsurmountable difficulties, because at the inner diameter the peripheral velocity is small and high deflection should be adopted, a matter that is not always feasible, as it was seen before, at these high values of the lift coefficient, a separation of the flow may occur.

In the case of a multi-stage compressor where the throttling factor $\sigma = \frac{\varphi^2}{\psi}$ should not be below a certain value, it was found that its value might be increased by an increase of the diameter ratio.

There is a higher limit of the diameter ratio that should not be exceeded; for the dynamic compression work increases at the expense of the static, and a heavy construction as well as high losses result. Considerable work has been done regarding the optimum diameter ratio. It was found that by increasing the diameter ratio, the passive area (blades, wheel casing, disc surface) increased, losses

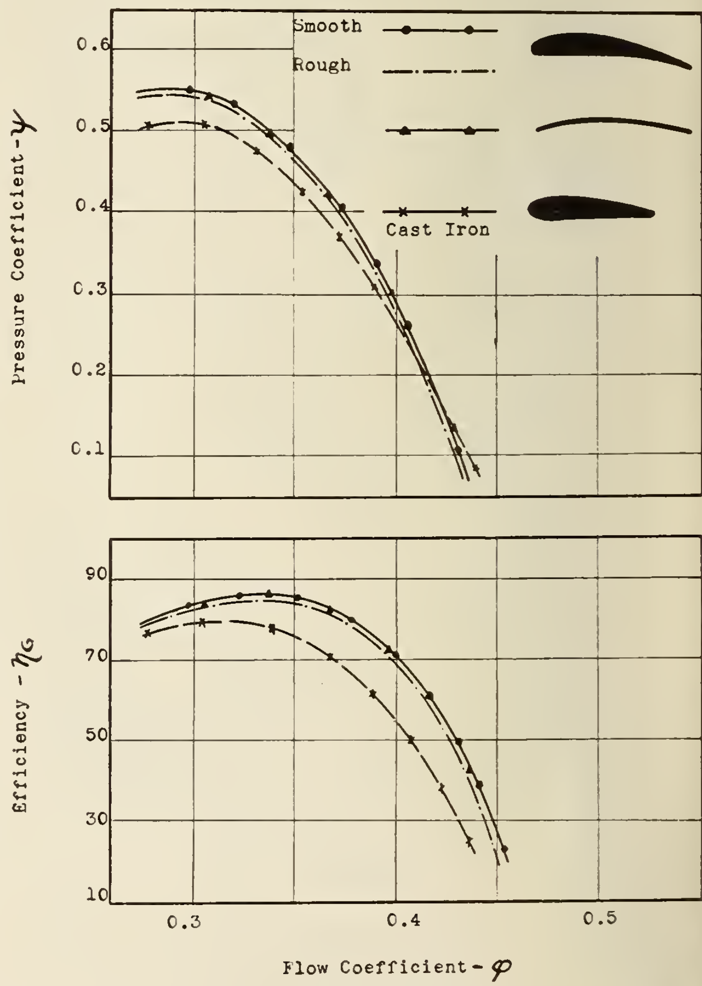

Fig. 15—Influence of the surface roughness on the characteristics of a single stage compressor.

increased and efficiency was reduced. For a diameter ratio between 0.70 and 0.85 there is very little variation in efficiency but above 0.85 the efficiency falls off rapidly.

Influence of the Reynolds Number

Considerable work has been done on the influence of the Reynolds number which is defined as

$$Re = \frac{U_t C}{\nu} \qquad (4)$$

Figure 13 shows the results[12] from three wheels consisting of 12, 18 and 24 blades with Re = 3, 4 and 6 x 10^5 respectively. It is seen that by decreasing the Reynolds number, lower efficiencies and narrower characteristics result.

Figure 14 shows the variation of efficiency with the Reynolds number for a great number of wheels, the $Re = 8.10^3$ to 8.5 x 10^5, the number of blades z = 6 to 60 and the blade chord C = 0.65 in. to 6.5 in.

The velocities were kept very low (260 ft. per sec.) in order to avoid the influence of compressibility.

From this, the great influence of the Reynolds number on the characteristics of the axial flow compressor is indicated.

The influence of the surface roughness has also been examined. Figure 15 shows the influence of roughness for a Re = 3.25 x 10^5.

Blading

General

The geometrical form and rotational speed of an axial flow compressor depend on the type, thickness, camber and diameter ratio of the blade adopted. It was found that any variation in the type of the blading would require important changes in the rotational speed, thickness and camber.

In the design of a single wheel, the direction of the air-flow is of great importance. By the use of guide vanes, we can introduce the air either in the direction of rotation or in the opposite direction or simply axially.

In the case where the relative velocity in the wheel is kept constant, a higher peripheral velocity can be employed if the absolute velocity is in the direction of rotation. In the opposite case where the absolute velocity is not in the direction of rotation, smaller diameter ratios and higher pressure coefficients can be used.

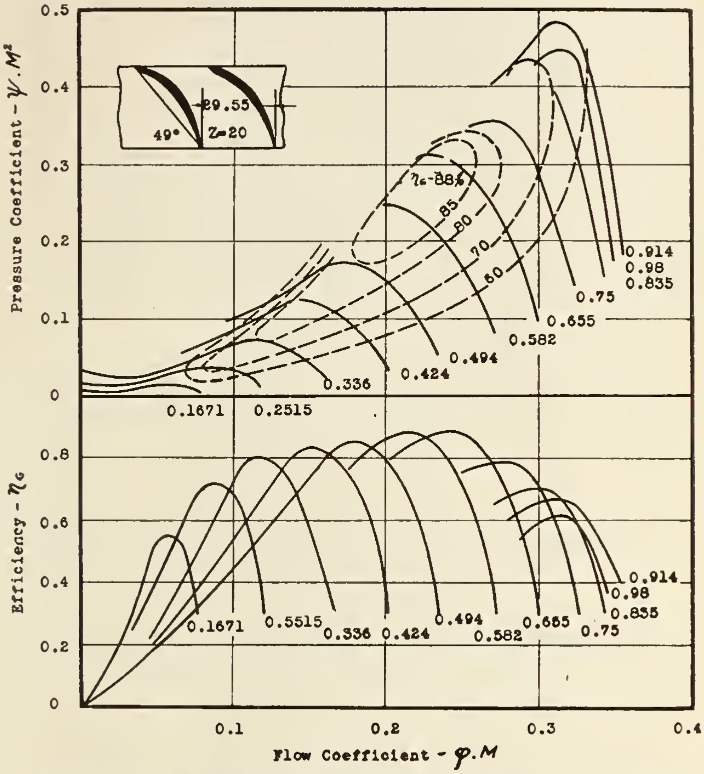

Fig. 17—The influence of the Mach-number on the characteristics of a 20-blade axial flow compressor with high camber blades and sharp leading edges.

In a multi-stage compressor with relative velocities opposed to the direction of rotation, the absolute velocity is, as an average, axial with small oscillations around the axis. In the other case, the absolute flow follows a helicoidal path and due to the large swirl velocities at the exit from the wheel, smaller axial thrust results.

The air outlet angle is a function of the stagger, camber and the pitch-chord ratio. The higher the stagger, the larger is the air outlet angle. Large air outlet angles, or staggers, give lower camber blades as the deflections, that can be used, are smaller.

By varying the air outlet angle, a variation of the rotational speed and the flow parameter occurs.

At the design point, the higher the air outlet angle the steeper are the characteristics and the higher the maximum pressure ratios. However, nothing is known about the starting characteristics.

A substantial increase in pressure ratio without any decrease in efficiency could be achieved on an axial flow compressor by decreasing the spacing distance of the blade rows. It was found that the present day practice of $^1/_3$ chord was too large.

Finally, it should be mentioned that the Coriolis forces and the centrifuge effect of the boundary layer have a great influence on the blading of high speed axial flow compressors.

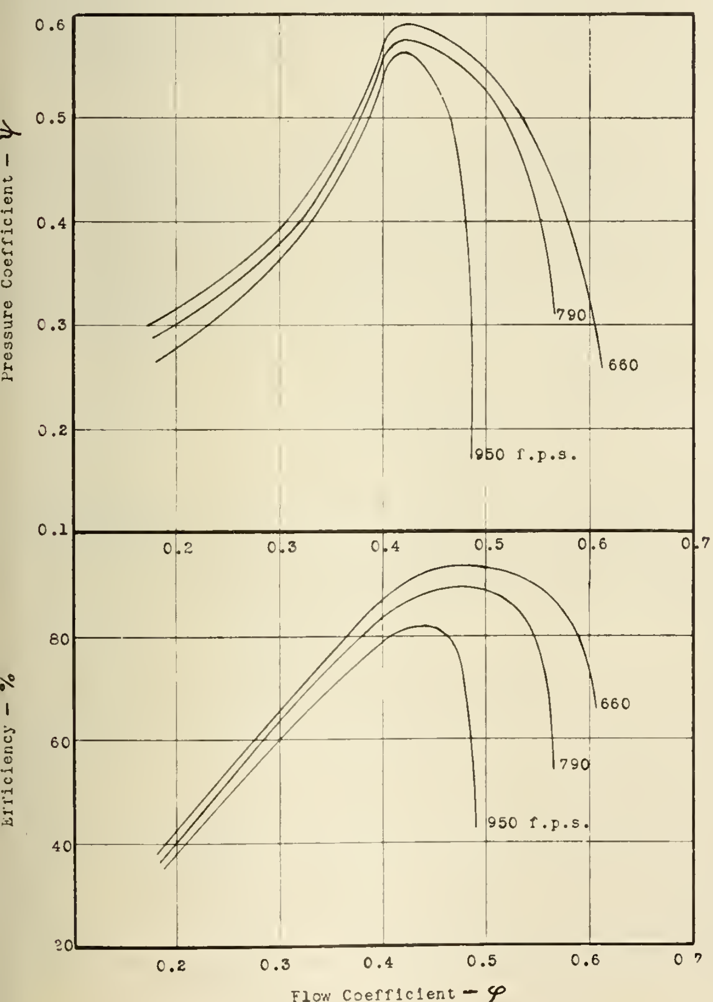

Fig. 16—Variation of the characteristics of a single stage compressor with the Mach-number.

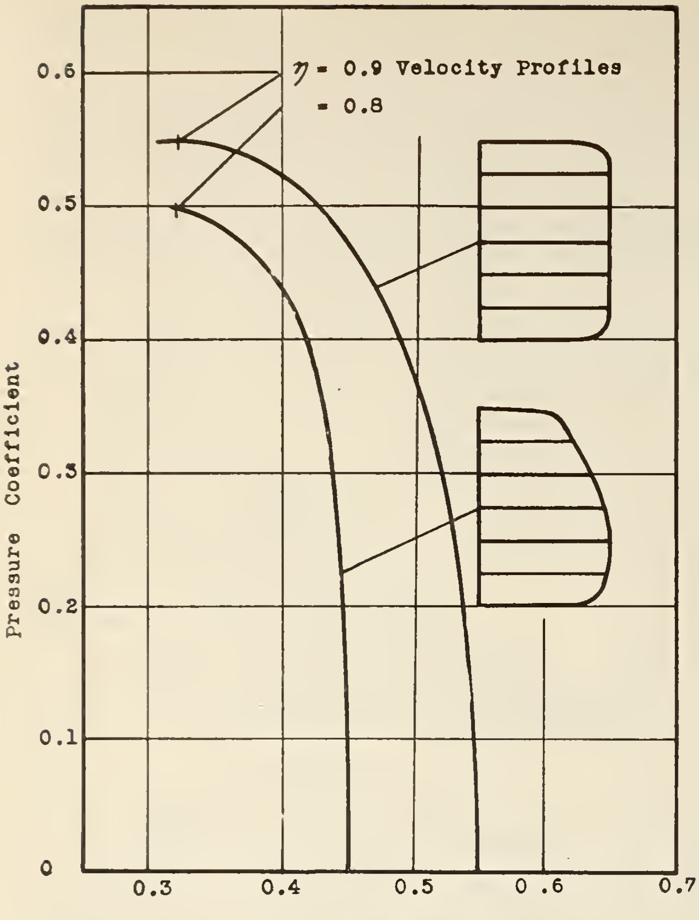

Fig. 18—Variation of the characteristics of a single stage axial flow compressor by different velocity distribution.

Influence of the Mach-Number

The Mach-number of the relative flow has a great influence on the characteristics of the axial flow compressors. Figure 16 shows the characteristics of a rotor wheel at different Mach-numbers. It is seen that the characteristics become steeper and the choking mass flow decreases with increasing Mach-number.

Tests on a series of high efficiency single-stage axial flow compressors were made with different numbers of blades and various types of blading. It was found that when the Mach-number (Mach-number of the tip speed) was low, the efficiencies fell off due to the decrease of the Reynolds number, also that when the Mach-number became greater than a critical value, the efficiency fell off again. In order to correlate the test results, the Glauert-Prandtl compressibility correction was employed. The critical Mach-numbers were between 0.70 and 0.75.

Figure 17 shows the characteristics of one of the above mentioned compressors having high speed airfoil sections of low thickness ratio and the maximum thickness of which is well in the rear. It was found that by further sharpening the leading edges, a slight change in the characteristics resulted, accompanied by a lower efficiency. This can be explained by the increased shock sensitivity.

Influence of Velocity Distribution

Investigations have shown that the inflow conditions in a compressor have a marked effect on the charaeteristics. Figure 18 shows the change of the charaeteristies due to asymmetrical velocity distribution.

It is not known whether in a multi-stage compressor, the influence of the inflow conditions is damped down or accentuated and how far these asymmetrical distributions, change the final characteristic lines of the compressor.

Incomplete evidence on a given type of blading has shown a damping effect, still this is not sufficient to draw general conclusions.

Methods of Design

The design of axial flow compressors is done either according to the hydraulic theory or according to the airfoil theory[13] with the necessary corrections in both cases.

The axial flow machines can be divided in three groups: high, average and low speed by the use of the specific rotational speed given as follows:

$$n_s = \frac{\sqrt{\pi}}{g} \cdot \frac{N\sqrt{Q}}{H^{3/4}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

In the case where the non-dimensional coefficients are used, the following is obtained:

$$n_s = \sqrt{\varphi} \,.\, \psi^{-3/4} \,.\, \sqrt{1-\nu^2} \quad \ldots\ldots\ldots (5^1)$$

According to present day experience, the following table is obtained:

TABLE I

Speed	High	Average	Low
Specific rotational speed	$n_s > 2$	$2 > n_s > 1$	$n_s < 1$
Design according to	Airfoil theory without corrections	Airfoil theory with corrections	Hydraulic theory with corrections for deviation
Type	Fans		Compressors

Considerable work has been published (Schilhansl, Betz, Ruden, Weinig, Ackeret, Howell, etc.) in the past, regarding the design of axial flow compressors by using cascade test results and applying the necessary corrections. Still this correlation is not satisfactory because it disregards the Coriolis forces and the centrifuge effect in the boundary layer.

ANALYSIS OF LOSSES

Many methods have been suggested to analyse the losses in an axial flow compressor. These can be divided into two main groups, those based on the hydraulic method of design and the others based on the airfoil theory.

The first analyse the losses in the same way as the steam turbine practice with the appropriate modifications.

The second analyse the losses into two-dimensional and three-dimensional flow taking into consideration the annulus loss.

As the matter is still in a fluid state, a combination of both may give the best answer.

TEST AND DEVELOPMENT

To obtain data for the design of axial flow multi-stage compressors, several testing methods have been suggested.

In the case of the internal combustion engine, developing a correlation of the results was as follows:

Bomb—single cylinder—multicylinder.

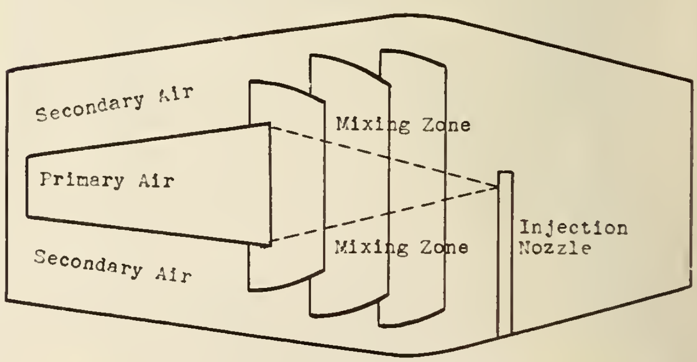

Fig. 19—Typical combustor subdivided in primary and secondary zone, and fuel injection system.

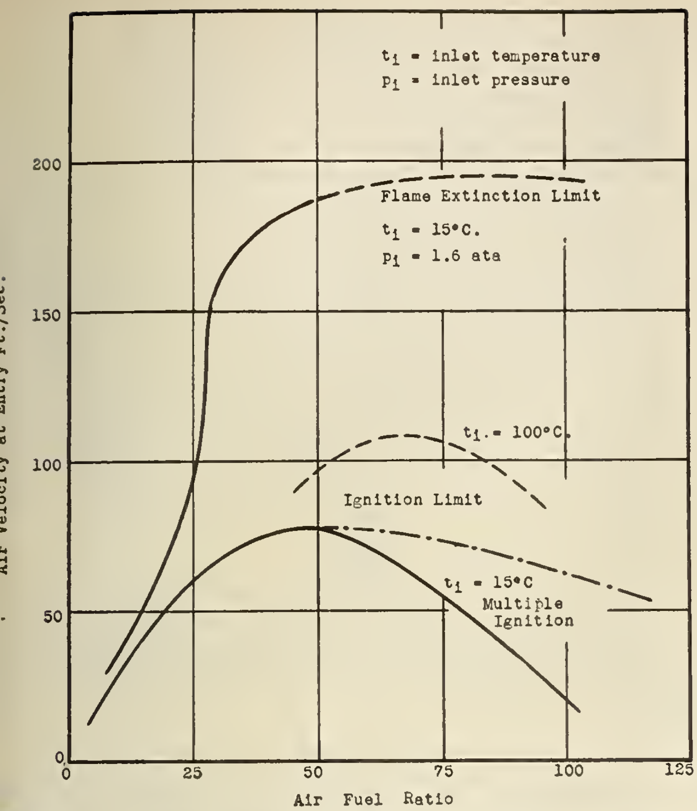

Fig. 20—Ignition and flame extinction limits of an experimental combustor.

It is logical to assume that the following is the rational correlation for axial flow compressors.

Single airfoils—Cascade tests—single stage (or two stage)—multi-stage compressor.

Combustors

General

The function of a combustor is to increase the temperature of the compressed air by burning the injected fuel.

The main requirements of a good combustor are: low total head pressure loss, high combustion efficiency, and minimum space. The last requirement places great limitations on the former two.

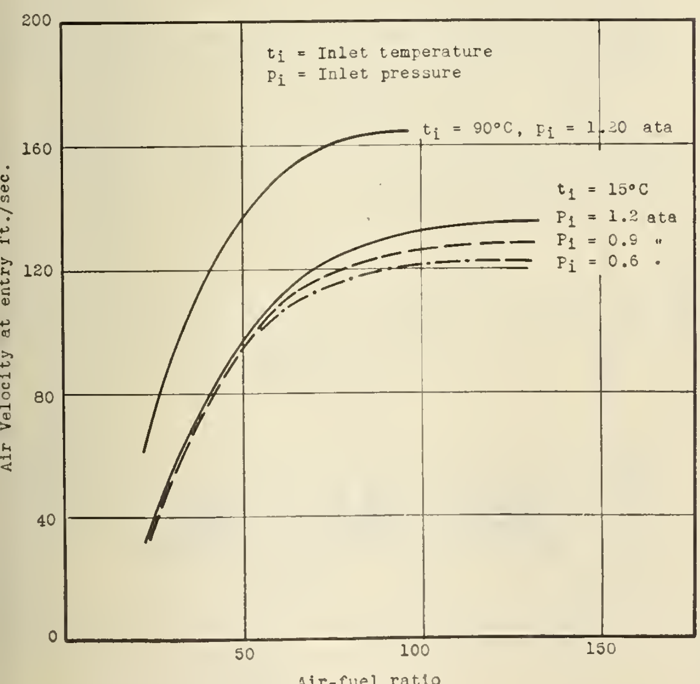

Fig. 21—Variation of the flame extinction limit with the temperature and pressure.

The effect of combustor volume on combustion may be expressed in terms of the *combustion intensity*, which is the heat released, per unit volume, unit time and unit pressure.

From the above it is easily seen that in order to keep the volume down, high intensities should be used. It was found that combustion intensities in gas turbines were rather high when compared with other applications.

Before going into details a description of a typical combustor is in order. Figure 19 shows one typical combustor which is sub-divided in the primary and secondary zone and the fuel injection system.

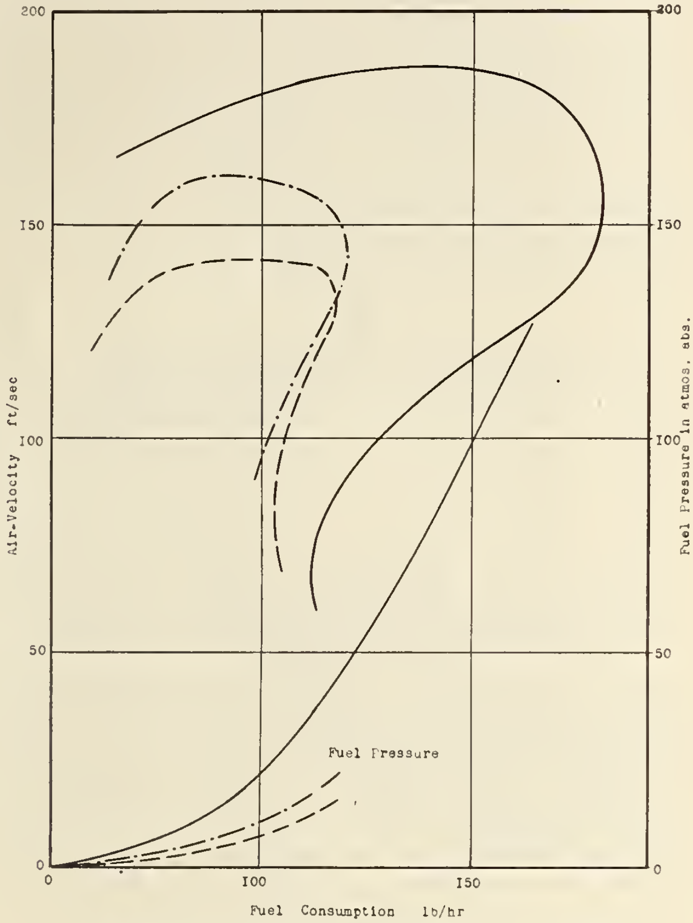

Fig. 22—Influence of the fuel pressure on the flame extinction limit.

As the permissible temperatures before the turbine are rather low, high air-fuel ratios have to be used; and in order to facilitate combustion, a division of the air is necessary in primary and secondary air. The air-fuel ratio in the primary zone is such as to secure temperatures of 1200 to 1400 deg. C (1700 to 2060 deg. F).

After burning in the primary zone, the combustion products are mixed with the secondary air in the secondary zone to reduce the temperatures to a permissible level. As combustion continues in the secondary zone, great care should be taken to avoid the deleterious effect of "flame chilling".

The secondary air keeps the walls of the combustor at a relatively low temperature.

Following more closely the physical and chemical processes that take place in a combustor, first, we have a high pressure liquid fuel that is injected into an air stream. Then atomization of the fuel occurs, the droplets fly relative to the air, but due to friction, heat conduction and radiation from the hot gases, evaporation on the surface of the droplets takes place. After a certain time of evaporation and mixing with the air, called ignition lag, ignition starts and finally more or less complete combustion results.

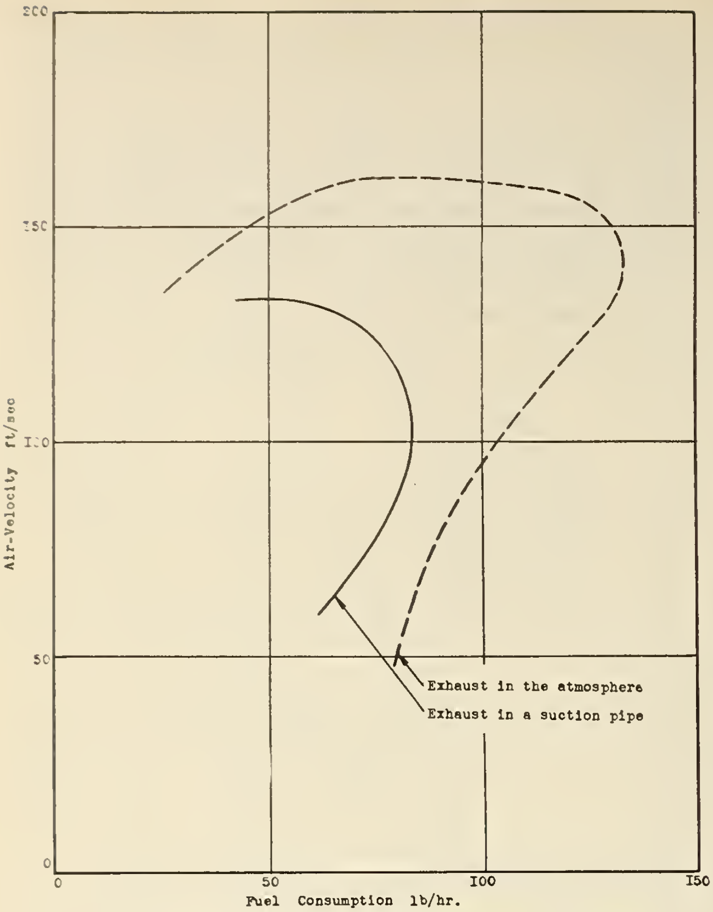

Fig. 23—Influence of the exhaust pressure on the flame extinction limit.

There are two ways in which fuel is injected into the combustor—upstream and downstream. Both have their advantages and disadvantages.

Atomization and evaporation depend on certain non-dimensional parameters such as *Re*, *N*, a parameter of surface tension, etc.

Several methods may be suggested to increase the combustion intensity but the two most important of these are:

(a) The use of catalytic combustion.

(b) Evaporation and injection of the fuel vapor in the hot stream.

For the mixing process in the secondary zone, large and small scale turbulence is required. This turbulence is created by the mixing action of two jets, by forced vorticity created by cascade rings or fans and the turbulence created by temperature gradients.

There are two limits that may be investigated in a combustor, namely, the upper or "flame extinction limit" and the lower or "ignition limit".

The flame extinction limit is defined as the limit at which combustion can still continue and the ignition limit as that at which combustion can still be started.

Figure 20 shows measurements made in an experimental combustor. It is seen that the ignition limit lies considerably lower than the flame extinction limit.

Both limits show a considerable drop in velocity in the neighborhood of the stoechiometric mixture. The more favourable variation of the upper limit is attributed to the higher temperatures present in the primary zone as compared to ignition during the starting process. It is also seen that, by increasing the temperature, the lower limit is improved.

Figure 21 shows the influence of pressure on the upper limit. It is seen that absolute pressure has little effect on the upper limit. From recent experiments, pressures of the order of 4 lb. per sq. in. abs. have shown only small variations from those of 8 lb. per sq. in. abs. The influence of pressure, then, may be attributed, in part, to the influence it has on the atomization.

The influence of temperature on the upper limit is considerably greater, because of its influence on the evaporation of the droplets.

Figure 21 also shows the flame extinction limit for air inlet temperatures of 15 deg. and 90 deg. C (59 deg. and 194 deg. F), at constant pressure.

In addition to temperature and pressure, the atomization of the fuel spray is also important. Figure 22 shows that as the fuel pressure is increased, a better atomization will result. Further, the flame extinction limit will be higher.

Back pressure of the combustor has definite influence on both the upper and the lower limits as it is shown in Fig. 23. This effect shows greater difficulties in high altitude operation. It was found[14] that the criterion for the upper limit is that of thermal equilibrium. Some stabilisation of the flame is achieved by the use of a baffle that creates recirculation and increases considerably the pressure loss.

Analysis of Losses

There are two principal groups of losses that occur in a combustor, namely, pressure losses and heat losses. The former are due mostly to aerodynamic and thermodynamic effects while the latter are due to chemical and physical conditions although there is a strong tie between them.

Pressure losses can be analysed in the following manner:

(a) Fundamental loss due to heat addition. This has been extensively investigated by the author and it has been found[15] that minimum loss occurs when the Mach-number is kept constant.

(b) Aerodynamic loss due to wall friction which is considerably small.

(c) Fundamental loss due to the mixing process in the secondary zone.

(d) Inductive loss due to frictional mixing and turbulence. This is by far the largest loss in a well designed combustor.

Heat losses can be analysed in the following manner:

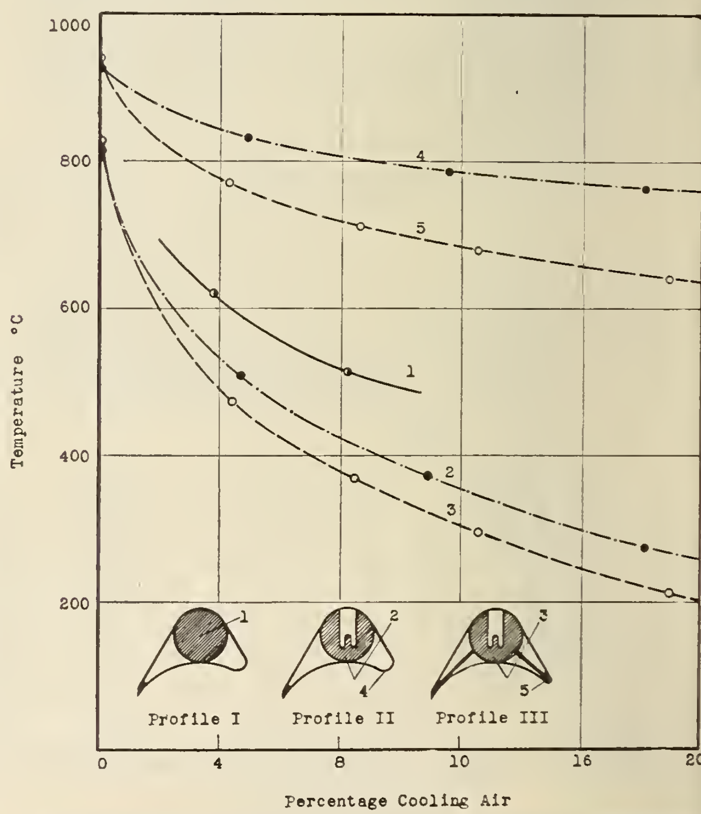

Fig. 24—Blade temperature as a function of the percentage cooling air.

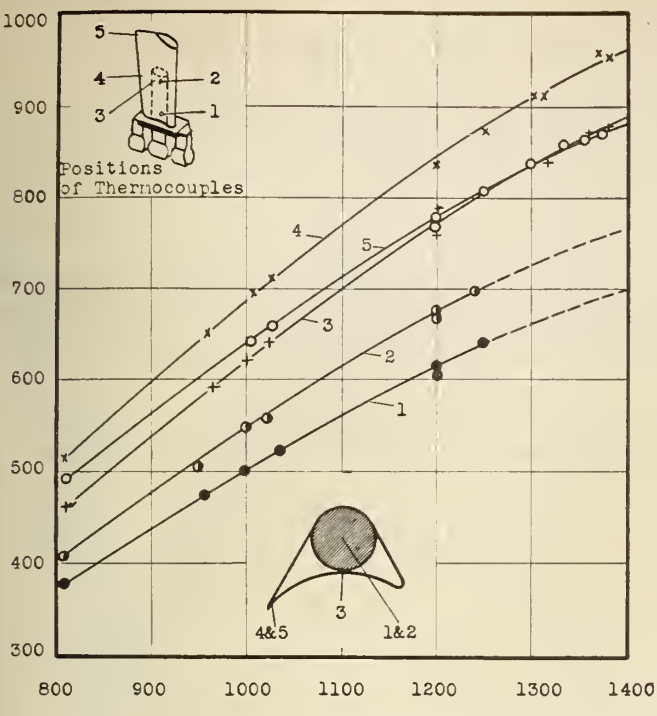

Fig. 25—Blade temperature as a function of the gas temperature.

a) Delayed combustion loss, mainly in the turbine and propelling nozzle.
b) Incomplete combustion loss.
c) Dissociation loss.
d) Radiation and convection loss.

The losses of (a) and (b) are a maximum at weak mixtures (cruising and idling). Also at low pressures (high altitude operation).

Pressure losses in the combustor greatly influence the starting time of the engine.

Although no attempt has been made to employ control in the combustor by moving parts, it seems very likely that the necessity of raising the upper and lower limits at variable conditions of altitude and speed would be successfully met by the use of movable parts as flaps, springs, etc.; in this way we can vary the primary air and keep the desirable air-fuel ratio and mass flow conditions in the primary zone. We could also vary the amount of the forced vorticity in the secondary zone.

A few unsuccessful attempts have been made to examine the similarity of conditions in combustors. The problem is not easy but its solution is urgently required.

Cold testing of efficient combustors of any form has no aerodynamical meaning.

REHEAT COMBUSTORS

Since inlet temperatures are higher and the temperature rise lower in reheat combustors, their design is much simpler than that of the main combustor.

TURBINES

GENERAL

To date very little experimental work has been done on gas turbines, their design being mostly based on steam turbine practice with few modifications. The turbine is thermally and mechanically the highest stressed component of a gas turbine engine.

The loadings are usually subdivided in the following groups:

(a) Temperature loading
(b) Centrifugal loading
(c) Gas bending loading
(d) Vibration loading

The severe temperature loadings create many bearing difficulties. However, this can be remedied by bleeding small amounts of air from the compressor to cool the turbine disc.

By appropriate design, e.g. using curved blades, the centrifugal and gas bending stresses can be decreased to a minimum.

Very little has been done regarding vibration. However, work that is now in progress should elucidate certain phenomena regarding vibration.

It is well known that the thermodynamic efficiency of a gas turbine improves by increasing the maximum temperature of the cycle. This increase in temperature cannot always be realized owing to the lack of materials able to withstand high temperatures, high stresses and the intense corrosive action of the gases.

Several high temperature materials have been developed or are in the process of development based on chromium and titanium. The composition of two of these, developed in the D.V.L., one for a range of 650 to 750 deg. C and the other for a 750 deg. to 800 deg. C, are as shown in Table II.

The strength characteristics of steel A are as follows:

U.T.S. = 220,000-250,000 p.s.i. at room temperature.
Creep strength 1% in 300 hours 74,000-81,000 p.s.i. at 600 deg. C (1110 deg. F).
Creep strength 1% in 300 hours 52,000-59,000 p.s.i. at 700 deg. C (1290 deg. F).
Creep strength 1% in 300 hours 27,000-30,000 p.s.i. at 800 deg. C (1470 deg. F).

No strength data are available for steel B; however, preliminary investigations indicated that the corrosion resistance was excellent and creep resistance good at temperatures from 750-800 deg. C (1380-1470 deg. F).

More recent advances inme tallurgy show that creep resisting alloys for temperatures as high as 870 deg. C (1600 deg. F) have been attained and the future promises even better materials.

The use of ceramics has not been sufficiently investigated; therefore conclusions as to their suitability should be withheld until more information is made available.

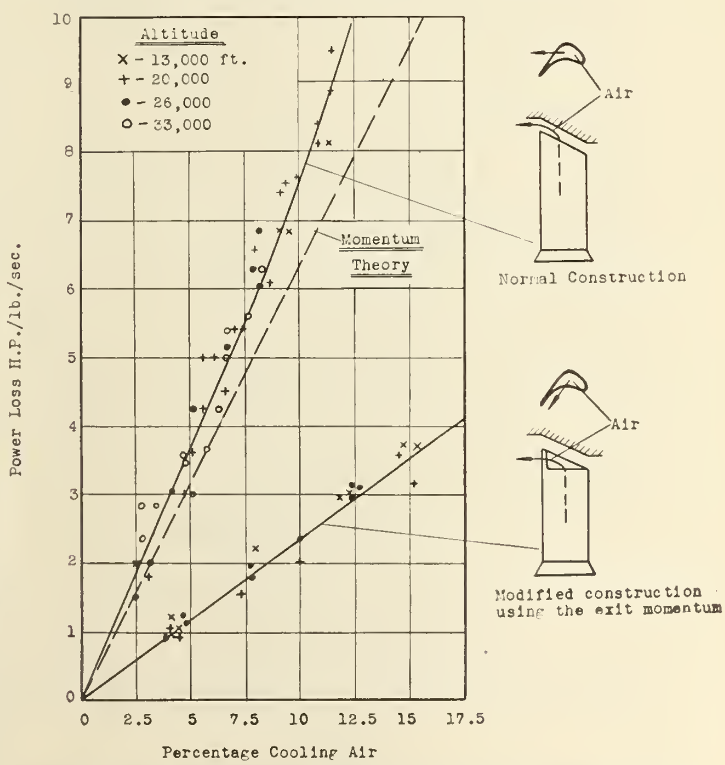

Fig. 26—Power loss as a function of the percentage cooling air.

Table II

Alloy	C	Si	Mn	Ni	Co	Cr	W	Mo	Ti	Fe	Range
A	0.1	0.5–0.8	1.0–1.5	30–34	25–30	13–15	40–45	5.5–6.0	1.0–1.3	Remainder	650–750 deg C
B	—	—	—	10–15	25–35	15–18	3.0	7.0	1.8–2.5	"	750–800 deg. C

Blade Cooling

There are two possibilities left for the use of high temperatures. First, by decreasing the stresses of the parts that are subjected to high temperatures and second by decreasing the blade temperature by cooling. Only the second possibility of cooling shall be dealt with. There are two principal methods of cooling, air cooling and liquid cooling. The latter may employ water, glycol or any other suitable liquid. With water cooling an open or closed cycle could be used. However, the use of other liquids would necessitate a closed cycle.

From the standpoint of weight only, air cooling can be successfully applied in aircraft gas turbines. Liquid cooling methods are best suited for land and sea turbines.

General thermodynamic considerations show that cooling results in a reduction of the expansion efficiency. Although due to the decrease of the boundary layer thickness, a decrease in the blade losses may result. It is left to further work on this matter to show which one of the two influences is prevailing.

Blade cooling is a problem of heat transfer where the flow of the cooling medium plays an important role.

As in a gas turbine rotor the blades rotate relative to the stator nozzles, the relative velocity should be taken into consideration when examining the rotor temperatures. Because of the expansion taking place in the nozzles, the static temperature is considerably lower than the total head temperature (before the turbine).

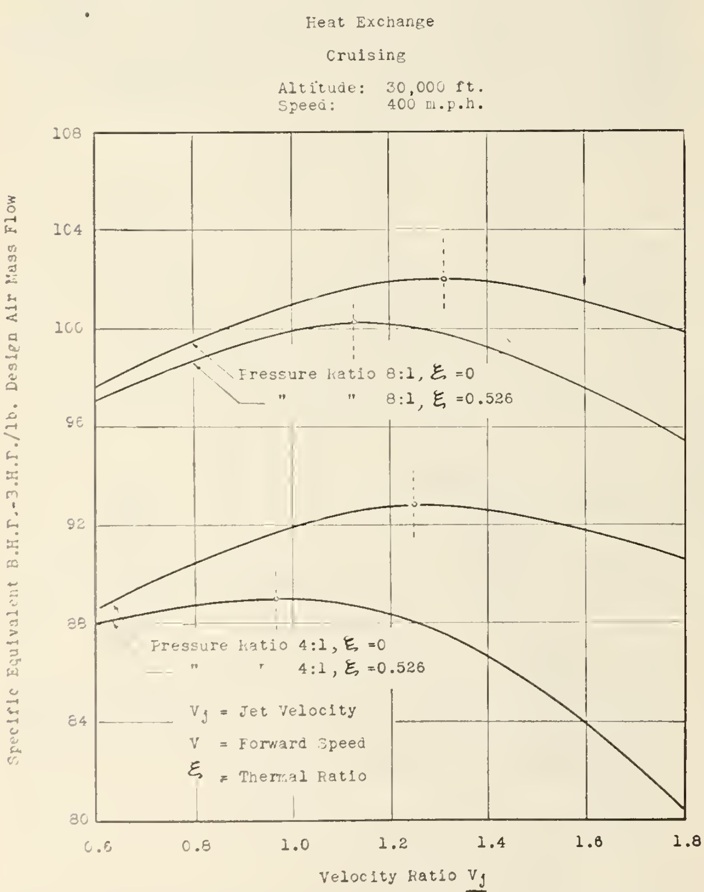

Fig. 27—Variation of the specific power output with the velocity ratio of propeller turbine engines with heat exchange.

The temperature reached by an uncooled blade is higher than the static temperature of the flowing gases because of the resulting temperature rise in the boundary layer.

This temperature rise is given as follows:

$$T = \theta \cdot \frac{w^2}{2gJK_p} \quad \text{(6)}$$

If air cooling is used, the higher the ratio of internal blade

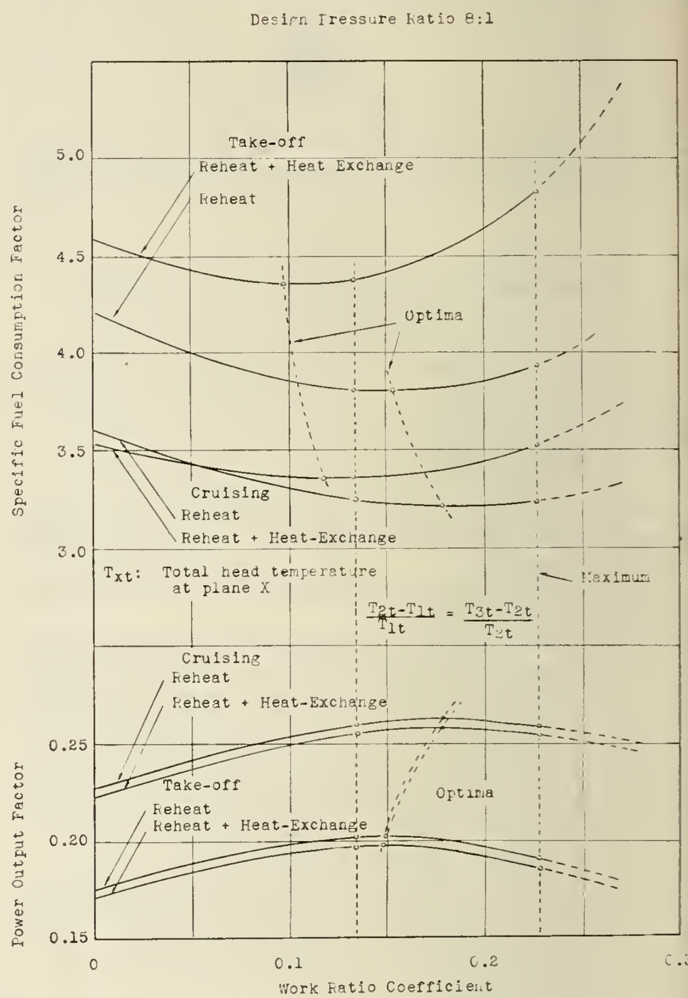

Fig. 28—Variation of the power output and specific fuel consumption with the work ratio of propeller turbine engines with reheat and heat exchange.

cooling surface to the external heat receiving surface, the lower the blade wall temperature will be. The film coefficient increases as the internal cooling air velocity increases.

Theoretical investigations have shown[16] that the radial heat flow at the root of the blade has a great influence on the cooling process.

Hollow blades usually consist of a more or less circular shaft capable of taking most of the stresses and of an outer thin wall shell. The blade is made of rather low heat resisting steel and the shell of thin highly heat-resisting alloy steel having a thickness of the order of 0.012 in. This results in a light construction which has a favourable effect on the turbine disc. The only disadvantage is that it has a low thermal capacity and this presents certain

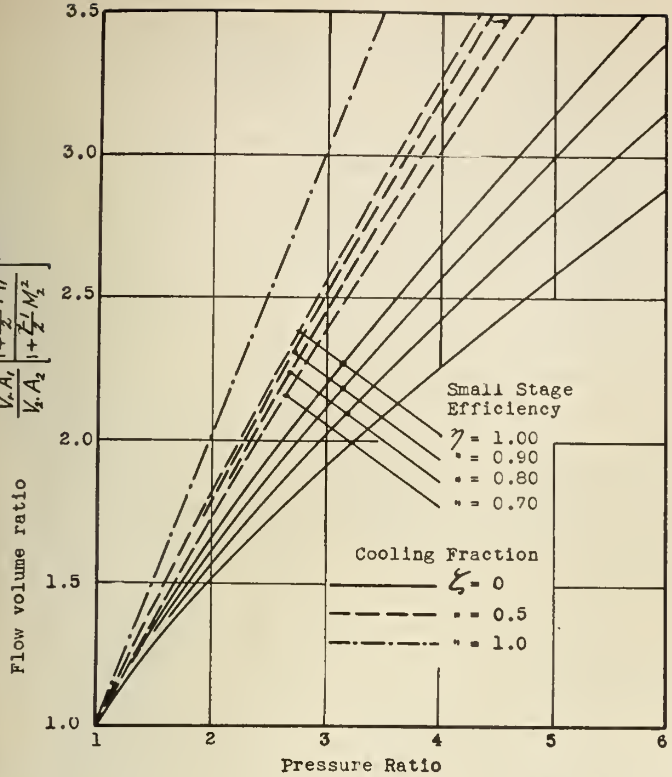

Fig. 29—Variation of the flow volume in a multi-stage axial flow compressor.

limitations in starting and load variation. Also that high local temperatures may result.

Figure 24 shows the results of temperature measurements of different points of the blade for three profiles as a function of the amount of the cooling air.

The stagnation air temperature is 950 deg. C (1740 deg. F) which corresponds to a total head temperature of the order of 1050 to 1100 deg. C (1920 to 2010 deg. F).

Each of the top curves shows the temperature of the leading edge at the mean diameter which more or less represents the maximum temperature of the blade.

The lower curves show the temperatures of the shaft in the neighbourhood of the root which represents the highest mechanically stressed parts of the blade.

It is easily seen that by increasing the internal area, the shaft temperature decreases. Even in the case of a simple cylindrical form the temperature of the blade shaft is considerably lower although the cooling area ratio is not larger than unity.

Figure 25 shows the temperatures at different points of profile I as a function of the gas temperature for 8 per cent cooling air. It is seen that the blade shaft temperatures corresponding to a gas temperature of 1100 deg. C (2010 deg. F) is below 600 deg. C (1110 deg. F) which proves that the use of low heat resisting materials for the blade shaft is feasible for the high gas temperatures.

In Fig. 24 it is seen that, in order to achieve satisfactory cooling, a considerable amount of cooling air is required. The energy required is shown in Fig. 26. As this energy wastage has a deleterious effect on the performance of the engine, methods should be devised to decrease it. One method is to permit air to escape in such a way as to utilise its exit momentum in the peripheral direction, giving part of its energy to the turbine and also improve the boundary layer conditions. In Fig. 26 it is seen that a considerable improvement results and the loss is reduced to $^1/_3$ of its original value.

These experiements show that it is possible to use higher temperatures without considerably lowering the overall efficiency of the engine by increasing the amount of cooling air.

In the case where a heat insulating material is used on the outer shell of the blade, e.g. ceramic of some sort, by keeping the same internal metal conditions and depending on the thickness of this material, higher temperatures can be employed of the order of 20 to 50 deg. C (36 to 90 deg. F).

Several methods of attaching such heat insulating materials can be suggested, spraying etc., but the thermal expansions should be examined in order to avoid scaling.

Number of Stages

Because of relatively low pressure drops in present day gas turbine engines, one or two stages are sufficient to handle the pressure ratios available. It was found that by a multi-stage construction, no essential advantages could be achieved. The attainable higher efficiencies by a multi-stage design are accompanied by a heavier machine, and waste of materials. In the case where blade cooling is used, the situation is further aggravated by the multiple amount of the cooling air necessary. Higher expansion ratios in the nozzles result in higher peripheral velocities and lower temperatures in the blades. This would suggest that another degree of reaction, usually less than 50 per cent, would be the best solution.

Nothing is known regarding the influence of the cooling air on the following stage. It can be seen that a deterioration of the efficiency may be expected but the order of it is unknown. When blade cooling is used, a single-stage turbine may be successfully employed for each compressor group. As the rim speed of a turbine should be kept lower than 1100 ft. per sec. the temperature drop in a turbine stage is of the order of 220 to 280 deg. C for turbine inlet total head temperatures of 1100 to 1800 deg. K. There is little variation in weight between the single and the two stage turbines, but the air cooling loss in the latter case is considerable, although the two stage turbine results in a smaller outside diameter and consequently smaller frontal area, but in most cases the turbine diameter is not a critical point as the frontal area of the engine is determined by other components.

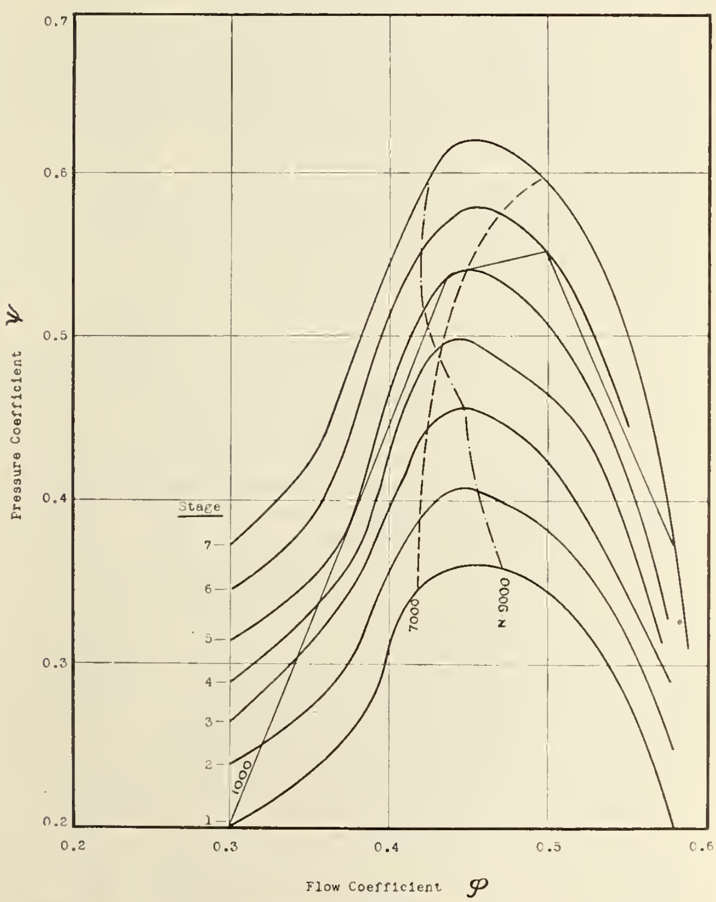

Fig. 30—Variation of the characteristics of a 7-stage axial flow compressor with the rotational speed.

Division of Power

With regard to the propeller turbine, the problem of division of power between the propelling nozzle and turbine and between the turbines of a compound unit is of great importance.

Division of Power Between Propeller and Propelling Nozzle

It was found[17] that optimum conditions result when the velocity ratio is given by the following formula:

$$\frac{V_j}{V} = \frac{\eta_j}{\eta_t \eta_p} \phi \qquad (7)$$

In the case where the above efficiencies are not constant, their variation is to be taken into consideration.

Figure 27 shows the variation of the specific power output as a function of the velocity ratio $\frac{V_j}{V}$. From this it is seen that the specific power output curves are very flat and there is a wide range of jet velocity forward speed ratio over which the engine can operate with negligible loss of power and efficiency. Also it may be inferred that there is a fair chance of a fixed propelling nozzle being used in a propeller turbine without appreciable loss of power and efficiency thus avoiding the additional complication and weight of a variable propelling nozzle. It was found that the optimum velocity ratio increases with the design pressure ratio, but falls off with increasing degree of heat exchange (thermal ratio).

Since, in practice, the exhaust system efficiency increases with jet velocity and the propeller weight decreases, the real optima occur at higher velocity ratios than those calculated above and the curves flatten more on the higher velocity ratio side.

Finally it is worth mentioning that at higher forward speeds, as the propeller efficiency falls-off, the jet becomes relatively more efficient, thus absorbing more power to maintain optimum conditions and therefore lightening the whole power plant installation.

Division of Power Between Turbines

Figure 28 shows the specific fuel consumption and specific power output of an 8:1 design pressure ratio double compound propeller turbine as a function of the work ratio coefficient (the ratio of the H.P. turbine temperature drop to its inlet temperature).

From these curves it is seen that the condition of equal temperature rise ratio in the high and low pressure compressors is not far removed from the optimum.

For optimum specific power output, the work ratio coefficient is higher than that of equal temperature rise ratios.

The optimum work ratio coefficient for maximum output is higher for cruising than for take-off conditions and it will be noted that there is but little variation between reheat alone and reheat with heat exchange.

Now, turning to the curves indicating the specific fuel consumption, the optimum work ratio coefficient is slightly higher than that yielding equal temperature rise ratio for each compressor but for the case of reheat and heat exchange the optimum coefficient is slightly lower.

Again, it is seen that for minimum specific fuel consumption, the optimum work ratio coefficient is higher at cruising than at take-off.

Finally it is to be noted that because of the flatness of the curves, little variation from the optimum values of specific fuel consumption and specific output will result with changes in the work ratio coefficient. This results in an appreciable measure of freedom in the design of the compressors and turbines of the double compound engine.

Matching of the Different Parts of the Power Plant

Owing to the steepness of the characteristics of the different parts of an aircraft gas turbine and especially the relatively high sensitivity of the efficiency, great care should be taken to ensure a satisfactory performance at cruising and starting conditions.

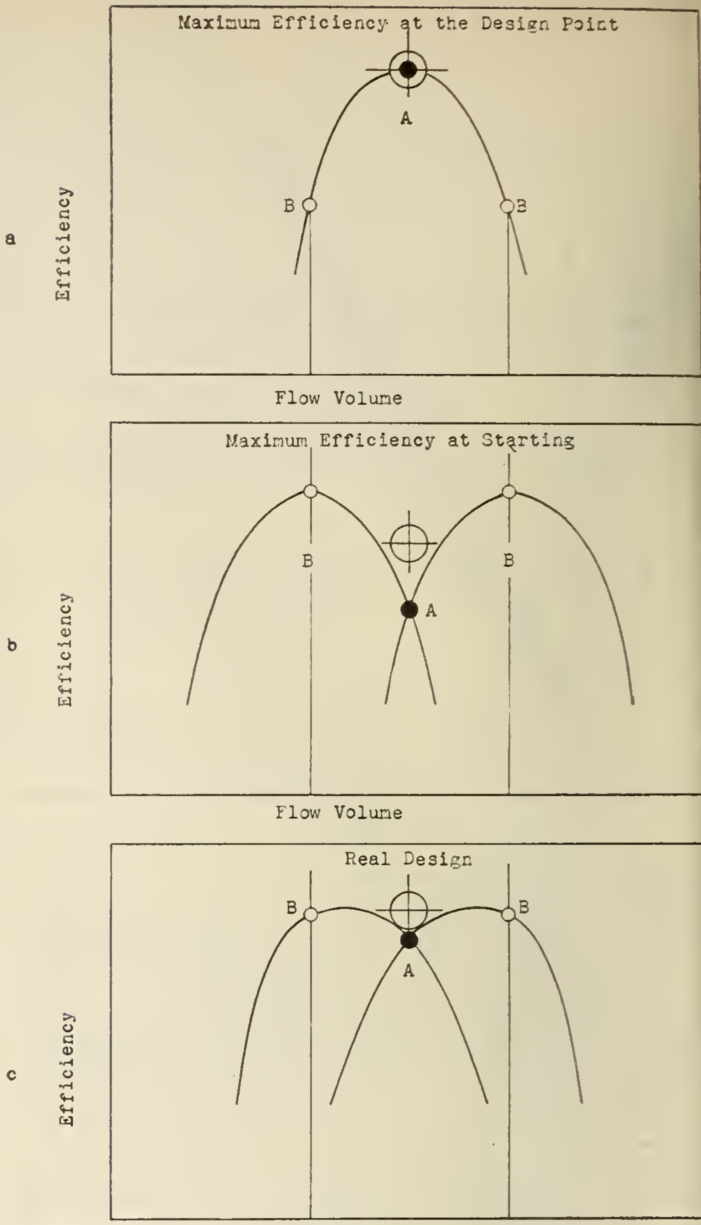

Fig. 31—Matching of the stages of an axial flow compressor.

Matching of the Stages of an Axial Flow Compressor

There are two main requirements that must be satisfied by a compressor; they are, high efficiency at the design point, and easy starting. Present day available data[18] show that the cooperation of the different stages of a compressor at different rpm. is not satisfactory. From fundamental theory, taking into consideration the continuity conditions, the following formula may be derived:

$$\frac{V_{a1} A_1}{V_{a2} A_2} = \left(\frac{1 + \frac{\gamma - 1}{2} M_1^2}{1 + \frac{\gamma - 1}{2} M_2^2} \right)^{\frac{1}{\gamma - 1}} \left(\frac{P_{2t}}{P_{1t}} \right) \left\{ 1 - \left(\frac{\gamma - 1}{\gamma} \right) \left(\frac{1 - \zeta}{\eta_\infty} \right) \right\} \qquad (8)$$

This has been plotted in Fig. 29. It is easily seen that at low rpm. the different stages are not working on the same design flow coefficient; because both the pressure ratio and the efficiency vary. Thus for high pressure ratio compressors, a dislocation of the stages at low rpm. cannot be avoided.

In the case where the compressor is designed for a high efficiency at the design point, a considerably lower efficiency will result at starting due to this dislocation.

Figure 30 shows the pressure and flow coefficients of a 7-stage compressor on which are drawn the constant rpm. lines. It is seen that at low rpm. the first stages surge and at high rpm. the last stages surge. It is also to be noticed that at high and low rpm. the mean stages take the most of the load and tend to keep the efficiencies high because as we progress through the stages of the compressor, the Reynolds number increases and the Mach number of the tip peripheral speed decreases, both resulting in an increase in efficiency. On the other hand, the diameter ratio $\frac{D_i}{D_o}$ and the relative gap increase, both resulting in a decrease in efficiency.

To make the above considerations clearer, let us plot in a schematic diagram the efficiency as a function of the flow volume coefficient ϕ.A. Assuming for simplicity that the efficiency curves are similar and disregarding the change in efficiency due to polytropic compression we examine the following cases:

(a) Maximum efficiency at the design point.

In this case all efficiency curves coincide and the overall efficiency at the design point coincides with the maximum efficiency. (Fig. 31a.)
At lower or higher rpm. owing to the variation of the flow volume of the different stages, a considerable drop in efficiency occurs. As it was seen above, this drop is larger with an increase of the pressure ratio.

(b) Maximum efficiency for starting.

In this case the distance between the maximum of the first and last stages is equal to the variation of the flow volume, (Fig. 31b) and the efficiency at the design point is considerably lower. This drop in efficiency is larger the greater the design pressure ratio.

(c) The real design case.

This case is a compromise between the above two (Fig. 31c). We design in such a way as to obtain a mean reduction of the optimum efficiency of the first and last stages at the design point and at starting rpm.

It is evident then that the intermediate cases will give better results and finally a more or less constant compressor efficiency, in the whole range of operation, will result.

From the above it may be inferred that it is advantageous for the first and last stages to have characteristics as flat as possible.

Many methods may be suggested to obtain flat characteristics on a stage but to our knowledge the most effective is that of using highly curved blades in which the centrifugal force compresses the boundary layer and a considerable delay in breakaway occurs.

In order to secure high efficiency at maximum rpm., several means for easy starting may be suggested such as movable stator and rotor blades, air bleeding, etc. These methods must always be used at pressure ratios higher than 3:1.

Matching of the Compressor, Turbine and the Propelling System

The results of good matching of the gas turbine components are seen in a diagram called the "equilibrium running" diagram. This diagram is found from the component characteristics of the compressors, turbines and exhaust systems.

The following may be mentioned as the main requirements of equilibrium running:

(a) Equal or proportional (in a reduction gear units) rotational speed of the connected rotating components.
(b) The energy absorbed by the compressor and propeller equals the energy produced by the turbine.
(c) The gas mass flow equals the air mass flow less any bleeding or leakage, plus the fuel added during combustion.
(d) Stability of running; that is, by an infinitely small variation of the running conditions of the one component, another stable running condition results.

The last condition is mostly secured when the running of the compressor is far away from surging regions.

In plotting the equilibrium running diagram, it was found profitable to use non-dimensional parameters. In Fig. 32 is shown the equilibrium running conditions of a simple jet using a variable propelling nozzle.

When a propeller turbine with fixed propelling nozzle is employed, similar characteristics can be obtained.

In compound engines, owing to the larger number of variables, more than one equilibrium running diagram is plotted. It was found that efficient running is assured when the high pressure compressor is coupled with the high pressure turbine.

Although a large amount of experimental data on compressor characteristics is available little or nothing of experimental material is available regarding turbines. Under these circumstances, theoretical characteristics have been used in the past, and discrepancies were recorded due to several unfulfilled assumptions made.

Now, with the introduction of blade cooling, the theoretical turbine characteristics are bound to differ even more from the actual, therefore experimental characteristics are urgently required.

Experimental characteristics for propelling nozzles are available although for counter-rotating propellers the situation is rather different.

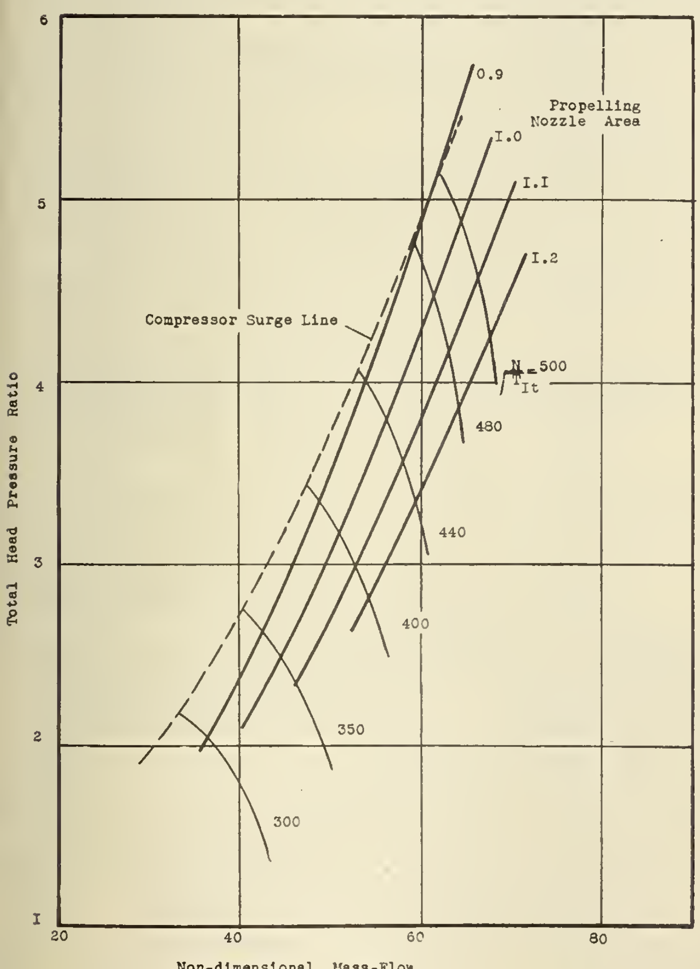

Fig. 32—Equilibrium running characteristics of a simple jet with variable propelling nozzle.

Regulation

After the matching of the different components and the plotting of the equilibrium running diagram the regulation of the unit is the next problem.

The components of an aircraft gas-turbine plant that may be controlled consist mainly of: the fuel supply, the rotational speed, the propelling nozzle area and the propeller pitch. Two methods of control have been proposed, namely, hydraulic and electronic, but is it too early to predict which should be adopted.

Non-Dimensional Plotting

Experience has shown that it is more convenient to plot compressor, turbine, propelling nozzle characteristics in a non-dimensional basis. This is usually done by the assumption of a mean specific heat.

Thus the pressure and temperature ratios in a unit will be functions of three non-dimensional parameters as follows:

$$\left.\begin{aligned} \frac{P_{II}}{P_I} &= f_1\left[\frac{W\sqrt{T}}{P}, \frac{N}{\sqrt{T}}, \frac{V}{\sqrt{T}}\right] \\ \frac{T_{II}}{T_I} &= f_2\left[\frac{W\sqrt{T}}{P}, \frac{N}{\sqrt{T}}, \frac{V}{\sqrt{T}}\right] \end{aligned}\right\} \quad \ldots\ldots(9)$$

In the simple jet engine, the fuel consumption and the thrust can also be expressed non-dimensionally.

Flight and bench test results of the whole power plant have been plotted non-dimensionally and correlated with each other; However, due to poor instrumentation, not sufficient agreement was found.

Conclusions

Although considerable progress has been made in the last five years towards the understanding of fundamental phenomena present in the gas turbine engines, much research is needed in order to obtain sufficient data to design efficient gas turbines.

A more or less clear picture regarding the ranges of utilization of the different types of gas turbine engines is available to-day[19].

The simple jet engine can be considered as the ideal fighter at high speeds approaching the sonic velocity. Above this speed, due to aerodynamic advantages resulting from smaller frontal areas, the rocket and the propulsive duct powered aircraft are the chosen competitors.

It has been proved that long range aircraft powered by simple jets for ocean crossing duties, are not justifiable in the near future.

The propeller turbine engine, most suitable for long range duties, is the most favoured type to-day and future advances in aerodynamics, metallurgy, gas dynamics, and heat transfer, will extend its use. The new impetus given by the methods of turbine blade cooling widens considerably the range of use for the propeller turbine. The gas generator is heavy and complicated, and the possibility of its application to very long range duties has been considerably decreased by the recent advances in materials, and the blade cooling that favours mostly the propeller turbine.

The ducted fan has some advantages, but it is rather difficult to foresee its range of application between the simple jet and the propeller turbine.

In the future, considerable decrease of bulk and weight for given power output is to be expected.

From the use of blade cooling and advances in fuels and combustion, smaller combustors will result.

A reduction in the number of stages in compressors is to be expected.

Finally, although higher specific output and more efficient engines may be expected, more complicated designs will result.

List of Symbols

The following symbols have been used:

- A = area
- a = local sonic velocity
- c = absolute velocity
- C = chord of the blade
- C_r = the circulation parameter
- E = Energy or work per unit mass flow
- g = gravitational constant
- H = the compression work per unit mass flow
- J = Joule's equivalent
- K_p = specific heat under constant pressure
- M = Mach number
- N = rotational speed
- n_s = specific rotational speed
- P = pressure
- Q = fluid volume rate
- Re = Reynolds number
- S = pitch of the blade
- T = Temperature
- U = peripheral velocity
- V = velocity
- w = relative velocity
- W = mass flow
- Z = number of blades
- α_1, α_2 = air inlet and outlet angles
- θ = constant
- ζ = cooling fraction
- γ = specific heat ratio
- η = efficiency
- η_∞ = small stage efficiency
- λ = work fraction, energy absorbed by the fan turbine expressed as a fraction of the total energy available in isentropic expansion after the compressor turbine.
- μ = by pass ratio, mass flow through the fan expressed as a fraction of the mass flow through the turbine.
- ν = kinematic viscosity
- ξ = thermal ratio
- σ = throttling factor
- υ = diameter ratio
- φ = flow coefficient, ratio of the mean axial to the mean peripheral velocity
- ϕ = factor correcting for reheat and heat exchange effects
- ψ = pressure coefficient

Subscripts

- $1,2$ = entry and exit
- a = axial
- t = total head (as second subscript)
- j,p,t = jet, propeller, turbine
- i,o = inside and outside diameter of the blading

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VERTICAL LIFT BRIDGE ACROSS THE LACHINE CANAL

On Canadian National Railways Line between Victoria Bridge and New Central Passenger Station in Montreal

R. O. STEWART, M.E.I.C.
Engineer of Bridges, Canadian National Railways, Montreal.

General Description

The history and outline of the development on the Canadian National Railways Terminal project in Montreal were given in a descriptive article which appeared in the July, 1943, issue of *The Engineering Journal.* The structure described in the present article was completed when the 1943 article appeared, but it being a " structure over navigable waters ", wartime censorship prevented publication of construction details at the time.

The locating of the new C.N.R. passenger station at the south or Montreal end of the Mount Royal tunnel necessitated the construction of new main line tracks to connect this station with the existing tracks to the east and south over Victoria bridge and to the west by way of Turcot. The arrangement of these tracks is shown diagrammatically in Fig. 1.

In general these new tracks are carried on elevated structures, embankments and on various steel and concrete subway structures. From St. Antoine street to Ottawa street, the track structure is a reinforced concrete viaduct so constructed that the portion under the track deck consists of a series of two storey buildings between consecutive streets—which buildings have a total usable floor area of 350,000 sq. ft. and have, since construction, been continuously in use for C.N.R. offices, C.N. Express garage; a large area in one building is rented to the Post Office for the sorting and handling of overseas mail. From Ottawa street to Victoria bridge the tracks are carried on various embankments and reinforced concrete and steel structures, with complete elimination of all grade crossings with streets and other railway tracks. Referring to Fig. 1, the point at which these new tracks cross the Lachine canal on a vertical lift bridge will be seen. This structure is located near the City of Montreal Wellington street vehicular tunnel under the Lachine canal and also close to a C.N.R. single track swing bridge on the line providing railway service to the south or west end of Montreal harbor from the C.N.R. yards at Point St. Charles.

The Lachine canal vertical lift bridge was originally designed to carry four tracks. In 1929-30, the substructure for the new bridge was constructed for a four-track structure, provision being made for two separate two-track superstructures. All construction work in connection with Montreal terminals was suspended between the years 1930 and 1939. During this time there was considerable development on a new system of controlling and improving the operation of trains by means of completely interlocked switches and signals installed continuously along each railway track and operated from some conveniently located central point. This system is known as " Centralized Train Control "—or on the railways as " C.T.C." Early in 1940, it was decided to provide C.T.C. on all Montreal Terminal trackage. This reduced the requirements in regard to the number of new tracks to be built and it also greatly increased the capacity of existing tracks. There are four tracks on either side of the Lachine canal two-track bridge—these four tracks being fully interlocked and with all switches and turnouts power operated by the C.T.C. system. Provision has been made for the future construction of the second two-track superstructure on this bridge, if and when this may be found to be necessary. All traffic in and out of the new station has, however, been handled quite successfully over the two-track bridge since July 1943, which would indicate that the present construction has ample capacity, in so far as passenger traffic is concerned, for some considerable time to come.

Many inquiries have been made as to why the Canadian National Railways built a vertical lift bridge across the Lachine canal at this location when a swing bridge could have been built at less cost and would presumably have been equally satisfactory. This question is partly answered by the explanation in regard to a possible eventual four track bridge as given in the preceding paragraph. It must be kept in mind that the bridge was designed and the substructure built in 1930 and that the canal at this location has one 80-ft. navigation channel on either side of a 30-ft. centre island giving a total canal width of 190 ft. The overall width of a four-track swing bridge would be about 62 ft., which when swung for the passage of a ship, would considerably exceed the width of the centre island and thereby reduce the effective widths of the two navigation channels. Moreover the proximity of various important public works, of the City of Montreal vehicular tunnel and of the C.N.R. single track low level swing bridge precluded the economic possibility of increasing the width of the canal to restore the required 80-ft. width for the navigation channels.

The advisability of changing to a two-track swing bridge was investigated in 1939 but it was decided to proceed with the superstructure of the lift bridge on the grounds that the substructure was already in place and that there was also a probability that the other two tracks on this bridge would eventually be required for purposes other than to handle passenger traffic to the new station.

This bridge crosses the canal and one 20-foot roadway on each side at an angle of 45 deg. It is a two-track structure, each track being carried on five deck plate girder spans; one movable span

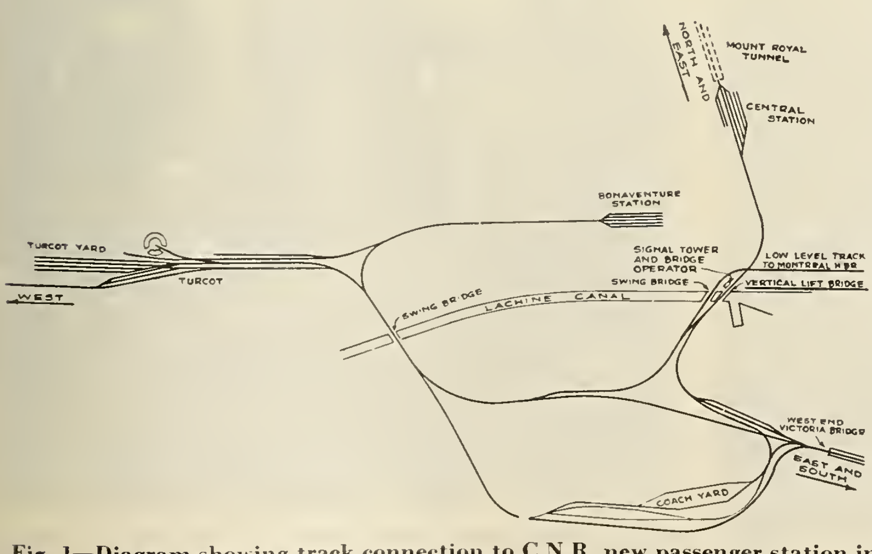

Fig. 1—Diagram showing track connection to C.N.R. new passenger station in Montreal, and location of lift bridge across the Lachine canal.

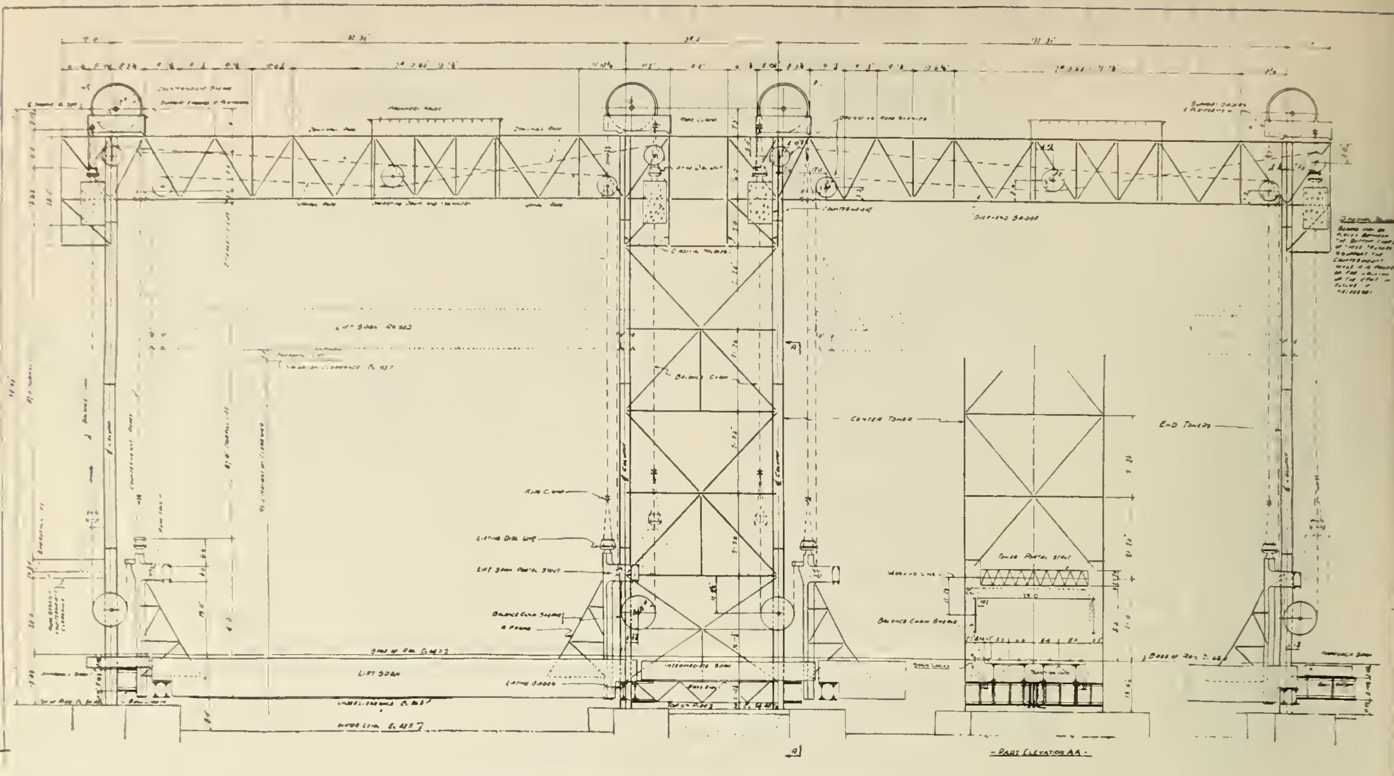

Fig. 2—Diagram showing general arrangement of bridge.

120 ft. long over each of the two navigation channels, one fixed span 36 ft. long over each roadway and one fixed span 39 ft. long over the island in the centre of the canal; the movable spans being so constructed and supported as to permit of either one or both spans being lifted vertically to a height of 95 ft. clear above the water level in the canal. The operating machinery and the counterweight sheaves are carried by an overhead fixed structure across the entire width of the canal. This structure is supported by a two-post rocker bent at each side of the canal and by a four-post tower on the centre island. The general arrangement as described above is shown in Fig. 2.

Substructure

The foundations for this structure were constructed in 1929-30 and consist of a reinforced concrete abutment at each end and four reinforced concrete piers—one on each side of the two navigation channels. Each pier consist of three 8 ft. 6 in. dia. reinforced concrete cylinders driven to rock and capped with a reinforced concrete beam which acts as the bridge seat.

Rock is from 70 to 72 ft. below ground level and it consists of limestone which invariably has, on the surface, some depth of shale or thin layers of stone sandwiched with layers of clay or other soft displaceable material. The material overlying the rock consists of alluvial clay with a very high water content and a layer of heavy gravel and boulders from 6 to 19 ft. deep immediately on top of the rock.

Of the twelve foundation cylinders the six in the centre of the canal were constructed first. Based on borings made by the Railway Company and on all other available data in regard to the soil formation it was considered by the Railway engineers and also by the contractor that these cylinders could be built by driving open cylindrical steel sheet piling cofferdams to rock; excavate these with an orange peel bucket; clean off the rock by diver; place the reinforcing steel and fill the cylinders with concrete, leaving the steel sheet piling in place. The construction of these six cylinders by this method was completed only after a great amount of difficulty and after considerable variations were made from the original concept. The old stone-filled timber crib construction in the centre of the canal was carefully removed to eliminate as far as possible all obstructions to the driving of the steel sheet piling. A centering pin, consisting of a 6 in. dia. steel pipe, was driven vertically in the exact centre of the location for each cylinder; a wooden template or form was then

Fig. 3—Steel sheet piling caisson with air lock. The pile of material in the foreground consists of shale and disintegrated stone removed from the surface of the solid lime stone rock.

lowered over the pin and the steel sheet piling was set up around this form and driven as far as possible, with the intention or hope that the steel piling cylinder would reach solid rock in the circular shape in which it was started. Unfortunately the steel sheet piling cofferdams did not retain their circular shapes to the bottom. In the case of three of the cylinders it was possible to excavate inside the open cofferdams, continue the driving of the steel sheet piling to rock, clean out the bottoms and fill with concrete in the manner originally intended. In the cases of two other cylinders, air locks had to be placed on the tops of the cofferdams; excavation proceeded with as far as possible; steel sheet piling cut off and the balance of the excavation taken out under air pressure and the cofferdams extended down to rock by means of bolted steel tunnel lining pans. There was considerable difficulty in sinking these two cylinders—chiefly due to the heavy leakage of air through the joints of the single wall steel piling cofferdam. Figure 3 shows one of the steel sheet piling cofferdams with air lock. The steel sheet piling in the remaining cofferdam was found to be so badly deformed that it was impossible to get it cleaned out below the surface of the gravel. It was, however, filled with concrete and later it was supplemented by eight 16-in. dia. steel bearing piles driven to rock and filled with concrete.

Fig. 4—Showing three wood stave pneumatic caissons being sunk on the shore of the canal. Photo also shows the tops of three completed steel sheet piling caissons on the right side of picture.

The experience with steel sheet piling cofferdams on the six cylinders in the centre of the canal was such that this method of construction was abandoned and the six shore cylinders were sunk by means of wood stave pneumatic cofferdams. These are shown in Fig. 4. The stone masonry canal walls were removed; the cofferdams set up, guyed and weighted by concrete lining; air locks installed; the excavation taken out to rock by manual labor and the cylinders filled with concrete without any unusual difficulties.

Each of the twelve cylinders is reinforced with twenty-four 2-in. dia. steel rods extending from the rock to substantially the top of the concrete capping beam. Each capping beam is 10 ft. wide by 8.5 ft. deep by 116 ft. long and is heavily reinforced top and bottom with 2-in. dia. steel rods. The 2¼-in. dia. anchor bolts for steel superstructures were set in place in the forms before the capping beams were poured. Six of these anchors were provided for each post.

To increase the stability of the substructure, the capping beams of the two centre island piers are trussed to each other by means of a series of heavy reinforced concrete diagonals and similarly the capping beams of the shore piers are trussed to the abutment footings. These reinforced concrete diagonals are located a sufficient distance below ground level to avoid damage from frost.

On the completion of the above work, the island in the centre of the canal was rebuilt, using two different types of construction. At the two ends of the island this construction consists of close-face timber cribs with concrete tops. Elsewhere it consists of a double row of timber piles along each face of the island and tied across the island with heavy steel rods. The island was filled with heavy rock. Timber and piles are creosoted to prevent deterioration during the three or four weeks when the canal is emptied each spring.

All construction work on the substructure was performed by the Foundation Company of Canada Limited.

Superstructure

The general arrangement of the superstructure of this bridge is shown in Figs. 2 and 5, or in the cover picture. The track girders are designed for E60 live load. Structural carbon steel with a minimum yield point of 35,000 and an ultimate tensile strength of 62,000 to 70,000 lb. per sq. in. was used throughout with a basic design unit stress of 20,000 lb. per sq. in. Canadian National Railways Standard Specifications for Fixed Span Steel Railway Bridges and CESA Specification A20 for Movable Bridges were used for design and fabrication

The movable spans over the two channels each consist of two single track deck plate girder spans 120 ft., 3 in. long with a 45 deg. skew at both ends, framed into and riveted to a transverse lifting girder and portal frame at each end of each span. With two separate girder spans rigidly connected to the same transverse girder, the deflection of any one span (due to live load on one span only) would result in torque stresses in the end transverse lifting

Fig. 5—Side elevation of bridge looking from the south.

Fig. 6—Centering pin on end of a movable span. This photo was taken with span partly raised. When span is lowered the lower end of pin enters snugly into a round hole in a heavy steel plate riveted to the adjoining fixed span.

girders and also secondary stresses in the connections between the main girders and the transverse girders. On investigation, these stresses were found to be prohibitive and to prevent their generation brace frames and top and bottom lateral bracing were provided between all four girders under the two tracks. The reason for this was, of course, to cause all girders to deflect vertically by nearly the same amount when the four-girder unit was loaded on one track only (with an eccentricity equal to half the distance between track centres). This eccentric loading produces a torque stress which can be considered as replaced by a couple acting horizontally in the planes of the top and bottom lateral bracing. This bracing was designed for the resultant stresses and the torque stresses in the end transverse girders were thereby eliminated. The deflections of all four girders have been measured with live load on one track only and they have been found to be approximately equal, thus substantiating the accuracy of the assumptions used in this particular feature of the design.

The span guide castings are attached to the ends of the lifting girders at both ends of the movable spans and at one end of each span a 7-in. dia. vertical steel pin is provided to transfer traction or braking stresses from the movable spans to the substructure. One of these pins is shown in Fig. 6. As a span is lowered, this pin enters a hole in a heavy steel plate connected to a shore span. In addition to taking care of traction and braking loads, this pin fixes the location of one end of the movable span, both laterally and longitudinally—the other end being fixed laterally by the span guides and left free to expand and contract longitudinally.

In the design of vertical lift bridges it is customary to leave a sufficient portion of the weight of the movable span uncounterweighted to ensure proper and positive seating when the span is lowered for railway or highway traffic. For reasons that will appear later, the movable spans in this bridge are, as nearly as possible, 100 per cent balanced by the counterweights. In order to insure positive seating, a motor-operated toggle type mechanism is provided at each corner of each movable span. These machines are automatically operated and apply seating loads of 25,000 lb. vertically on each corner of each span. These machines have proved to be very effective in providing positive seating of all four corners of each movable span and they also serve as very effective span locks.

Pneumatic buffers are attached to the undersides of all lifting girders to check or cushion the end of the downward vertical movement of the lifted spans. Similar buffers are attached to the overhead structure to check and cushion the end of the upward movement of the spans.

The pier members for the movable spans consist of the conventional discs and welded steel plate pedestals. The discs are suspended from and rise with the lifting girders. No expansion rollers were provided due to the fact that there is normally no dead load on these pier members and therefore only negligible friction between the discs and the pedestal bases to resist sliding due to changes in temperature. The surfaces between the discs and the pedestals are lubricated with dry graphite. No anchor bolts are provided.

Because of the 45-deg. skew the construction of the deck at the span breaks was complicated and steel deck construction was used at the ends of all spans (except the abutment ends) for sufficient lengths to square up the deck for timber ties. The track rails are carried on special tie plates on both timber and steel deck construction. The tie plates rest on ¼-in rubber pads and are firmly anchored to every deck tie and to the steel deck. The track rails are clip-anchored to every tie plate in a manner that prevents longitudinal creepage of the rails. This special anchorage of rails was provided in order to prevent creepage of rails which might displace the rail break castings.

At the end of both movable spans and at the adjacent ends of the fixed spans, rail breaks have been provided. These are chrome-molybdenum steel castings so designed that a slightly raised part lifts the locomotive and car wheels as they pass the rail gap thus eliminating noise and impact. See Fig. 7.

Fig. 7—Rail break assembly. Note the slightly raised casting that carries the treads of the wheels across the gap in the main running rail. The low flat unit to the left of the rail break is an enclosed mechanism for automatically making or breaking the track side of the electric traction circuit when span is raised or lowered.

Riveted to the transverse lifting girders at the ends of the movable spans are the portal frames which carry the overhead electric traction wires, the span ends of the counterweight cables and the uphaul ends of the operating cables. On top of these frames there are special trolley arrangements to pick up, from vertical trolley wires, the 110 volt electric power for the operation of the navigation lights on the movable spans.

The general construction features and dimensions of the fixed overhead structure are shown in Fig. 2 and various photographs. The purpose of this structure is to provide supports for the operating machinery and the counterweight sheaves. The only structural feature that deserves special mention is the provision of heavy transverse trusses between posts below track level, the purpose of these being to develop a transverse fixture of post bottoms by some means other than the anchor bolts with, of course, a consequent reduction in stress in the anchor bolts. It will be noted by looking at the cover picture that the height-to-width ratio of this structure is quite large and that the wind loads on the anchor bolts are therefore of major importance. The posts supporting the fixed overhead truss also serve to carry the guides for the movable spans and the counterweights.

The counterweight sheaves are 12 ft. in diameter and are located on top of the fixed overhead structure. These sheaves are of all welded construction, the machining being done subsequent to the completion of all welding and stress relieving operations. They are carried on 14-in. dia. axles which in turn are supported by SKF roller bearing units of large size. It is worthy of note that the design of these roller bearings takes into consideration the fact that the movable spans and therefore the bearings will stay in a fixed position for the period during which navigation in the canal will be closed each year and this condition requires special consideration in order to avoid the formation of flats on the rollers and grooves in the roller treads. The calculated load per bearing is 233,000 lb. and the rated static capacity of each bearing is 780,000 lb. thus establishing a brinelling safety factor of 3.35. Under operating

Fig. 9—Wheel to restrict the swing of counterbalancing chains. The weight of this wheel is carried by the chain. Wheel supports are carried on bridge post in such a way as to permit unrestricted vertical motion of wheel due to variegations in length of chain.

Fig. 8—Showing attachment of counterweight cables to end of a concrete counterweight. Steel framework to which cables are attached is actually part of a structural steel construction buried in the concrete counterweight. The mechanism in the left foreground is for adjusting the tension in the main operating cable.

conditions of 3 r.p.m. the minimum theoretical life of these bearings is 121,500 hours or 14 years of continuous operation; this figure being of value only to show that the design of the bearings was not controlled by operating conditions. Taking into account the fact that the bridge is not operated during winter months and only a relatively small number of times per day during the balance of the year, it is realized that a bearing life of 14 years of continuous operation should far outlast the life of the structure as a whole.

The use of roller bearings on the counterweight sheaves and of 100 per cent counterbalancing was determined entirely as a matter of economics. The added cost of these bearings together with that of the power operated seating mechanisms and of various other added detail parts being considerably less than the cost of larger motors and operating mechanisms that would otherwise have been required, together with the capitalized value of the increased electric power consumption. The use of roller bearings also greatly reduced the starting friction and thus made it much easier to comply with the comparatively fast operating times required by the Department of Transport.

The movable spans are suspended by twelve 1⅝-in. dia. plow steel stranded wire cables at each corner of each span. These cables pass over the counterweight sheaves and are connected at their ends to the spans and to the counterweights. The connections are made by means of rope sockets around the circumference of so-called lifting disc units and the cables are brought to plane surfaces by means of clamps. These connections are shown in Fig. 8. In order that the load be taken as equally as possible by

Fig. 10—Bridge operator's view of canal upstream from bridge. The swing span in the foreground carries the low level C.N.R. freight track serving the west or south end of Montreal Harbor.

all cables, they were prestressed at a load of 20,000 lb. and held at that load for a sufficient length of time to take the mechanical stretch out of the rope. The ropes were then measured (under 20,000 lb. load) and marked for cutting and socketing after which the load was released and the cables cut to length and end sockets attached.

Each counterweight consists of a structural steel frame, for the attachment of cables and guides, filled and housed in reinforced concrete. It is interesting to note that the concrete counterweights were constructed in their raised position, this of course being necessary as the spans could not be raised (and the counterweights lowered) till after the completion of the counterweights. Provisions were made in the bridge structure for the placing of steel beams on the bottom chords of the overhead structure to support the counterweights while being constructed and for jacking them up in future, if this should become necessary in order to change one or more cables. The counterweights are adjustable by the addition or removal of concrete blocks each weighing 100 lb. There are 95½ cu. yds. of concrete in each counterweight. The counterweights are so adjusted that the amperage on the operating motors is substantially the same to lower the span as it is to raise it and also that each span seats as nearly as possible simultaneously on all four corners. The first of these requirements means, of course, that the span is

Fig. 11—Bridge operator's view of canal downstream from bridge. The apparent restriction in length of view is due to a 90° bend in the canal.

100 per cent counterweight. It might be added that this adjustment is for calm weather when the timber deck and concrete counterweights are dry. Snow, sleet, rain and wind upset this balance but motor power, operating cables and braking capacity are such that the only effect of this disturbance in the counterbalancing is to vary the time required to lift or lower the span and to increase the current on the operating motors.

The weight of each set of counterweight cables is balanced by the weight of a steel link and pin chain, one end of which is attached to the counterweight and the other end to the movable span. These chains hang down just clear of the railway track clearance limits and in order to prevent any encroachment (due to swing of chains from wind or other causes) the lower part of the sag in each chain passes around a flanged wheel or sheave which is secured to a structural post. The weights of these sheaves are carried by the chains and the connections to the posts are such that the sheaves have a free vertical motion to take care of changes in lengths of chains — due to wear, temperature variations or other causes. The construction features of these sheaves are shown in Fig. 9.

Operating Machinery

As stated above, the operating machines are located on the overhead structure in weatherproof welded steel machinery houses; there being one machine for each of the two movable spans. Each operating machine consists of two 5-ft. dia. grooved drums (of all welded steel construction) actuated by a simple mechanism made up of a train of gears driven by two 80 hp. electric motors. All gears are totally enclosed and operate in oil. Each machine operates four cables (two to each drum). One end of each cable is attached to an end of a lifting frame at one end of a movable span and the other end of the cable (after being wound twice around the drum) is attached to the top of a counterweight. The cable drums on the operating machines are so located that the lengths of all four operating cables are substantially the same — the reason of this being, of course, to equalize the elongation of cables at all four corners. Manually operated devices for the adjustment of the operating cables are provided at all operating cable attachment points on spans and counterweights. It has been found that the bridge functions best when there is a slight amount of slack in the operating cables. To raise the span the operating machine and cables exert an upward pull on the movable bridge spans and to lower the span the upward pull is on the counterweights.

The two operating motors working together are capable of lifting or lowering a span in 82 seconds which, with an added 8 seconds to actuate the end seating machines, gives 90 seconds for the entire operation of either raising or lowering a span. In case of failure of one motor (or of any of the relays or controls for either motor) the other motor working alone would perform the above operations in about 135 seconds. The operating motors are reversible and each one is provided with a motor operated hydraulic brake which is automatically applied at all times except when there is electric power applied to the operating motors. An emergency motor operated hydraulic brake is also provided on each operating machine. These are controlled manually from the operating desk and their principal purpose is to control the speed of lifting or lowering a span when the counterbalancing is seriously upset by sleet or snow on the span deck or the counterweights. As an added precaution, these brakes are always kept applied when the span is in its down position and seated for the passage of railway traffic.

Access to the machinery houses is provided by ladders and stairs on one side of the centre tower and by footwalks in the overhead structure.

Cranes, hoists and trap doors are provided in the overhead machinery houses to facilitate the repairs, renewals and replacements of machinery.

Operation

Operation of the bridge is by remote control, the operating desk being located on the top floor of the C.T.C. tower on the north shore of the canal. From the desk in this room the operator has a clear view of the canal both upstream and downstream and also of both movable spans at all points between their extreme up and down positions as well as of both canal channels under the bridge. This is shown by Figs. 10 and 11 — these being photographs taken from the position at which the operator stands to lift or lower a span.

The operating desk is shown in Fig. 12 and consists in general of the following:—

- A voltmeter for the main A.C. operating power circuit.
- A voltmeter for the auxiliary D.C. circuit.
- An ammeter for each of the two motors in each of the two operating machines.
- An electrically operated dial type indicator to show the vertical position of each span.
- A reversible street car type controller for each span.
- A manual control for the electric emergency brake on each operating machine.
- Pilot lights to show various predetermined locations of the spans in their vertical movement.
- Pilot lights to show the positive seating for each of the four corners of each span.
- A button to operate an electric horn to warn employees on the track or working on the bridge that a span is to be moved.

The bridge operating desk is interlocked with C.T.C. and cannot be operated unless unlocked by the train interlocking system. The operating current for the motor and emergency brakes is 120 volt D. C. and this is supplied from storage batteries used in connection with the train control system. A Phanatron tube A.C./D.C. rectifier is provided for use as a standby in case of the failure of D.C. supply from the storage batteries. The motor actuating current is 550 volts, 3 phase, 60 cycles. The relays and contactors for all motors are located in the basement of the train control tower.

The operation of raising or lowering a movable span is performed by releasing the emergency brake and applying the current to the operating motors through the controller. Having performed these operations manually the balance of the operations can be controlled either manually or automatically (at the operator's pleasure), but in either case the sequence of these operations is as follows for raising a span—

Emergency brake released	1 sec.
End seating mechanisms released.......	7 "
Span accelerates	15 "
Span travels at full speed..............	39 "
Span decelerates to 1/3 speed..........	5 "
Span decelerates and stops at point 6 ft. below top buffers	5 "
Time interval of no motion............	4 "
Span accelerates and travels at 1/3 speed	5 "
Span decelerates and stops against top buffers	9 "
Total Time	90 seconds

The sequence of operations for lowering a span is just the reverse to the above. Both spans can, if desired, be raised or lowered simultaneously.

The normal vertical motion of a span is 87 ft., but allowance is made for three feet of emergency over-run.

Fig. 12—Operator's desk on top floor of C.T.C. tower.

The telephone gives the bridge operator direct communication with maintenance men working in either of the two machinery houses on top of the bridge structure.

The two rectangular boxes on the back corners of the desk house the span height indicators. Each of these indicators consists primarily of a relsyn motor—the companion motor being directly connected to the overhead span operating machinery.

The round meter standing up at the back of the desk shows voltage of D.C. current for operation of brakes.

The five meters (on this flat) at the back of the desk show voltage of A.C. current for operation of motors and amperage in each of the four main motors.

The two controllers at the front of the desk each operate one movable span. Other levers and buttons are for manual operation of subsidiary functions.

Limit switches at the end of this over-run cut off all operating power and automatically apply all brakes.

Electric power for the operation of the new Central Terminal Station is supplied by Hydro-Quebec from two sources of supply at 12,000 volts A.C. The main transformer room is in the basement of the new Central Station and from this point 4,000-volt, 3-phase, 60-cycle A.C. power is supplied from each of the initial power supplies, to the canal vertical lift bridge. The power cables are in ducts along the side of the high level tracks to a transformer room in the basement of the C.T.C. tower where the two 4,000-volt power supplies are separately converted to 550 volts for power purposes and to 110 volts for lighting purposes.

Miscellaneous

No auxiliary power is provided for the operation of this bridge as a general failure of electric power in the city of Montreal would stop not only the operation of this bridge but also the operation of all lock gates and most of the movable spans on the Lachine canal and thus paralyze canal traffic.

The superstructure was constructed by the Dominion Bridge Company and all electric equipment was supplied by the Canadian General Electric Company.

The "as constructed" quantities of materials in the superstructure of this bridge were as follows:—

Structural steel	4,276,519 lb.
Machinery	265,616 "
Wire cables	68,340 "
Balance chains	51,220 "
Counterweight sheaves	188,800 "
Concrete	382 cu. yds.
Timber deck	75 M.f.b.m.

WARTIME PRODUCTION OF PRECISION OPTICS IN CANADA

D. C. R. MILLER, M.E.I.C.

Development engineer, Fiberglas Canada Limited, Oshawa, Ont., formerly production superintendent of optical shops, Research Enterprises Limited, Toronto, Ont.

This is the last of four instalments of a paper describing the establishment, as the result of war exigencies, of a new industry in Canada. Previous instalments appeared in the April, May and June issues.

ABRASIVES

In many of the preceding descriptions of production methods for optics, mention has been made of abrasives of various kinds. Because of the great amount of confusion existing as to materials and grain sizes, some further elaboration of this subject appears advisable.

There are three main factors governing the selection and usefulness of abrasives: type of material and cost, grain size, and uniformity. These factors and their interacting effects will now be discussed in that order, ignoring at first the aspect of availability.

MATERIALS

The basic abrasive materials used at present in optical work are, in order of decreasing hardness: diamond dust, boron carbide, silicon carbide, aluminum oxide, and garnet.

Because of its high cost, diamond dust is never used loose, but embedded in steel, copper, or synthetic resin wheels in a manner which has already been sufficiently described.

Boron carbide is a recent synthetic material of hardness next to diamond. Its optical use so far appears to have been confined to roughing work and it remains to be seen to what extent it may later replace the much cheaper and more common abrasives.

Silicon carbide or carborundum is a very hard, fast-cutting abrasive used in bonded abrasive wheels and for roughing work. The hardness and sharpness of its crystals make it unsuitable for use in powder form for fine grinding, as it will not break down readily enough. It should not be confused with corundum.

Aluminum oxide is the best abrasive for medium and fine grinding. It is available in a number of natural and synthetic forms under many different names. The impure natural form is known as emery and less impure forms as corundum. The synthetic aluminum oxides are best-known as Aloxite or Alundum and these are the most satisfactory types for all but roughing use. Another synthetic variety, developed by the British Scientific Instrument Research Association and marketed as Sira, is slightly harder and coarser than the others, and although fast, is less useful because of the poorer finish obtained.

Abrasives made from garnet, an impure iron, magnesium and aluminum silicate, first became available in optical grades during 1943. Garnet is slightly softer than aluminum oxide, and we used it in large quantities as a substitute for the latter, especially in the fine grinding sizes. At first it was thought that the decreased hardness would be advantageous in producing finer finishes, but later experience showed that it breaks down too fast and before sufficient glass has been removed, making it slower and giving a finish which appears better than it really is. This behaviour and somewhat higher cost make it unlikely that it will continue in permanent use in the optical field.

GRAIN SIZES:

If confusion exists in regard to abrasive materials, then chaos is the only word to apply to conditions in regard to grain size: for there is as yet no nomenclature common to all manufacturers, with the result that each concern uses different numbers or letters — some based on mesh size, some on micron size, and some just arbitrary—to designate equivalent materials. In the coarse abrasives the use of mesh sizes is fairly general; in the medium and fine abrasives one must simply attempt to memorize what each manufacturer's terminology means. For that reason, micron sizes have been used throughout this article, a usage which one may hope will ultimately become general.

The desirable number of grain sizes of loose abrasives for production use appears to be eight, and to clarify the nomenclature used herein and co-relate it with general usage elsewhere, these sizes are listed with their equivalent mesh sizes and recommended materials in the table below:

Recommended Use	*Approx. Micron Size*	*Mesh Size*	*Recommended Material*
Rough Grinding	177	80	Silicon Carbide
	125	120	Silicon Carbide
	65	220	Silicon Carbide
Medium Grinding	31	500*	Aluminum Oxide
	22½	700*	Aluminum Oxide
Fine Grinding	18	850*	Aluminum Oxide
	12½	1200*	Aluminum Oxide
	9½	1600*	Aluminum Oxide

The mesh sizes marked with asterisks are approximate extrapolated values, since 400 mesh is about the finest screen size commercially used. For hand polishing use, abrasives down to 6 microns (2,600 mesh) are valuable in reducing polishing time. They are too fine for machine use.

UNIFORMITY

The average particle size is not in itself sufficient to determine the usefulness of an abrasive. The distribution of particle sizes about the mean, that is, the uniformity of grading of the material, is a most important factor. The presence of even a very few coarse particles in a fine abrasive will render it useless by causing scratches. On the other hand, the presence of any substantial proportion (say 20 per cent) of particles much finer than the average will mean that this fine material is rendered inactive by the coarser particles which separate the work and the grinding surfaces, and will result in slower and more wasteful grinding. The perfect abrasive should have all grains of equal size. It is this factor of uniformity which principally governs the choice between equivalent abrasives of different manufacture, and any future standardization should fully specify distribution in each grade.

AVAILABILITY

During the years 1942 and 1943 in particular, acute and sometimes critical shortages existed in Canada of loose abrasives in the medium and fine grades. During this time serious consideration was given to the feasibility of installing our own facilities for producing these materials. Had we done so, we would have used a ball mill, purchased coarse aluminum oxide, ground it and separated it by elutriation and sedimentation. Our consumption of abrasives towards the end of 1943 reached very high monthly figures: 8000 lb. of coarse, 7500 lb. of medium, and 2000 lb. of fine materials of all types. Investigation revealed, however, that a large capital expenditure and considerable experimental work would have been necessary to produce these quantities, and we therefore confined our efforts to salvaging for re-use abrasives which collected in the drainage sumps.

Salvage operations were begun late in 1942 after the necessary experimental work had developed suitable methods. The coarse grades are relatively easily reclaimed by first mixing to a slurry and straining to remove garbage, rough grading by sedimentation, followed by thorough drying and screening. Material finer than 220 mesh passes through the screens and is segregated by elutriation, down to an average particle size of 26 microns. The presence of fine ground glasses of specific gravities very close to that of the abrasives themselves makes separation of effective grades of fine abrasives a more difficult problem, solution of which was not attempted because of the expense involved. In total about 100,000 lb. of mixed material was reclaimed, of which less than 25 per cent was in the scarce medium sizes. The cost of the salvaged abrasives was substantially less than new material in the coarse grades, and about equal in the medium grades. Due to the inclusion of ground glass, however, these were perhaps 70 per cent as effective as new material. The operation was therefore a marginal one, and was abandoned in 1944 as supplies became increasingly available.

The Development and Use of Ceria

The main advantages in using ceria for glass polishing have already been mentioned under Lens Polishing. This is a development of sufficient importance to justify further description, as it has now virtually supplanted rouge everywhere in precision optical work.

Ceria appears to have been in use in France and Germany some time earlier than 1936, when Dévé[1] mentions it very briefly as *rose à polir*. Our attention was directed to it by our Austrian optical technician who had seen it used in Austrian and German plants, and had unavailingly advocated its trial in optical firms in England. As far as is known, ceria was used nowhere in the English-speaking countries until our own use of it in the summer of 1941. Early experimental work on methods of production was carried out by Mr. C. A. West in the Optical Department, and he was the first to establish the heat treatment required to produce an acceptable material. This heat treatment, as we have subsequently learnt, is a necessity with all metallic oxides used for polishing and depends on the little-known property of a change of crystalline structure at temperatures close to the fusion point. Early work employed a very pure grade of ceria made by igniting the double nitrate of ammonium and cerium, and is fully described by Mr. West in his interesting article on the subject[2]. Tests then indicated that heat treatment of the oxide at a temperature of 2050 deg. F. gave the best results, and established the usable range as between 2250 and 1900 deg. F., with increasing hardness as the temperature was raised. The softer grades are useful on extra dense flint glasses, which scratch very readily, while the harder ones give the shortest possible polishing time with the hard crown glasses. It was established by the preliminary work that polishing times with properly prepared ceria were from ½ to 2/3 those with rouge, and full-scale use was therefore decided upon.

Failure to obtain satisfactory grades of ceria from chemical manufacturers in Canada and the United States obliged us to undertake its production ourselves. As use of the double nitrate resulted in a material costing at least $25.00 per lb., the chemical laboratory under H. M. Davis developed a method, using crude cerium hydroxide as the raw material[3], which reduced costs some ten times, and was producing ceria in sufficient quantities for all our own requirements by early in 1942.

Ceria varies in colour from white or pale yellow for the purest grades to pink or dark brown for those commercially used. The colour gives no positive indication whatever as to efficacy, as the impurities may be other rare earth oxides with similar or even superior polishing properties. The fineness of the ceria varies with the method of preparation, and seems to have no bearing on polishing time. All that is necessary is removal of coarse aggregates by screening through a 150 mesh sieve.

Our results with ceria were communicated to Frankford Arsenal in Philadelphia and led before long to its wholesale adoption by the American optical industry. Samples were also supplied to British firms through the British Scientific Instruments Research Association and resulted eventually in an order for a very large quantity from the Ministry of Supply in England, for distribution throughout the United Kingdom. To meet this requirement, we raised our production rate to 4000 lb. per month, although our own use required barely one tenth of this amount.

The introduction of ceria into general use was the direct result of our efforts and was of considerable importance in speeding the output of military optical instruments in the allied countries.

Production Operating Conditions

Little or nothing has so far been said about conditions of temperature, dust and humidity control, yet these and similar factors have an important bearing on most of the operations already described.

Until the last twenty years or so, air-conditioning was virtually non-existent, so that it can hardly be said to be essential to the production of optics. Yet there are so many advantages in using air-conditioning that it was adopted at the outset in the main polishing shop, which was provided with full temperature and humidity control, together with electrostatic dust removal and monochromatic lighting.

Temperature control is especially helpful in machine and hand polishing, as otherwise blocking and polishing pitches must be constantly changed to suit varying indoor temperatures which can thus easily cause considerable loss of production. In the more delicate polishing work, temperature fluctuations can introduce distortions which may seriously affect surface accuracy. We found a constant temperature of 76-80 deg. F. gave the best results with our pitches.

Humidity control is less important than temperature control, but is an aid in all glass cleaning operations, especially those incidental to contact blocking, cementing and high vacuum evaporation. Glass cannot be effectively cleaned under widely fluctuating humidity conditions, apparently owing to imperfectly-understood effects connected with the inward and outward flow of water vapour and migration of alkali ions through what may be a colloidal silica film on the polished glass surface. Furthermore, extremely low relative humidities—below 25 per cent—are common in Canada in wintertime, and result in electrostatic charging of the glass during cleaning, causing attraction and retention of dust particles. Humidities over 60 per cent on the other hand, if the temperature is much over 72 deg. F., cause trouble with fogging which results from perspiration from the hands of operators. Humidity control is also valuable in polishing, as with low humidities the blocks dry up too fast. A constant relative humidity between 40 and 45 per cent gives good results throughout.

The value of dust control is sufficiently obvious to require but little elaboration. Cementing and polishing, especially of graticule surfaces, benefit most from dust control. In addition to removal of dust from the air, it is advantageous to have a linoleum floor as this also prevents breakage of test glasses and valuable optics if accidentally dropped. We never found it necessary to resort to special footwear and lint-free clothing. It is doubtful if the possible savings would be worth the trouble.

Avoidance of draughts is most important and seems to be a difficult problem in air-conditioned rooms with a high rate of air change. Draughts directly over polishing spindles not only cause scratches from dust, they also

[1] C. Dévé—Le Travail des Verres d'Optique de Précision (Paris, 1936: *Revue d'Optique théorique et instrumentale*).
[2] C. A. West—Ceria for Glass Polishing (*Canadian Chemistry and Process Industries*, Jan. 1944).
[3] H. M. Davis and R. M. Wayman—Ceria Polish (*Canadian Chemistry and Process Industries*, Apr. 1945).

introduce distortions through evaporative cooling, making production of precision surfaces impossible. The cooling effect may at the same time harden the pitch and further increase the tendency to scratching.

Special monochromatic lighting by Cooper-Hewitt mercury-vapour lights or other suitable means is very helpful in all polishing operations, as interference fringes are much more readily visible under such lighting.

Growth and Efficiency of Production

In the preceding passages an attempt has been made to outline what were the manufacturing problems involved, and what methods were adopted for their solution. In this final section it is proposed to trace the growth of production up to its peak and mention some of the less tangible, but equally real, factors affecting efficiency and volume of output.

production attainments

The original allotment of space for the grinding and polishing departments was made on what appeared at the time to be a very generous basis, and equipment was provided with capacity far in excess of any orders actually received in the early stages, even with one-shift operation. It was fortunate that this was so, because the trend of the war between 1941 and 1942 resulted in tremendously increased orders for many different kinds of optical instruments. In three separate programmes involving tank and anti-tank fire-control equipment the original requirements were increased as much as tenfold. Towards the middle of 1942 the first orders were also received for two different sizes of binoculars and before long these orders were so increased as to constitute the largest single item of manufacture. By the end of 1942 outside orders for optics, particularly for naval sighting telescopes and computing reflector sights, began to assume important proportions. Then in 1943 orders from the United States led to a four-fold increase in the short-base rangefinder programme and faced us with what was probably the hardest of all our problems, the production of these difficult optics in quantities unsurpassed in any of the allied countries. Not all these requirements were superimposed one on the other, yet the resultant was such that the peak of production was not reached until near the middle of 1944. It is rather hard to give any single figure which adequately presents the combined output of lenses, windows, graticules and prisms for the varying distribution of requirements for optics with varying degrees of intricacy, yet an attempt has been made to convey some idea of this in the graph in Fig. 32. This shows the manner in which production increased, in terms of the production rate at the end of the first year of operation, in March 1942. A glance at this output chart will show that production increased to its peak more rapidly from 1943 onwards, and that such recessions as did occur were invariably *pour mieux sauter*. The maximum production, representing approximately a nine-fold increase in slightly over three years, may be visualized as 95 per cent composed of a *monthly* output of optics for some 7,000 pairs of binoculars, 500 short-base rangefinders, 2,000 assorted sighting telescopes, panoramic sights, directors, etc., and the remaining 5 per cent of much smaller numbers of more intricate optics such as those for the larger base-length rangefinders. It is doubtful if this output was exceeded anywhere except by one or two of the larger United States firms.

During this period of growth we were short, at various times, of glass, machine capacity, operating supplies and labour—sometimes all at once. Glass shortages were mainly in the types most difficult to make: the extra dense flints, dense barium crowns, and first quality borosilicate crowns for use in prisms. Limitations in lens grinding capacity occurred at the end of 1942, before lens milling equipment was available to replace hand methods. In operating supplies there were shortages of blocking and polishing pitches, rosin, sealing wax, hydrofluoric acid, carnauba wax and ceria. The really critical shortage, however, was in the medium and fine abrasives during the years 1942 and 1943. These shortages frequently compelled us to use inferior materials, or materials not of the best grain size, and certainly resulted in some loss of production due to slower polishing times, increased amount of reprocess work, and increased rejects. The exact amount of lost production would be difficult to assess, but during certain times was probably not less than 20 or 25 per cent. Short-handedness was a chronic condition throughout and was equally severe with male and female workers, especially for night shift work.

Another limiting factor was the shortage of engraved graticules up to the end of 1942. As already mentioned, had it not been possible during this time to obtain photo-etched graticules from a subcontractor, a very serious condition would have developed. Even so, the succession of rapid expansions was continually taxing engraving capacity as well as our own capacity to produce the polished graticule blanks in large enough quantities. In spite of everything, however, in very few cases was instrument production limited by the supply of optics. The supply of subcontracted and machined metal parts was a much more frequent limitation.

expansion of capacity

Up to March 1942, increases in production of optics were obtained first by gradually building up personnel from the nucleus earlier mentioned, then by progressively increasing night-shift operation in all departments. Full-scale adoption of ceria for polishing at about this time came close to doubling polishing capacity. From that point until 1944, the steadily mounting requirements were met by successive expansions in the polishing shop, ultimately doubling the number of lens and planar polishing spindles. This additional equipment was mainly made to designs of our own which combined the best features of existing equipment and incorporated numerous improvements. With the increased binocular requirements, it was decided to set up a separate self-contained department for the production of binocular optics. Considerations of space made it necessary to locate this in a different building some distance away from the main shops. This department reached peak production in the first two months of 1944, but was reabsorbed into the main shops shortly thereafter, when increased production efficiency and contract terminations freed sufficient capacity to make this possible. We were glad to be able to do this, for the supervisory and administrative difficulties of running this separate optical department on a large scale at some distance

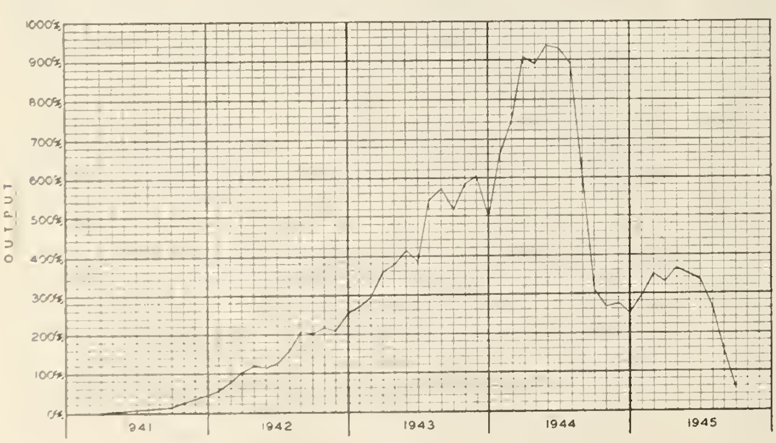

Fig. 32—Production chart.

away were very considerable. Early in 1943, the increased rangefinder requirements necessitated a large-scale rearrangement of the main polishing shop to provide additional planar polishing capacity. In the grinding shop, only one increase in floor-space was necessary, and the successive increases in production were met mainly by improvements in production methods, with milling superseding hand grinding both in lens and planar work, as the necessary equipment was designed and built, or purchased. Methods reached substantially their final form by the end of 1943, and from then on increases were the result of increased production efficiency.

PERSONNEL FACTORS

This growth of production capacity was of course parallelled by a growth in personnel. The number of employees in grinding, polishing, and auxiliary operations rose quite uniformly to a peak of 1,007 in January 1944. The maximum production was obtained some five months later, when the total number of employees in these departments had dropped to 840. This condition was the natural outcome of increased proficiency, application of improved methods, and incentive bonus.

There were two main personnel problems during this period of expansion: training of employees themselves, and the selection and training of supervisory personnel. As ours was an entirely new industry in Canada, we were placed in a different position from most other firms, in that we were able to hire almost no skilled labour. Such skilled labour as we did obtain was from the spectacle trade and although its techniques are different in many respects, the assistance thus furnished was not entirely negligible. For the most part it was simply a matter of selecting the employees who seemed best fitted for particular operations, and training them, while the main nucleus of already-trained personnel acquired skill and experience through practice on the particular groups of operations they had been taught. These employees then assumed supervisory positions and instructed others in their skills.

Contrary to the general impression, machine polishing is not an exceptionally difficult operation: an operator of good ability, with proper instruction, can polish the most difficult planar surface after 18 months' to two years' experience. With lens polishing, after one year's experience a good man should be able to handle most lens blocks. Girls can be trained to polish a particular size and kind of block within four or five months. The more difficult hand-polishing operations require several years of experience, but the simpler ones can be learnt within six months. Proficiency in centering and cementing takes normally at least as long to acquire, and the latter operation in particular is one requiring special capabilities which only one operator in two or three possesses. This, and the exacting nature of the work, result in high turn-over. In the grinding shop, there are few, if any, jobs that cannot be picked up within 18 months, and for the majority six months or less is sufficient. The times mentioned in all cases are those after which the individuals may work entirely on their own: it is of course to be understood that, almost invariably, additional experience results in increased proficiency and speed.

The effectiveness of the supervisory staff was greatly enhanced by a very complete, plant-wide, foreman's training plan, instituted during 1942, and operated continuously thereafter. This provided much-needed guidance on the psychological factors involved in handling people, and was supplemented by instruction on Company administrative procedures.

We found that, usually, groups of female employees worked best under male supervision. Other things apart, women seem averse to taking orders from their own sex.

The proportion of male to female employees averaged exactly 50 per cent during the period of highest output, but varied very considerably from operation to operation. In general, the skilled operations were left in the hands of men, and women used for semi-skilled or unskilled work of a repetitive nature. Thus, in the grinding shop, all the hand work of a difficult or arduous type was done by men, and women used for operating lens milling machines or on simple jobs like cleaning and bevelling. Women were found to be satisfactory for lens polishing only on the easiest work, involving a particular size and kind of block; even so, they are physiologically unsuited for this type of operation, involving, as it usually does, continuous standing and walking throughout the shift. As a result, labour turnover was far too high, when women were used on such work. In the binocular optics shop, nevertheless, female employees were 70 per cent of the total. In the operations of cleaning, centering, and cementing, women were used exclusively. Inspection, except prism inspection, was likewise all done by women. The critical man-power shortages in 1943 and 1944 also compelled us to use women for the simpler hand-polishing operations, in which they proved entirely satisfactory. The same can be said of their performance elsewhere: in most of the places where they were used under wartime conditions they could equally be used in peacetime.

Increased absenteeism and uncertain attendance were the greatest disadvantages with women, and much of this was owing to the wartime employment of women with domestic responsibilities who were unable to make proper arrangements for looking after their children.

During the periods of most critical labour shortage, we engaged a number of part-time women workers. As a group, these proved even less reliable than the others and we were glad when conditions made it possible to eliminate part-time work entirely.

The problem of military call-ups and deferments was a harassing one throughout. Especially during 1941 and 1942, the undefined government policy meant that men hired from an age group not then subject to call were called up four or five months later, just at the time when they were trained to the point of usefulness. In a period of rapidly-expanding production, this was particularly inconvenient. Yet the deferment policy in regard to fully trained men, especially those who would take a year or more to replace, was eminently reasonable, and appears to have been planned with more consideration for industrial problems than in the United States.

WORKING HOURS AND NIGHT-SHIFT PROBLEMS

For most of the first year of operation, under pressure of urgent need, working hours of 60 or more per week were adopted on both shifts. After a while this resulted in such manifest inefficiency that day-shift hours were dropped to 55½ (5½ 10-hour days) while night-shift hours remained at 60 (5 12-hour nights) mainly because this greatly facilitated overlapping of shifts, a matter of some importance with the high dilution of skill which then existed. The early start of the night-shift also made things easier for those of us who were obliged to maintain close contact with both shifts. This arrangement, furthermore, was approved by the majority of the night-shift workers themselves.

The polishing of lenses on two shifts introduced a peculiar problem. The length of polishing time of most blocks was such that at the end of the day-shift there were many blocks partially-finished still on the spindles. Normally, one might have expected the night-shift operators simply to have taken these over and finished them up. But unfortunately, all polishing is very much an individual matter of machine settings, and one where each operator has his own preferences. Unless operators on both shifts use identical techniques, different fine grinding curves are required for each, for quick polishing. As a result, after several fruitless attempts, we had to abandon trying to run the same work continuously through both shifts, and were obliged to segregate entirely the work done by each shift. While this caused some loss in efficiency, at least it separated responsibility for faulty work. In prism polishing the same result came about from a different cause: here, the shortage of skill obliged us to concentrate the difficult work on the day-shift, leaving the easier work to be done at night. In the binocular optics shop, however, the relative simplicity of the work made standardization of grinding tools and polishing techniques a much easier matter, and we were able to operate straight through both on lens and planar work very successfully.

Hoarding by each shift of scarce abrasives and other materials of variable quality was another constant source of trouble. This is best exemplified by an occurrence in which a day shift operator polished a group of lens blocks for two hours or more using a small jar of special ceria accidentally left out by the night-shift. It was only when polishing seemed abnormally slow that the foreman investigated and found he was trying to polish with cocoa, which is deceptively similar in appearance, but quite dissimilar in polishing properties.

Shortage of man-power and shortage of skilled supervision made the adoption of 3-shift operation impracticable, apart from other considerations.

During 1943 and 1944 the progressive installation of incentive bonus systems made the inefficiency of long working hours very apparent and permitted successive reductions without any diminution either of individual earnings or output. In fact, with the final working week of 46¼ hours on days and 5 9-hour nights, the output per operator per week was about 20 per cent higher than previously. Some portion of this improvement was of course due to increased proficiency with time, and to improved methods.

INSPECTION STANDARDS

There are few factors which so closely affect volume and cost of output of optics as inspection standards, and few less tangible. This is not true of gauged and measured dimensions such as sizes, diameters, and angles, which can be exactly specified on the blueprint and are either within tolerance or not; but it does apply to surface quality standards — scratches, pits, and degree of polish — and to similarly hard-to-define defects such as bubbles and striæ. When is a scratch not a scratch, but a ‘ score ’ or a ‘ sleek ’? When does a ‘ bubble ’ become a ‘ seed ’, and what constitutes ‘ objectionable ’ striæ? These problems of definition are further complicated by the fact that such defects may be permissible in greater degree at the outer edges of a surface than at the centre, and again by the fact that altogether different standards apply to optics depending on their function and position in the optical train, and even between parts of identical function and position in different instruments — as, for example, graticules, which in one instrument are viewed with a magnification of four times, and in another at fourteen times. It is hardly possible in an article of this scope to do more than indicate the existence of these problems. The solution of them was never more than partial, and was attempted in two ways: first, by specifying inspection conditions in such a way as to limit the visibility of many of these defects by defining the type of lighting used, and degree of magnification, if any, to be used in looking for them; second, by grouping together optics where the same standards applied — such as objective lenses, eye-lenses, and field lenses — and attempting to define, through discussion and mutual agreement, the surface and other standards applicable to each group. Other optics were treated according to their individual requirements.

Superimposed on these intrinsic difficulties was the equally difficult problem of co-ordinating such inspection standards between three, and sometimes four, different inspection groups, each operating under different control. First there was the Inspection Board of the United Kingdom and Canada, or the British Admiralty Technical Mission Inspection, either of which examined the optics in finished instruments, and whose standards had to be met. Secondly, there was our own Final Inspection Department, operated under our own, but separate, control and passing only optics considered fit for assembly. Third, there was floor inspection in the optical shops, which was found by experience to operate most satisfactorily under production authority. Lastly, in certain instruments supplied to the U.S. Government, there was U.S. Ordnance Inspection which inspected finished instruments after acceptance by the I.B.U.K. and was fully empowered to reject them for optical defects—and frequently did.

The summation of these difficulties may be better imagined than described. It resulted in an unending series of controversies in which the final authority—I.B.U.K. or U.S. Ordnance—invariably won. In many cases, we disagreed with the standards imposed, as undue importance seemed to be attached to ‘ beauty ’ defects — defects which, while visible to experienced inspectors under especially favourable conditions, would almost certainly be invisible to the user, and in any event had no bearing on performance. Scratches on objective lenses, small pits in field lenses, and minute pits in graticules are examples of this class of defect. Argument on these matters was equally prevalent between our own production and final inspection groups, but the decisions finally reached were always governed ultimately by what Ordnance Inspection would accept.

The importance of these standards was such that, in several cases, output and cost could be virtually halved or doubled by a change in surface quality requirements. There is therefore an urgent need for clearer definition of all the less tangible causes for rejection. Such standardization, if based on performance rather than appearance under close scrutiny, could very materially reduce costs. The standards which eventually crystallized certainly tended to become no less severe as the skill of the inspectors increased, and from comparison of work produced in Britain and the United States with our own, it may be stated that our standards appeared to be higher than either—that is, in general, needlessly high. Appreciation of this condition is a prerequisite to the discussion on operational losses which follows.

OPERATIONAL LOSSES AND PRODUCTION CONTROL

In any large-scale manufacturing operation, some form of production control is essential, in order to regulate the flow of work through the various operations, permit forecasting of raw material requirements, control the quantities in process, and schedule deliveries so as to meet assembly or shipping requirements. There are probably few industries where production control is attended by the same difficulties as in the manufacture of optics, where losses in successive operations may be so high that only two pieces out of three started, or in extreme cases one in six, are shipped out in finished instruments. Since losses are so much higher than, for example, in machined parts, an exact knowledge of losses at each operation for each piece is all the more necessary before any proper production control may be exercised.

Knowledge of losses is readily obtained from production records, which are so arranged as to record the number of permanent rejects occurring at each major stage of processing. The major stages differ from piece to piece, but are most simply broken down into grinding, polishing, fluoride-coating, centering, cementing, engraving, and assembly. The grinding and polishing stages may be further broken down if the volume is very large, but this adds to the complication.

It is not intended to give here any detailed figures on operational losses. To the non-specialist they would be of little interest; to the specialist they might either appear too low, and be questioned, or too high, and be derided. Such figures, in any event, have little meaning without the fullest knowledge of inspection standards. A few general remarks may, however, be of interest.

With lenses, the losses are roughly equally divided between grinding, polishing, and centering; with fluoride-coating, cementing and assembly losses all about equal and on a much smaller scale. All losses are higher in flint components, and higher with eye-lens flints than objective flints owing to steeper curves and higher surface standards. Field lenses of eyepieces, with standards second only to graticules, have the highest polishing and assembly losses. Grinding losses tend to be high for moulding flaws and similar defects, since the cost of the mouldings makes it worth while taking chances on whether or not such defects may be milled or ground out. With windows and filters having no extremely close tolerance on parallelism, losses are somewhat less than for lenses. With graticules, losses in polishing, engraving, and assembly are all higher than with lenses and on these parts it is not uncommon to have to start three or more for each finished piece assembled and shipped.

With prisms, grinding losses are slightly higher, and polishing losses somewhat lower, than for lenses. Cementing losses, especially on prisms with focal plane surfaces, may be substantially higher than for lenses. In spite of this, it is a significant fact that overall losses, even for intricate prisms, may be less than for simple lenses. This is an index of the importance to be attached to handling care: valuable prisms are only entrusted to skilled operators, whose careful handling produces this anomalous result.

We found that the most effective form of production control for all high-volume work was by means of large boards on which the cumulative total of pieces passed through each major operation for each part was represented in graph form by movable coloured markers sliding along horizontal cords. The cumulative figures plotted were not the actual number of pieces, but the number of instruments which could be assembled with this quantity, taking into consideration anticipated losses in all subsequent stages. This reduced everything to a common denominator, and enabled one to tell at a glance how close each part was to completion, which part was most behind and at what stage, and how deliveries to Finished Parts Stores stood in relation to instrument assembly requirements and to each other, while the difference in the position of the markers between successive operations indicated the amount of work in process or in stock between stages, in terms of finished instrument requirements. The daily and weekly reports necessary to compile this information required considerable bookkeeping and calculation, but in spite of this, the total numbers of clerical an other non-productive personnel such as chasers and truckers, were kept between six and seven per cent of total employees.

This method of production control was used to furnish the grinding and polishing shops with a monthly forecast showing the numbers, both gross and net, of each part required to pass through each major operation. Losses for this purpose were revised monthly, using, as a guide only, the average for each preceding four-month period. The glass-making department was also supplied each month with a schedule showing for each part the number required monthly during the four subsequent months, and the balance to be delivered to complete the contract. This planning work required considerable judgment and a detailed knowledge of manufacturing processes, since it was complicated by changes in methods, changes in losses (often due to changes in inspection standards), and changes to contracts.

The above information on operating losses is used in conjunction with time studies for any calculations involving processing capacity—particularly where polishing capacity is concerned. Here it is also necessary to know the amount of internal reprocess which occurs, as capacity must be provided for handling this as well as replacing permanent rejects. Our methods of routing the work in polishing and elsewhere were based on a minimum number of transfers back to the stock-room, as in this way both storage-space and handling is reduced to a minimum. In the polishing shop, therefore, we made a practice of issuing work to the floor and wherever possible leaving it in process until all sides had been polished, although with certain lenses it is more convenient to separate first and second sides. Our records, as a result, did not reveal the amount of internal re-processing in polishing, but for the purpose of polishing capacity calculations, a figure of 30 per cent appears to be adequate to cover both this and re-reprocess work. Control on re-processing appears to be best exercised by controlling the amount of work in process, which is readily done by means of the system described.

Conclusion

In the light of the manufacturing problems—technical and otherwise—which I have attempted to set out in this article, the results achieved may be assessed at their true worth, and are perhaps best left to speak for themselves.

The quantity production of a variety of optics of the types described is essentially a wartime problem, and one which I have endeavoured to outline in such a way as to supply to fellow-engineers an up-to-date and comprehensive picture which neither over- nor under-states the difficulties involved. If this purpose has been achieved, the facts and production data given here may also serve as a rough guide to whoever may be concerned in the unfortunate event of a recurrence of the same problem. This treatment of the subject may also aid in stripping away some of the prevalent misconceptions as to the extent of the difficulties; for the processing of optics has in recent years changed from an art to a science, and the methods now being used are almost as much subject to exact control as the production of machined metal parts, and, indeed, owe much to machine shop practice.

It seems unlikely that there will be any radical changes in polishing techniques for high-precision work, although the day is within sight when low-precision lenses may be made from moulding to polished lens on a single machine. Automatic polishing machines which generate the spherical surface in a manner similar to inclined cutter lens milling machines are already on the market. It is also to be expected that the considerable amount of work now being done on the surface chemistry and physics of polished glass surfaces will eventually bear fruit in improved quality and reduced manufacturing costs.

ACKNOWLEDGMENT

I should like to acknowledge with gratitude the assistance furnished in preparing this article by all members of the optical department staff, and particularly by Dr. D. C. Jones, under whose direction the work described was carried out, and to whom, more than any other single individual, should go credit for the results achieved.

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COMMUNITY PLANNING IN THE RECONSTRUCTION PERIOD

RIGHT HONOURABLE C. D. HOWE, Hon.M.E.I.C.

An address delivered to a conference of provincial planning officials and technical experts, Ottawa, June 25th, 1946.

I should like, first of all, on behalf of the Government of Canada, to welcome you to this conference on Community Planning. In the years ahead we shall all be working together toward common goals in terms of the welfare of Canadian communities. The most effective ways and means of working together—spread as we are across a continent—will only be developed by a systematic pooling of our administrative and technical experience.

During our discussions here, and in our work after we get back to our own offices, I think we would do well to keep in mind how planning fits into the broader picture of the development of this country. I think you will agree with me that community planning has an important place in the achievement of high levels of employment and social security which we are pledged to maintain. We all want conditions of welfare worthy of the rich natural wealth that is ours as Canadians.

We are familiar with the techniques for developing our resources of forest, field and mine. We begin with surveys and analyses to find out the best ways of using the wealth we are given. The same is true when we come to the development of the resources embodied in our communities. The first need is for accurate topographic and population surveys, to find what we have; then we need fully studied and understood principles by which to proceed from the existing condition to the one that is wanted.

I think we may have lost track of what is the existing condition of our cities, towns and economic regions. Our development of industry and transport has been so rapid under the pressure of war that we have just begun to notice how that development has affected our communities—both urban and rural. We know from the census that, half a century ago, there were twice as many Canadians living outside the towns as in them; while now there are more living in towns than out. This shift to the towns was accelerated by the war. From 1940 to 1942 our larger cities grew three times as much as they had grown over the previous ten years. The rate at which goods were turned out in those cities probably doubled during the war; the army of industrial workers in the cities and towns increased by about 50 per cent.; while the productive capacity of the factories and works in our communities was correspondingly raised.

Now it may be said that this shift was abnormal, and should not be given too much weight in community planning. But there are three things about this change that I think planners must consider. First, many of the people who have moved to urban centres and acquired industrial skills want to stay there. Second, the problems in civic administration which wartime developments have rendered acute are in many cases continuing problems, not new ones; they may require more urgent and drastic treatment because they were intensified by the war, but they needed treatment anyway. Third, there is no denying that we now have an enlarged supply of modern and efficient plant and skills at our disposal in Canada, and that the intelligent course in the national interest is to make the best use of these community resources. To realize the highest possible standards of living, Canadians must employ what we have in the most efficient way—and the most efficient employment of our people and our resources is increasingly dependent on the efficiency and amenities of the communities where we live, and the routes connecting those communities.

One part of the problem of community development that is particularly urgent at present is the extension of local improvements, utilities and services. The war has made deferment of local improvements necessary to the point where a substantial back-log of work has to be done. I do not need to enlarge on the obvious fact that the layout of these surfaces, pipes and wires out-of-doors has a bearing on the overall efficiency of our industry and housing, just as surely as good design of their counterparts indoors affects efficiency. The reconstruction period, in which we are bound to undertake these improvements on a large scale, provides an opportunity that we may not be offered again to enhance the efficiency of this part of the national plant.

The job of improving the physical plant belonging to our own communities, and to the citizens in and around those communities, is one that we must do as Canadians for ourselves. Obviously the carrying out of community plans may be affected one way or the other by uncertainties in international trade and sentiment. But the decision as to whether we are to develop good communities is ours as Canadians—and ours alone. It is a decision which the citizens of every Canadian community must make on their own, and must act upon, without delay.

Modest outlay on community and regional surveys and plans, now, will make for better health and welfare for all time to come. Viewed in this light, planning is probably one of the least expensive kinds of social security. The security of every man's home and family against unnecessary dirt, noise, traffic and taxes is certainly a kind of social security that merits more attention than it has been given.

We are all morally pledged to maintain in this country high and stable levels of employment and income. To maintain those high levels, the various governments have in mind the undertaking of various kinds of developmental works, to be begun at the time at which they will be most effective in maintaining national objectives. Many of these developments—not only public buildings, but also utilities, harbour works, roads and facilities for pleasant touring and recreation—will materially affect the physical shape of our communities. I have not mentioned publicly-aided housing, because I understand that you will discuss that in relation to community planning in greater detail a little later; but the same statement may be made of all these public or publicly-aided developments: They cannot proceed in a healthy way, and be most effective in affording continuous employment and service, until the authorities of every populated area in Canada have studied the desirable physical shape of their community, and the desirable locations and directions of needed developments and improvements. Make no mistake about this.

The federal government is prepared to do what it can to maintain high and stable levels of employment. Among the many things the federal government has in mind to accomplish this aim, is to offer—as we have done in the proposals placed before the Dominion-Provincial Conference—inducements to the co-ordinated timing and placing of local developments. But the federal government cannot alone do the job.

Local government must fulfill its responsibility, in establishing needs and finding locations for the developments in the community or region it serves. In other words, to maintain employment and income levels, as well as to provide for the healthy building and rebuilding of the places where we live, we must have carefully prepared community plans. Also we must have competent personnel and clean-cut legislation at local levels to give our community plans adequate and continuing effect.

I would say that this conference already has made a beginning, in that we have met together, and come to know personally the men in other provinces and other groups whose efforts may be of use to us in our planning work—and who may from time to time be able to profit by whatever we may learn in this field. Personal acquaintanceship with our colleagues in Community Planning is, I am sure, to be only one of the achievements of this Conference. It is however important, especially in Canada, because when we know each other, these first-hand contacts lubricate the vehicles we shall set up to carry a continuous flow of ideas and experience between the working groups across the country.

The problems that arise in developing interest locally in the preparation of community plans, and in gaining endorsation for the execution of those plans, when they have been prepared, are yours to consider, at this conference and during the months and years ahead. I am confident that Canada will measure up to this situation as worthily as she has met and surmounted challenging situations in the past.

WARTIME PRODUCTION OF PRECISION OPTICS IN CANADA

(Continued from page 427)

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A PROVINCIAL DIVISION FOR ONTARIO

Recently the corporate members in Ontario have been canvassed, under instructions of Council, to see if they desired a provincial division. Such a division has been provided for in the by-laws with the intention that any matters of importance, that were related specifically to branches in one province, could be handled entirely by the members in that province. In other words, it was to provide a full degree of autonomy for any province that felt it could use it to advantage.

In this instance, the Ontario councillors had recommended a division so they might have an organization to investigate and, if desirable, carry out certain proposals made by themselves. Council agreed unanimously to canvass the members, as is required by the by-law, and at the time of writing, almost enough replies have been received to give the necessary fifty per cent support.

It has come to the attention of Council that some members have thought the proposal looked like a sign of separatism, which they did not wish to support. This is far from the intention, and it is not expected the division will develop along that line. There have been provincial divisions before for specific objectives—one in Ontario and one in Quebec. Each was set up to provide a provincial body to assist in securing legislation to control the practice of engineering within the province. In Quebec it was the members of the provincial division that constituted the original membership of the Corporation of Professional Engineers of Quebec. Both divisions were dissolved when their objectives were accomplished.

If you have not returned the post card provided by Council, please do so now. It is not too late, and it is desirable that the proposal have the full support of all members. If your card is misplaced, a letter or other form, which indicates your support of the proposal, will be accepted.

COMMUNITY PLANNING ASSOCIATION OF CANADA

Under this title an organization was planned at Ottawa on June 26th. It was the outcome of a two-day conference held under the auspices of the Central Mortgage & Housing Corporation to which were invited representatives of all provincial governments and certain other organizations, to the number of forty.

The invitation stated " the object of this conference is to establish an organization that will foster, and be a channel for, the propagation of information on community planning as well as the routine and technique of ensuring unity of purpose by government at all levels, and other groups interested in this important work ".

The conference was opened by the Right Honourable C. D. Howe, Hon.M.E.I.C., Minister of Reconstruction, whose address appears elsewhere in this issue. He was followed by Stanley Lewis, who, in the dual capacity of mayor of the city and official delegate of the Federation of Mayors and Municipalities, welcomed the participants to Ottawa.

It is possible that the plans made at this conference will go a long way towards solving some of the many obstinate problems associated with community planning. It was the unanimous opinion of the delegates that an essential to success was a wider knowledge of the subject on the part of the general citizenry, and it was believed that best results could be obtained through a society devoted principally to such purposes. It will not be easy to set up a national organization of this kind, and much valuable time has been lost already, but every effort will be made now to get it under way with the minimum of additional delay.

The agenda for the first day dealt principally with provincial interests, each delegate describing the situation in his province, including a description of the legislation and an account of activities up to the present time. The concluding item was set up under three headings and was dealt with by the following technical organizations:

a) THE ENGINEER IN THE PLANNING TEAM—
(The Engineering Institute of Canada)

b) GOOD BUILDING IS MORE THAN GOOD BUILDINGS—
(The Royal Architectural Institute of Canada)

c) KEEPING IN TOUCH WITH OUR CLIENTS — THE CITIZENS—
(The Town Planning Institute)

In the evening the delegates were the dinner guests of the Corporation with D. B. Mansur, its president, in the chair.

The second day was devoted to a general discussion of the usefulness of a national association in the community planning field—an organization that could assist in developing the thinking on this important subject, and in the dissemination of information to the public. After several hours of discussion, it was agreed that such an organization could do a really useful work in both the local and national fields.

A committee under the chairmanship of A. E. K. Bunnell, M.E.I.C., was created to prepare a preliminary draft of a constitution. It presented its recommendations in the afternoon and they were accepted unanimously. The draft is to be submitted to the solicitors for final wording, with a copy going to every delegate for final approval before application is made for a charter.

An essential factor in the deliberations was the necessity of finding funds beyond those to be collected from members' fees. The meeting was informed that the Corporation would be prepared to assist materially, particularly over the first year or two and possibly longer if necessary.

The concluding action of the conference was the approval of a resolution that an interim board of directors be appointed to consist of three representatives each of the Royal Architectural Institute of Canada and The Engineering Institute of Canada, one each from the provincial governments, organized labour, the Canadian Welfare Council, and the Corporation.

It is essential that active support be given to the Association by existing organizations — particularly the Architectural Institute and the Engineering Institute. Already these two have taken a leading part in the project, having first discussed its possibilities over two years ago and having taken some preliminary steps leading up to the present development. The Engineering Institute can readily relate its own Committee on Community Planning to the Association, to the advantage of both.

INTERESTING PROPHECY

In a piece of literature issued recently by the Newcomen Society of England there appears the following:

" In Essex, England—famed for its salt marsh islands in the North Sea and for leafy Epping Forest, is a tombstone, dated A.D. 1440, bearing this amazing inscription of prophecy, cut in stone half a century before Columbus discovered America:

'When pictures look alive with movement free,
When ships, like fishes, swim beneath the sea,
When men, outstripping birds, shall scan the sky,
Then half the world, deep drenched in blood, shall lie.' "

COLLECTIVE BARGAINING RULINGS

At long last there are official pronouncements upon applications for certification made by professional groups in Ontario and Quebec. In the one case, it is employees of the Bell Telephone Company that are concerned, and, in the other, employees of the Toronto Hydro-Electric System. Both applications have been before the National Wartime Labour Relations Board for many months, and in the case of Toronto Hydro the application was made originally to the Ontario Labour Relations Board, where it was refused, because the Board felt it had no jurisdiction.

A knowledge of the many details involved in these precedent establishing cases gives one an appreciation of the difficulties that had to be surmounted. There was no pattern to follow, there were opposing interests of several types, and new types of employer groups were involved. The Board has taken a long time to reach its decisions. It is to be hoped that they are fair and equitable—and workable.

Following are the official releases from the Department of Labour. As examples of the use of words to conceal meanings, they are distinguished. Paragraph five of the first release is commended particularly from that point of view. Nevertheless, something new in the profession has occurred. Collective bargaining for engineers under the current labour legislation has been authorized. For the first time, Canadian engineers, within certain classifications, may now legally insist on collective bargaining with their employers.

Wisely used it can be of great benefit, but it can do an even greater injury if it is not administered carefully, cautiously and sensibly. Here are the releases:

Department of Labour—June 26th, 1946

"It was announced today by the Wartime Labour Relations Board (National) that it had ordered a representation vote of employees in the Department of the Vice-President (Engineering), the Engineering Department, Eastern Area, and in the Division Plant Engineering Groups of the Eastern Area Plant Department of the Bell Telephone Company of Canada, Montreal, P.Q.

The Board, in answering objections raised by the Company as to the status of professional employees under the Regulations, traced the development of the Board's policy in regard to such employees from April, 1944 down to February, 1945, when the policy was adopted that the Board was prepared, in proper cases, to certify bargaining representatives for units of employees engaged in professional capacity.

The Board stated that following the hearing of the case the parties had conferred in an endeavour to reach agreement upon the classifications of employees to be included in the bargaining unit, and had requested that, pending finality of such discussions, the application be held in abeyance.

While a substantial measure of agreement was reached, the Board found that the Company would desire to have an engineering plant unit exclusive of clerical employees, while the Federation of Professional Employees desired an Engineering craft unit comprising engineers and their technical assistants.

The Board stated, in determining the scope of the unit, that like considerations apply in general in determining an appropriate bargaining unit comprising or including occupational classification requiring professional skills as apply in determining an appropriate craft unit comprising or including occupational classifications requiring particular artisan skills. An appropriate unit should include the occupational classifications engaged in common employment in the same line of skilled work and in which there is by reason of training or experience and established practice the normal opportunity for promotion from the lowest to the highest occupational classifications comprising the professional or professional and technical group.

The Board drew attention to the particular organization structure of the Company and determined the appropriate bargaining unit as comprising employees performing the duties of engineering assistant, technical assistant, student engineer, assistant engineer and engineer below the rank of division plant engineer employed in the Engineering Divisions of the Company affected by the application. The Board excluded by title or classification a number of employees from the bargaining unit because possessing confidential or supervisory duties."

Department of Labour—June 25th, 1946

"It was announced today by the Wartime Labour Relations Board (National) that it had allowed the appeal of the Toronto Hydro-Electric System of Employee-Professional Engineers and Assistants from a decision of the Ontario Labour Relations Board dismissing the organization's application for certification.

The Ontario Board dismissed the application on the ground that it was uncertain as to the present attitude of the National Board toward the inclusion of professional employees in bargaining units in view of earlier declarations of policy and rulings.

The National Board stated, in reversing the decision of the Ontario Board, that it was prepared in proper cases to certify duly elected or appointed bargaining representatives of bargaining units constituted of employees employed in professional engineering or employed in training for professional engineering and to deal with the issue of whether a professional employee is employed in a confidential capacity on the facts of the particular case.

The National Board, therefore, granted certification of bargaining representatives for a bargaining unit consisting of all employees in the works of the Toronto Hydro-Electric System, Toronto, employed in the practice of professional engineering or employed in training for professional engineering, except those employed in a confidential capacity or having authority to employ and discharge."

MULBERRY EXHIBITION DISCONTINUED

Members everywhere will be disappointed to learn that the exhibition of the model of "the harbour that went to France" was discontinued before the completion of the itinerary. The change in plans deprived the citizens of Quebec, Saint John and Halifax of the privilege of seeing it.

The exhibition in Canada was a joint project with the Hudson's Bay Company, and was shown at many cities where branches of the Institute are located, such as Montreal, Ottawa, Toronto, Hamilton, Winnipeg, Regina, Edmonton, Vancouver and Victoria.

The Company felt that owing to the lateness in the season, and the remoteness of the war, the attendance was falling off to an extent that seemed to justify discontinuing the tour. Officers of the Institute were desirous of having it completed, and to this end cabled the Canadian Prime Minister then in London, and the Canadian High Commissioner. This exchange of messages, plus further discussions with Company officials in Canada did not influence the Company to the point that they would be willing to continue financing the tour.

With an entourage of from ten to twelve people to be financed, and all the costs of transportation, the liability was too great for the Institute to assume, and therefore reluctantly the tour was discontinued after the showing in Victoria.

This whole undertaking was a new experience for the

Institute. While the end of it was disappointing, the entire project was a great success. The objectives were to inform the Canadian people in some detail of at least one British undertaking that made a great contribution to winning the war, and to give them a picture of one phase of the engineers' work in the war. In short, the Institute's objects were to assist in circulating honest propaganda for the British people in general, and the engineers in particular. It is evident that these objectives were accomplished.

Although it was an unusual activity, there appears to be no reason based on this experience that should deter the Institute from undertaking equally unusual activities in the future. Members in all cities where the model was shown were interested and helpful. The Hudson's Bay Company was a generous and cooperative "partner", continuing to meet all costs under all conditions—many of them not foreseen in the original plans.

Previous to coming to Canada, the model was shown in the headquarters building of the Institution of Civil Engineers in London for three months. The attendance was reported as 300,000. In Canada the total attendance was 650,000. A record was made in Winnipeg where over 22,000 people saw it in a single day. The total at Montreal was 83,425, Ottawa 45,066, and Toronto 125,689. At all centres there was a special showing for the branch, at which Colonel Steer-Webtser gave a most interesting and informative talk.

To the British War Office, to the Hudson's Bay Company and to the personnel accompanying the exhibition, the Institute is greatly indebted.

THE PRESIDENT RETURNS FROM THE WEST

New Ground Broken

For the first time, an officer of the Institute met with the members in Kamloops and vicinity. A luncheon meeting was held on May 31st at which thirty-four engineers and wives attended. H. L. Hayne, chief location engineer, Department of Public Works of British Columbia, presided, and with him at the head table, besides the president and Mrs. Hayes, were Mrs. Hayne, Mr. and Mrs. M. L. Wade and Mr. G. J. Currie

The chairman introduced the guests, and Mr. Wade thanked the speakers, at the same time telling of his long association with the Institute and the services which it had rendered to him. He was of the opinion that branches could do more for non-resident members than was being done now. He thought if such members were kept well informed of branch activities many of them could arrange to attend at least some of the functions.

The chairman placed emphasis on the desirability of the Institute keeping closer to groups such as the one at Kamloops, where there were not enough members to justify establishing a branch, but where occasional meetings could be held, both of a social and of a professional nature. He hoped that succeeding presidents would be able to include Kamloops in their western itinerary.

From Kamloops the party motored over the Trans-Canada highway to Sicamous where they entrained the next morning for Calgary.

Calgary

Here the programme included a meeting with the executive, a trip to the oil fields of Turner Valley and a dinner meeting with the members of the branch and their ladies. At this latter function there were about a hundred present. Chairman H. H. Younger presided. The president was introduced by James McMillan and thanked by S. G. Coultis. The ladies entertained Mrs. Hayes at tea.

The two photos at the top are of the Kamloops dinner. Head table, left to right, Mrs. Hayne, the President, H. F. Hayne, chairman, and Mrs. Hayes. Lower left—the engineers of the Okanagan Valley greet the president at Kelowna. Lower right—the Banff local members entertain for the presidential party. Left to right, Mrs. Hayes, A. B. Geddes, Miss M. McLaren, the president, P. J. Jennings, Mrs. Geddes, G. J. Currie.

Regina

The two days at Regina were filled with pleasant events of importance. A large portion of the first day was given over to meetings with the executive of the branch and the Council of the Association—the personnel of these two bodies being identical. In the evening there was a dinner meeting with the members to the number of about sixty. Chairman Fred Estlin presided and had as his chief aid Jack Spratt, chairman of the Papers and Meetings Committee. The president presented the Duggan Medal to H. L. Lexier for his paper " Metallurgy and Machine Design ". Mr. Lexier had been unable to attend the annual meeting of the Institute in February.

An interesting feature of the whole trip was a visit to the barracks and criminology laboratories of the R.C.M.P. Incidentally, the laboratory is in direct charge of an engineer, Staff Sergeant Mallon, a graduate of Saskatchewan, who was the party's guide.

On the Saturday afternoon the ladies of the branch entertained Mrs. Hayes at tea in the hotel — a very pleasant affair.

Lakehead

It was a happy thought that prompted the members in Fort William and Port Arthur to hold the branch meeting at Kakabeka Falls—a beautiful spot not far from Fort William. There was an excellent turnout of members and their wives which indicated that the local people too appreciated an escape from the heat of the city.

The newly elected chairman, W. H. Small, was in charge, and following the tradition of the branch called on Joachim Antonisen to thank the speakers—Mr. Antonisen does this in a most pleasing colourful style that is indeed rare in these bustling days.

Other items of the programme included visits to the grain elevators, the ore terminal, and the plant of the Canadian Car and Foundry Co. Ltd., where buses were being turned out in quantities that should go a long way to solving the transportation problems of many cities. There was also a business meeting with the executive, and the ladies entertained Mrs. Hayes at luncheon.

Sault Ste. Marie

Once again the delightful weather permitted a branch to go out into the country for a meeting. This was held at the golf club with W. D. Adams in the chair. The attendance was substantially larger than usual—which, of course, is particularly encouraging to a small branch.

The party enjoyed a tour of the plant of the Algoma Steel Company, under the supervision of Chief Engineer Carl Stenbol.

Sarnia

From Sault Ste. Marie, by a devious route over highway, rail and water, the party moved to Detroit and Sarnia. A meeting with the new Sarnia Branch was held at the golf club on Friday, June 4th, with Chairman George Macpherson doing the honours. This was the first visit of a president to the branch, and the members with their wives turned out to the capacity of the club accommodation. A feature of the visit was a tour of the Polymer plant.

Detroit

The semi-annual meeting of the American Society of Mechanical Engineers was conducted in Detroit on June 17-18-19th. This was billed " with the Engineering Institute of Canada participating ", and so it was appropriate that the president of the Institute should be there. As usual the meeting was a great success. Unfortunately, the cyclone of the day previous had done a great deal of harm to transportation facilities, and authorities in the neighbourhood of Windsor did not encourage travelling. Doubtless this reduced the number of Canadians in attendance.

The Institute branch at Windsor organized a tour to the Canadian side, which included a trip through the plant of the Hiram Walker Distillery. It was well attended! There were plant trips on the American side as well, which with a technical programme of eighty-six papers, plus four luncheons and three dinners made up a series of rather full but profitable days.

It was a much appreciated manifestation of goodwill that the American Society of Mechanical Engineers should have so generously included the Canadians in the programme of this important meeting. By the terms of the co-operative agreement between these two societies, it should be possible to hold many joint functions and activities throughout the years, to the general advantage of all concerned.

Montreal

The president returned to Montreal on Friday, June 21st, and presided at the meeting of Council on the 22nd. On Sunday, in company of G. J. Currie, Louis Trudel, assistant general secretary, and Lt. Col. A. J. Kerry, rehabilitation officer, the president left by boat to visit the Saguenay branch at Arvida.

Saguenay

The boat trip down the St. Lawrence river was made in varied weather. The party, arriving at Bagotville on Tuesday night, June 25th, was met by members of the branch executive and driven to the Saguenay Inn at Arvida.

In the morning of June 26th, the president and his entourage visited the works of the Aluminum Company of Canada. At lunch, members of the executive and their wives entertained the visitors. Vice-president G. F. Layne of Quebec, a former councillor of the branch, and Mrs. Layne joined the group at this point.

In the afternoon, the party, including the ladies, visited the hydro-electric development at Shipshaw.

The branch meeting was held at the Arvida Inn that evening and, as usual, was attended by a large percentage of the members of the branch.

After the meeting the party was taken to the boat at Bagotville.

At Quebec the next evening, President Hayes and Councillor Currie boarded the train which took them back to Halifax after a tour which lasted more than two months.

"THE WAR SEEN FROM BRITAIN"

Recently Headquarters has received a forty page pamphlet issued by the British Ministry of Information. The full title is " The War Seen from Britain 1939-1945—Victory in spite of all Terror "—Chronology and Commentary. This pamphlet should be in everyone's possession, not only because it is an interesting story of the world's greatest events, but as a library reference for all time.

The pamphlet is a complete story of the war in a cleverly abridged form. Each page is divided into two parts, one side carrying a running narrative, alongside of which are notes which give the geographic information and dates. Together the two make up a short story in great detail.

As a piece of propaganda literature, it is one of the best that has come to Canada. The story is told dispassionately, but the very modesty of it impresses one with the great part played by the British people. It is a great credit to the British Ministry of Information and indicates clearly that the Englishmen have learned that the world should be kept properly informed.

The pamphlet is circulated in Canada through the United Kingdom Information Office, at 10 Albert Street, Ottawa, Ontario.

As Mr. George Walkem of Vancouver could not be in Montreal at the time of the Annual Meeting, the presentation of the Julian C. Smith Medal which had been awarded to him by Council had to be postponed. Fortunately he could be in Montreal on June 22nd the date of the Council Meeting at which the president presided. Accordingly, a luncheon was arranged at the University Club in his honour. The photograph shows the president making the presentation. Mr. Walkem's reply was delightful, with flashes of humour but over all a sincere acknowledgment of the honour done him. The citation appeared on page 196 of the February issue of the *Journal*.

R.C.E.M.E. CORPS ASSOCIATION

Headquarters has received notice of the creation of this Association, whose object is "to foster the development of R.C.E.M.E. Corps and to stimulate interest in training, design development, inspection, maintenance and repair techniques, procedures and facilities affecting army technical equipment".

The membership consists of all officers of active reserve units of the Corps, together with any inividual officers (active, reserve, regular or retired) who desire to belong. The first president is Colonel H. G. Thompson, D.F.C., B.A.SC., M.E.I.C., of Toronto, and the secretary is Lt.-Col. LeSueur Brodie, B.SC., M.E.I.C., also of Toronto. (76 Adelaide Street West).

Officers of the Association have stated that to maintain the many units of strength required for the reserve army it will be necessary to have the support of the engineering profession in general. It is with this in mind that the *Journal* brings to its readers' attention the existence of this new organization. The secretary will welcome enquiries from all who desire additional information or who are interested in becoming members.

It is highly important that the profession maintain its interest in the Royal Canadian Electrical Mechanical Engineers Corps. It is essential that the Corps become and remain an engineering corps. Such is the desire of those who are promoting the Association. Members of the Institute should not forget the many times that it became necessary during the war for Council to remind someone at Ottawa that an engineer corps should have engineers in it. Non-professional interests in high places can readily overlook such considerations, but an organization such as the Engineering Institute which is free from departmental restrictions and bias must not overlook them.

Every assistance should be given this Association. The best interests of the Corps and of the profession are their objectives.

WARTIME BUREAU OF TECHNICAL PERSONNEL

The future of the Bureau has been a subject of discussion for several months. It was realized that it was organized as a war agency and that the war was over. At the same time it was desired to preserve for peacetime use some of its facilities. Just how this could be accomplished has not been easy to determine.

Several months ago the Council of the Institute expressed the opinion that the Bureau should be dissolved, believing that all forms of compulsory procedures should be abolished now that the war is over, and not being able to see how the records could be maintained in useful form without compulsory measures. As a matter of fact the Minister of Labour issued an order to the effect that the Bureau would cease to exist as of August 1st, 1946, but representations made by several individuals and organizations have caused him to withhold action for the present.

In May, after a discussion in which the Institute representative again presented the Institute's opinion, the Advisory Board agreed unanimously to approach the Minister with the recommendation that in some manner or other certain Bureau records and services be continued. The latest word from the Deputy Minister is—

"The Minister has asked me to thank you for your letter of June 3rd regarding the continued operation of the Wartime Bureau of Technical Personnel.

I am sure you will be pleased to know that we have agreed in principle that its continuance is fully justified, and we are now exploring what form of administrative machinery is most appropriate.

This will no doubt mean that we will request your Advisory Board, which has done such excellent work, to take on a more permanent character".

THE ENGINEERING INSTITUTE OF CANADA

PRIZE AWARDS 1946

Twelve prizes known as "The Engineering Institute of Canada Prizes" are offered annually for competition among the registered students in the year prior to the graduating year in the engineering schools and applied science faculties of universities giving a degree course throughout Canada.

Each prize consists of twenty-five dollars in cash, and having in view that one of the objects of the Institute is to facilitate the acquirement and interchange of professional knowledge among its members, it has been the desire of the Institute that the method of award should be determined by the appropriate authority in each school or university so that the prize may be given to the student who, in the year prior to his graduating year, in any department of engineering has proved himself most deserving as disclosed by the examination results of the year in combination with his activities in the students' engineering organization, or in the local branch of a recognized engineering society.

The following are the prize awards for 1946:

Nova Scotia Technical College	James Pemberton Oakley
University of New Brunswick	Albert MacLean Stevens, S.E.I.C.
Laval University	Adrien Morin, S.E.I.C.
McGill University	Geoffrey Wakefield Ince, S.E.I.C.
Ecole Polytechnique	Jean-Paul Valade, S.E.I.C.
Queen's University	Robert Blair Glass
University of Manitoba	William Hollis Matthews, S.E.I.C.
University of Toronto	Keith Coleman Hendrick
University of Saskatchewan	Andrew Thomson Bingham
University of Alberta	John Anderson Randle
University of British Columbia	Edward T. Kirkpatrick
Royal Military College of Canada	No award, regular course discontinued during the war.

ENGINEERING EDUCATORS FORM UNIVERSITIES' CONFERENCE COMMITTEE

The following report has been written for the Journal by past-president, Dr. C. R. Young, Dean of the Faculty of Applied Science and Engineering of the University of Toronto. It will be a matter of modest satisfaction to members of the Institute to see that the preliminary conference of engineering educationalists which was a feature of the 1946 annual meeting of the Institute, has resulted in a permanent committee to deal with matters of importance to engineering education.

It is interesting to observe the proposals of the representatives of professional societies wherein recommendations were made with regard to uniformity of entrance standards, and the inclusion in the curricula of additional "non-scientific" courses. The replies to these proposals from the professional educationalists indicate how complex is the problem. There is no easy way in which courses can be standardized, or expanded to include other subjects. The minutes of this conference and the following report indicate this very clearly.

There has been a great deal of casual thinking about engineering education, which has resulted in all sorts of proposals. This report gives valuable information which should be helpful to the layman in his future thinking about such matters.—Ed.

Growing out of the conference of deans and teachers of engineering held in Montreal on February 9, as a concluding feature of the Annual Meeting of The Engineering Institute of Canada, another conference was arranged by the engineering educators to coincide with the Annual Meeting of the National Conference of Canadian Universities at Toronto on May 27-29.

Twenty representatives of the engineering schools offering work of university grade attended. Those present, and the institutions from which they came, were as follows: Dean A. F. Baird, University of New Brunswick; Dean Ignace Brouillet, Ecole Polytechnique; Reverend Father M. W. Burke-Gaffrey, University of St. Mary's College; Dean D. S. Ellis, Queen's University; Dean E. P. Fetherstonhaugh, University of Manitoba; Dean J. N. Finlayson, University of British Columbia; Professor A. E. Flynn, Nova Scotia Technical College; Reverend Father W. P. Fogarty, St. Francis Xavier University; Professor H. Gaudefroy, Ecole Polytechnique; Lt.-Colonel L. F. Grant, Queen's University and Royal Military College; Professor N. B. Hutcheon, University of Saskatchewan; Professor R. E. Jamieson, McGill University; Professor H. J. MacLeod, University of British Columbia; Dean H. W. McKiel, Mount Allison University; Professor L. M. Pidgeon University of Toronto; Professor J. W. Porteous, University of Alberta; Dean A. Pouliot, Laval University; Dean R. A. Spencer, University of Saskatchewan; Professor H. R. Theakston, Dalhousie University; Dean C. R. Young, University of Toronto.

On the morning of May 27, these representatives met as a group, with Professor J. W. Campbell, University of Alberta, Professor R. C. Dearle, University of Western Ontario, Professor H. R. Kingston, University of Western Ontario, and Professor M. Y. Williams, University of British Columbia, sitting in as assessors.

A spirited discussion of many matters relating to engineering education took place. The principal topics considered fell under the following heads:

(1) Extent of specialization
(2) Choice of course or option
(3) Cultural material in undergraduate courses
(4) Lengthening of undergraduate course by one year
(5) Formation of a Committee on Engineering Education of the National Conference of Canadian Universities.

From the discussion it appeared that specialization has gone as far as is desirable in the engineering schools of Canada. More generally than not, the first engineering year is common to all courses and the advantage of making this practice as widespread as possible was stressed. It was appreciated that the length of course for a first degree had an important bearing on the matter.

There was general agreement that too much emphasis is often placed by the student, and sometimes by the employer, on the particular course or option that the student has pursued in college. The important factor is the quality of the men who are graduated, rather than the particular courses they have taken.

Sympathetic though the group was to the inclusion of so-called "liberal" or "cultural" subjects in the unergraduate curriculum, it was agreed that the 20 or 25 per cent of the total time for a four-year course, as proposed by the SPEE Committee on Engineering Education After the War, could not be approached in Canada without impairment of the course from the scientific and technological point of view. The existing proportions reported varied from about 6 to 15 per cent. The importance of teaching scientific subjects in such a manner as to reveal their inherent cultural quality was noted.

Lengthening the course to five years, based on senior matriculation for entrance, did not appear practicable to the group at the present time. The importance of a post-graduate year was stressed.

There was general agreement that some organization of engineering education should be set up in Canada whereby means could be afforded for teachers of engineering to confer with each other on matters of mutual interest and to consider any measures that might further engineering education in this country.

After considering the possibility of the formation of a section of the American Society for Engineering Education (formerly the Society for the Promotion of Engineering Education), it was finally decided that the National Conference of Canadian Universities be requested to set up within the Conference a Committee on Applied Science and Engineering Education, representative of the engineering schools of the country.

Following the discussion of a paper on "Problems of Engineering Education" presented by Dean H. W. McKiel at a general session of the National Conference held on May 28, a resolution was passed by the Conference authorizing the establishment of the Committee that had been recommended by the deans and teachers of engineering. The Committee is to consist of one representative named by each of the member-institutions of the National Conference offering courses in applied science or engineering at the university level. The secretary of the Conference was instructed to obtain the names of the members of the new Committee selected as above and to conduct by mail an election of a chairman from nominations submitted to him by the members of the Committee.

On May 29, the group of deans and teachers of engineering present at the National Conference met in special session a group of seven representatives of Canadian professional engineering organizations. These seven, and the organizations represented, were: Professor J. Watson Bain, Chemical Institute of Canada; Dr. Alan E. Cameron, Dominion Council of Professional Engineers and the eight Provincial Associations; Mr. W. P. Dobson, Dominion Council of Professional Engineers; Mr. C. C. Huston, Canadian Institute of Mining & Metallurgy; Mr. C. S. Landon, Association of Professional Engineers of Manitoba; Mr. C. E. Sisson, Engineering Institute of Canada; Mr. M. Barry Watson, Dominion Council of Professional Engineers.

Dr. Cameron, acting as spokesman for the professional group, referred to the interest of the Dominion Council of Professional Engineers and its constituent Associations and Corporation in engineering education and felt that they could give constructive assistance to the universities. He expressed the thanks of his colleagues to Dean McKiel for organizing a meeting with the university representatives. He then presented to the meeting two recommendations which had been prepared by the professional group the day before. These were:

(1) That in order to maintain and possibly improve the graduates, entrance requirements to university engineering courses be set at the highest possible standard, and that these standards be as nearly as possible uniform across Canada;

(2) That in view of the complexity in industrial specialization, it is recommended that basic fundamental instruction be given in Canadian Universities, with as great emphasis as possible on the non-scientific courses, leaving industry to do the specialization instruction, in collaboration with the universities, even though this may necessitate the increase of certain courses to a minimum of five years beyond senior matriculation.

Discussion of Recommendation (1) revealed the difficulty of attaining uniformity of admission requirements across Canada. Many universities had to accept students from provinces, or from countries outside of Canada, where secondary school courses concluded at varying levels. High school standards are set provincially, and universities, especially those receiving government aid, must accept the product of the provincial system. In some provinces senior matriculation work is not given in the secondary schools, or in only a part of them, and the universities have had to offer such work in a pre-engineering year. It was agreed that any influence which the professional organizations could exert towards improving the calibre of students entering the universities and engineering colleges in every province would be welcomed by these institutions.

Referring to Recommendation (2), Dr. Cameron enquired as to whether the universities would consider arrangements with industrial and research laboratories, whereby work done in them under university staff supervision would be recognized and accorded academic credit. He suggested that adequate control might be secured by having the directors of some of the better industrial laboratories appointed as part-time staff members. Several of the academic representatives pointed out the need for the universities proceeding cautiously in any programme of this kind lest they be put in the position of having to accept for credit work that could not properly be regarded as of university standard. It would be particularly difficult to co-ordinate such credits with undergraduate courses. The value of training courses in the great industries, without academic credit, was generally admitted.

It was the consensus of opinion that a useful purpose had been served in calling the meeting. The professional representatives expressed the hope that similar meetings might be held from time to time and promised to give any assistance they could to the academic staffs of the engineering schools.

ADDRESSES WANTED

As it is planned to publish a membership list shortly, Headquarters would be glad to receive as quickly as possible, information regarding the addresses of the following members some of whom have been overseas. A list of students for whom we have no addresses will appear in the next number of the *Journal*.

MEMBERS WHO HAVE BEEN OVERSEAS

Members

Ewart, Geo. R.
Fry, Edmund Botterell
MacFadyen, Allan Burt
Mann, Arthur Drummond
Martin, Frank J.
Stein, Chas. R. S.
Walker, Roger Hugh
Wallace, Reginald Henderson

Juniors

Fraser, Fred. Walter
Glenn, John Burgess
Lane, Robert Campbell
Pangman, Arthur Henry
Rodger, Norman Elliot
Shaw, F. W. B.
Wilde, William Clayton
Willis, Lloyd Everett
Wishart, William Donald

MEMBERS IN CANADA

Members

Ball, Walter Lance
Beattie, James Edward
Bell, Norman
Chapleau, Samuel J.
Dempsey, Herbert Clarence
Doherty, Chas. Alexander
Ewart, Cecil
Fetherstonhaugh, Wm. S.
Fowler, Chas. Allison DeWitt
Fowler, Charles E.
Gould, John
Gregor, Michael
Grey, Noel William
Hanlon, John E.
Harris, Wallis Rutherford
Hault, George Christie
Havens, Verne Leroy
Hendry, Rolph Allison
Higgins, Franch Chipman
Hyle, Willard Hugh
Ireton, Jos. Maurice
Lapeyre, Jean
Lazier, Francis S.
Mackenzie, D. Campbell
Mackenzie, Wm. Jas.
McDonald, Norman-Geddes
Meade, John Campbell
Miles, Harold R.
Neales, W. S.
Palmer, Roland Foster
Patterson, Donald Skillman
Petursson, Hannes Jon
Richards, Edward Green
Rust, Henry P.
Russell, John Hartley
Sauders, Lionel John Reduers
Simard, Joseph Edmond
Stuart, W. Grey
Sutherland, J. R. S.
Thompson, Geo. Alexander
Turnbull, Allison Dewar
Tremayne, John Ernest

Juniors

Boultbee, James Greer
Colgan, Patrick Jos.
Cowley, Hugh Rose
Hart, Herbert French
Mable, Wilfred H.
Macnab, Edward Nelson
Macnab, Thomas Creighton
Mathieson, John Richard
McLean, Gordon M.
Saunders, Geo. Ostrom
Schnyder, Max
Senkler, Edmund John
Skerry, Francis S.
Smith, Dillard A.
Smith, Murray Sutherland
Torrington, Frank Delbridge

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, June 22nd, 1946, convening at nine-thirty a.m.

Present: President J. B. Hayes (Halifax) in the chair; Vice-President W. R. Manock (Fort Erie, Ont.); Councillors A. Cunningham (Kenogami), G. J. Currie (Halifax), J. R. Dunbar (Hamilton), E. Lavigne (Quebec), W. L. Saunders (Ottawa), Paul Vincent (Quebec), R. S. Eadie, R. C. Flitton, C. C. Lindsay, C. A Peachey and J. B. Stirling of Montreal; Treasurer J. A. Lalonde, and E. P. Muntz, member of the Committee on Professional Interests; Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation Past-Presidents A. J. Grant of St. Catharines, and George A. Walkem of Vancouver, arrangements having been made to present to Past-President Walkem, at a special luncheon meeting at the University Club, the Julian C. Smith Medal awarded to him in 1945. This was the first opportunity for presenting the medal as Mr. Walkem had not been able to attend the annual meeting in February and was in Montreal in May when the president had been in Vancouver.

Canadian Construction Association—The general secretary reported that in response to Council's resolution regarding the government form of contract as related to foundation conditions, three replies had been received, one from the Deputy Minister of Transport, another from the Deputy Minister of Public Works, and one from the acting chief engineer of Public Works.

Mr. E. P. Murphy, Deputy Minister of Public Works, had replied that a similar resolution has been received from the Canadian Construction Association and that they had been advised by the Minister that determination of foundation conditions was " one of the ordinary risks of bidders and that the department was not in favour of complying with the request ".

The Deputy Minister of Transport, with his reply, submitted a copy of a letter written to the Canadian Construction Association by Mr. Lionel Chevrier, Minister of Transport, in which he stated " I would advise that your representations have been duly considered by our technical officers who are of the opinion that the practice presently followed should not be discontinued ".

In the discussions which followed it was agreed that these replies were decidedly unsatisfactory. It was pointed out that it was not fair to bidders, for the government to give information regarding foundation conditions in remote locations and then to disclaim responsibility for it. It was also pointed out that in many instances it would be wasteful for every contractor to make a separate investigation.

Eventually, it was agreed that the matter should be investigated further, and the president asked Messrs. J. B. Stirling, E. P. Muntz, J. A. Lalonde and R. E. Chadwick to act as a committee for this purpose.

Community Planning—The general secretary reported that the Central Mortgage and Housing Corporation had arranged for a conference to be held in Ottawa on June 25th and 26th, to discuss the possibility and advisability of establishing a community planning association. The notice indicated that each of the provinces would be represented as well as several societies, including the Royal Architectural Institute and the Engineering Institute. Mr. Wright reported further that the Institute's representatives would be R. L. Dobbin, of Peterborough, chairman of the Institute's Committee on Community Planning, N. B. MacRostie, consulting engineer, and Alan Hay, chief engineer of the Federal District Commission, both of Ottawa, and himself.

The general secretary pointed out that this conference tied in very nicely with the resolution passed at the May meeting of Council in which provincial conferences of engineers were suggested. He was of the opinion that following the national conference the provincial conferences would seem to be a natural development.

It was noted that in the list of provincial delegates there was no representation from the province of Quebec, and the hope was expressed that such a representative would be appointed in time to attend the conference.

A general discussion followed dealing principally with the fact that not many engineers were available for consultation on community planning. Many were interested in the subject but were employed full time usually by some government office. It was pointed out, also, that those consulting engineers who were interested in the field were so busy that it was almost impossible for them to take on additional assignments. Mr. Lalonde was of the opinion that engineers could be found in the province of Quebec who could handle further work of this kind.

Mr. Saunders expressed the opinion that it would be helpful if engineers would take a more prominent part in public discussions on community planning. As there are a great many badly conceived plans he thought the public should have the benefit of the engineer's critical opinion. As an example, he referred to one member of the Institute who publicly had taken a very strong stand against a plan which was being considered by his community.

The meeting agreed that the resolution with regard to provincial conferences of engineers on community planning should be pushed to the limit.

National Capital Planning Committee—The general secretary presented a letter from F. E. Bronson, M.E.I.C., of Ottawa, chairman of the Federal District Commission, stating that the government had established a National Capital Planning Committee which was to be responsible for the replanning of the city of Ottawa. He invited the Engineering Institute to have two official representatives on that committee. Council accepted the invitation and the names of five members were selected to be contacted by the general secretary in the order established by Council in the hope that two of the five would be able to act.

Harry Bennett Educational Fund—A report was presented from Mr. Heartz, a member of the committee, which indicated that the collection of the fund was proceeding in a reasonably satisfactory way. Several branches have not reported to the committee but those that have, in some instances, have far exceeded their quotas and in others are well on their way to meeting their quotas. Mr. Heartz' report pointed out that in those branches where canvassers had actually seen the members whose names were on their list, complete success had been attained, but that in other branches that had relied on telephone calls and circular letters, less favourable results had followed. The report stated that the committee was confident that the objective of $25,000.00 would be obtained.

At this point, following a custom established at the May meeting in Trail, the president asked Vice-President Manock to take the chair.

Committee on Professional Interests—Mr. Stirling, chairman of the committee, stated that there was no formal report to be made. The various matters before the committee had been studied further but no meetings had been held because of the absence of himself and other members of the committee from Montreal. He pointed out, however, that he had had several reports from western branches indicating that the president's visit had promoted closer relationships with the association in each province. The reports he had received following the president's visit had been very encouraging.

The general secretary reported that the returns from the canvass of the Ontario members regarding a provincial division showed that out of 1,360 notices sent out, 621 had been returned approving of the division. The by-laws require that a majority of fifty per cent of the corporate members in the province approve the proposal, which indicated that in this case 681 replies would have to be received. The general secretary reported that during the president's visits to the branches at the Lakehead, Sault St. Marie and Sarnia, there had been several inquiries with regard to the purpose of the provincial division. It seems that members do not wish to support the proposal if it indicated any tendency towards separatism. Mr. Saunders reported that similar doubts had been in the minds of several members of the Ottawa branch.

It was agreed that the *Engineering Journal* in its next issue, should carry a message which would indicate to members that in making the proposal there was no thought of separating the provinces.

Sixtieth Anniversary, 1947—At the May meeting of Council it had been decided, subject to approval by the Toronto Branch, that the 1947 annual meeting, which would mark the sixtieth anniversary of the Institute, would be held in Toronto on April 18th and 19th. A letter from the Toronto Branch indicated that these dates were not wholly acceptable as they coincided with the examinations at the university. The only other dates available at the hotel were May 8th and 9th. These were acceptable to the branch, and on the motion of Mr. Eadie, seconded by Mr. Currie, it was unanimously resolved that the dates of May 8th and 9th be approved for the adjourned annual meeting and that the formal meeting be held at Headquarters in January as usual.

Wartime Bureau of Technical Personnel—The general secretary read a report from L. C. Jacobs, one of the Institute's representatives of the Advisory Board of the Wartime Bureau of Technical Personnel. This dealt with a meeting of the Board held in Ottawa on May 21st. It pointed out that the main purpose of the meeting had been to recanvass the Minister of Labour with regard to continuing the work of the Bureau. The report pointed out that as the Council of the Institute had, by resolution, indicated its opinion that in the interests of economy the Bureau should be discontinued at an early date, Mr. Jacobs had continued to make the same representations. However, the majority were of the opinion that some efforts should be made to preserve the man-power register of the Bureau and to continue the employment service for technical personnel. Eventually, the meeting agreed unanimously to support a further report to the Minister recommending—

1. That provision be made for the maintenance and efficient use of the roster of scientific and technical personnel.
2. That in any employment service established for scientific and technical personnel, the direction shall be fully qualified scientifically and technically and the staff salary scales shall be commensurate with those of the prospective employees they are to serve.

The report also states, "We are not at the moment concerned as to the aegis under which the above two functions are carried on. We are concerned only with the essential objectives and the efficient use of government money expended in attaining them".

Mr. Jacobs' report and the minutes of the meeting of the Advisory Board were studied further and it was pointed out that it was difficult to see how the personnel records could be kept up to date without some compulsory legislation, but Council was agreeable to an effort being made, particularly in view of the unanimous support given to the proposal by the Advisory Board of the Bureau. Eventually, it was moved by Mr. Stirling, seconded by Mr. Eadie, and carried unanimously, that Mr. Jacobs' report be received and that Council agree with the action taken.

National Construction Council of Canada—Mr. Muntz, as chairman of a special committee appointed by the president, reported as follows:

"Your committee, appointed pursuant to Minute 4548, consisting of Past-President Dr. J. M. R. Fairbairn, Dr. P. L. Pratley, J. B. Stirling, with the writer as chairman, reports as follows:

Re Minutes 4546 and 4547

The committee feels that the N.C.C. is not a suitable body to handle construction controls. This opinion is predicated upon the following:

1. The N.C.C. has neither adequate funds nor suitable organization.
2. It is not an executive body.
3. It has no corporate membership.
4. It consists of representatives of national bodies in the construction field and these representatives have no power to commit the bodies they represent.
5. It is virtually a conference committee, the sphere of usefulness being limited probably to the extent each representative is able to mould the policy of his autonomous body along lines in co-operation with or complementary to others.
6. It should not act as a mouthpiece without prior approval of all the constituent bodies.

Re Minute 4549

Standards for building materials and standards in the building and construction fields in general fall within the scope of the Canadian Standards Association in which the Institute has representation on practically every committee as well as being represented on the executive by Dr. P. L. Pratley.

The C.S.A. has done splendid work in the specifications and approvals fields relating chiefly to quality of the more technical materials as well as some common building materials. Little has been done in Canada towards standardization of sizes and correlation of dimensions of products entering into construction.

This committee agrees with the N.C.C. that "some study should be given to the possibility of standardizing building materials", and recommends—

1. That the C.S.A. is the appropriate body to undertake such a study;
2. that the request to the C.S.A. should come from those primarily concerned with the manufacture of building products and their installation;
3. that the Institute should be ready to endorse such a request.

The committee also suggests that the constituent bodies forming the N.C.C. should express individually their views to the C.S.A. and that the N.C.C. might appropriately make this suggestion to its constituent bodies. It should not express a direct opinion on behalf of others."

On the motion of Mr. Stirling, seconded by Mr. Dunbar, it was unanimously resolved that this report be accepted.

Mulberry Exhibition—The general secretary reported that following the May meeting in Trail he had been in communication with the Hudson's Bay Company officials with regard to the possibility of having the Mulberry Exhibition in Halifax. After due consideration the company reported that they could not accept the recommendation and that arrangements had been made to have the models shipped back to England from Victoria.

An effort was then made to bring the matter to the attention of higher officials to see if the tour could not be completed as planned originally. These negotiations included an exchange of cablegrams with the Right Hon. W. L. Mackenzie King, who was then in England, and the Canadian High Commissioner, and further telephone conversations with the Hudson's Bay Company in Winnipeg, all of which resulted in the company maintaining its decision not to proceed any further with the exhibition.

The general secretary pointed out that it was unfortunate from the Institute's point of view that the company had thought the attendance did not warrant the continuation of the tour, but that as the company was handling the finances exclusively, there was nothing the Institute could do. Therefore, reluctantly, notice had been sent to the branches at Quebec, Saint John and Halifax that all arrangements would have to be cancelled.

At this point, President Hayes resumed the chairmanship of the meeting.

Maritime Professional Meeting—A request was presented from the Halifax Branch for a grant of $250.00 to assist in meeting the expenses of the Maritime Professional Meeting to be held in Digby, Nova Scotia, on September 5th, 6th and 7th, 1946, under the auspices of the Associations of Professional Engineers of Nova Scotia and New Brunswick and the maritime branches of the Institute.

The Finance Committee pointed out that some time ago a decision had been made by Council not to make advance grants for an annual meeting and the committee felt that in this instance the same practice should be followed, but in view of the presence at the Council meeting of the president and the councillor from the Halifax Branch it was decided to make no recommendation until Council could consider the whole subject.

It was pointed out that it is not customary for a branch to have to pay out money as part of the expenses of an annual or a professional meeting before revenue is received from the sale of tickets. Thus it has been found that the advance financing was not required. The general opinion of the meeting was that everything possible should be done to encourage the maritime members and although it had been arranged that the meeting would be a joint one between the Associations of Professional Engineers in Nova Scotia and New Brunswick and the Institute, it was felt that the Institute should indicate immediately its readiness to meet its share of any deficits.

Mr. Currie, councillor of the Halifax Branch, indicated that there had been some doubt in the minds of the committee members in Halifax with regard to this advance. It had been noticed in the minutes of the professional meeting of 1939 that such an advance had been made and therefore the committee thought they had been following the established procedure. The general secretary read portions of a letter from the secretary treasurer of the Halifax Branch in which comment was made on the joint sponsorship of the professional meeting. It was pointed out that the 1939 meeting had been exclusively an E.I.C. affair but that the committee thought it would be better in this instance to make it a joint meeting. The letter bore out Mr. Currie's observations with regard to the question of advance financing and of sponsorship, and, eventually, the general secretary was instructed to advise the secretary of the Halifax Branch that while an accountable advance would not be made, the Institute was fully prepared to meet its responsibilities. At the same time Council asked that its good wishes be transmitted to the branches, and several individuals indicated that they would endeavour to attend the meeting.

Amendments to the By-laws—On the motion of Mr. Dunbar, seconded by Mr. Flitton, it was unanimously resolved that the recommendations of the Finance Committee regarding the application of the new fees to applications for admission and for transfer be approved.

E.C.P.D. Booklet—A communication from the chairman of the Engineers' Council for Professional Development was presented which outlined a proposal to publish a special booklet to commemorate the fifteenth anniversary of the Council. The main purpose of the booklet was to inform industry of the work of E.C.P.D. to the end that a fund might be established, perhaps $250,000.00, which would enable E.C.P.D. to extend its work, particularly in the research field. A dummy of the booklet was circulated to the councillors from which it was seen that the thirty-five pages contained a great fund of vital information dealing with the profession and with the eight constituent organizations. It was the opinion of councillors that this was a most worthwhile object and that the Institute should agree to carry its share of the cost as recommended by the Finance Committee. It was planned to have an edition of 10,000 to cost about $3,000.00.

Quebec Agreement—A communication was presented informing Council that the Council of the Corporation of Professional Engineers of Quebec had appointed Messrs. Ernest Lavigne, G. H. Midgley and E. R. Chadwick as the Corporation's representatives on the joint committee provided for in Clause 9 of the agreement for the purpose of exploring the possibilities of simplification of existing arrangements for the collection of fees and the possibilities of reduction of total fees payable by those who hold membership in both the Institute and the Corporation. It was suggested that the Institute should appoint its three representatives on this committee.

Mr. Lalonde pointed out that at the March, 1945, meeting of Council three Institute representatives had been appointed to this committee. On the motion of Mr. Eadie, seconded by Mr. Dunbar, it was unanimously resolved that these three representatives, namely Messrs. J. B. Stirling, Andre Benoit and J. A. Lalonde, be reappointed as the Institute's representatives on the joint committee provided for in the agreement.

It was noted that Mr. Ernest Lavigne had been reappointed as the Corporation's representative on the Institute Council.

Joint Finance Committee in New Brunswick—The general secretary presented a letter from which it was noted that the Association of Professional Engineers of New Brunswick had appointed G. M. Brown, of Saint John, and E. B. Martin, of Moncton, as the Association's representatives on the joint finance committee provided for under the terms of the cooperative agreement. On the motion of Mr. Dunbar, seconded by Mr. Currie, it was unanimously agreed that the general secretary should write to the Saint John and Moncton branches requesting nominations to the joint finance committee and that the appointment of the Institute's representatives on this committee be left to the president.

Additional Councillor for Montreal Branch—A letter was presented from the secretary of the Montreal Branch pointing out that as the corporate membership of the branch is now over 1,200 the branch is entitled to an additional councillor, making a total of seven. The general secretary was instructed to inform the branch that it would be in order for them to submit to the chairman of the Nominating Committee the name of an additional nominee for councillor.

Admissions Committee—The general secretary outlined briefly the purposes of the new Admissions Committee, provision for which is made in the recent amendments to the by-laws. As a standing committee, the chairman must be a member of Council, and as most of the work will have to be done in collaboration with Headquarters, it was desirable that a Montreal councillor be selected. Some discussion followed as to the size of the committee and its membership, and it was finally unanimously agreed that an Admissions Committee of five be established; that Mr. C. A. Peachey be asked to accept the chairmanship of the committee, and that he be empowered to select the other four members, the committee to act until the next meeting of Council when the names could be submitted for formal approval.

Julian C. Smith Medal—Discussion took place as to the desirability of making additional awards of the Julian C. Smith Medal at the time of the Sixtieth Anniversary Meeting. The rules provide that not more than two awards shall be made each year, but that, by resolution of Council, additional awards may be made on special occasions. The opinion of Council appeared to be that the standard of the medal should not be lowered by making any large number of awards, and, on the motion of Mr. Lalonde, seconded by Mr. Eadie, it was unanimously agreed that no additional awards be made.

The general secretary was instructed to submit to the Julian C. Smith Medal Committee the nominations received for the 1946 award so that the final selection may be made.

Honorary Memberships—A suggestion that it might be appropriate to confer some honorary memberships at the Sixtieth Anniversary meeting received unanimous support, and, on the motion of Mr. Dunbar, seconded by Mr. Lalonde, it was unanimously resolved that a letter be sent to the branch secretaries informing them that Council is considering the possibility of conferring some honorary memberships at the time of the sixtieth anniversary meeting, and asking the branches to submit any suggestions they may have, the notice to the branches to include an outline of the qualifications for honorary membership.

Engineers' Council for Professional Development—It was unanimously agreed that Dr. C. R. Young be renominated as the Institute's representative on the Engineers' Council for Professional Development for a term of three years commencing in October, 1946.

President's Visit to the Branches—The president reported that he had now completed visits to all branches of the Institute west of and including Toronto. He had experienced the utmost in hospitality and in kindness at every centre. All branches were active and enthusiastic and the Institute was held in very high esteem. He referred also to the splendid reception which he had received at the semi-annual meeting of the American Society of Mechanical Engineers held in Detroit, June 17th to 19th. There were many references to the Institute from the officers and the speakers which indicated to him the high regard in which the Institute was held by its sister societies in the United States. He pointed out also the great responsibility that rests with the Council of the Institute in view of the fact that members everywhere look to Council for leadership and readily accept its decisions. He thought this placed Council in a unique position as leader for the profession.

Date of next Meeting—It was agreed that unless there was some urgent business requiring immediate attention no meeting of Council would be held during the month of July. It was suggested that instead of holding a meeting in August it might be possible to hold it in Digby, Nova Scotia, at the time of the maritime professional meeting. It was finally agreed that it be left with the president, in consultation with other officers of the Institute, to decide upon the date and place of the next meeting.

The Council rose at four forty-five p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered and the following elections and transfers were effected.

Members

Andrews, Samuel Warren, Mech. Engr., (Cornell), president, H. G. Acres & Co., Niagara Falls, Ont.

Campbell, Donald William, B.Sc., (Mech.), (Queen's), sales engr., T. C. Chown Ltd., Montreal, Que.

Campbell, James Douglas, B.Sc., (Chem.), (Queen's), mgr., Chemical Lime Limited, Beachville, Ont.

Cooke, Donald Norry, B.A.Sc., (Elect.), (Toronto), genl. mgr. and Secretary, Soft Water Supply Ltd., London, Ont.

Critchley, John Churchill, B.Eng., (N.S. Tech. Coll.), Asst. elect. supt., Page-Hersey Tubes Ltd., Welland, Ont.

Davison, William Eric, B.Sc., (Elect.), (N.S. Tech.), asst. supt., sub-stn. divn., Shawinigan Water & Power Co., Montreal, Que.

Eggertson, Sigurdur Hjalti, B.Sc., (Elect.), (Manitoba), distribution engr., Winnipeg Electric Co., Winnipeg, Man.

Elford, Glenn Earl, B.A.Sc., (Toronto), engr., St. Clair Processing Corp., Ltd., Sarnia, Ont.

Gooch, Peter William, B.A.Sc., M.A.Sc., (Aero.), (Toronto), chief eng., Canadair Limited, Montreal, Que.

Grosvenor, Frank, B.A.Sc., (Toronto), asst. engr., Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Hartwick, Elbert Frederick, B.Eng., (Chem.), (McGill), engr., The Aluminum Co. of Canada, Arvida, Que.

Hiscocks, Richard Duncan, B.A.Sc., (Toronto), asst. research engr., The National Research Council, Ottawa, Ont.

Lyons, Joseph Harvey Kent, B.Sc., (Elect.), (Manitoba); B.Eng., (Mech.), McGill, scheduling dept., Canadian General Electric Co., Peterboro, Ont.

McLachlan, Robert Angus, S.B. (Naval Arch. & Marine Engrg.), (Mass. Inst. Tech.), chief dftsman., Dominion Bridge Co., Ltd., Vancouver, B.C.

Nicholas, Gordon Alfred, B.Sc., (Civil), (Manitoba), engr., Cowin & Co., Ltd., Winnipeg, Man.

Shepherd, Herbert Lawrence, B.A.Sc., (Elect.), (Toronto), asst. to director of studies, Faculty of Applied Science & Engrg., Ajax, Univ. of Toronto, Ajax, Ont.

Simmons, Dwight Sylvester, B.Sc., (Mech.), (Queen's), asst. mgr., St. Clair Processing Corp. Ltd., Sarnia, Ont.

Smuck, Frederick Harold, B.Sc., (Mining), (Queen's), jr. engr., Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Spigelman, Max, B.Sc., (Elect.), (Manitoba), street lighting engr., City of Winnipeg Hydro Electric System, Winnipeg, Man.

Thornber, William, B.A.Sc., (Mech.), (British Columbia), School of Graduate Studies, Univ. of Toronto (Canadian Lumberman's Association Timber Research Fellowship).

Tuck, Albert Edward, B.A.Sc., (Toronto), elect. test engr., Steel Co. of Canada Ltd., Hamilton, Ont.

Welch, Donald Herbert, B.A.Sc., (Chem.), (Toronto), asst. supervisor, Butadene plant, Polymer Corporation, Sarnia, Ont.

Juniors

Balshaw, Frank Ewart, Calgary Power Co., Ltd., Calgary, Alta. (Has passed the Institute's examinations.)

Beecher, Keith Davidson, B.Eng., (Elect.), (McGill), patent examiner, Canadian Patent office, Ottawa, Ont.

McLean, Donald D., B.Sc., (Elect.), (Queen's), radio engr., Canadian Marconi Co., Montreal, Que.

Ransom, George Edgar McKee, B.Eng., (McGill), asst. to master mtce. mechanic, Beauharnois Light, Heat & Power, Beauharnois, Que.

Walker, Harley Havelock, B.Eng., (Mech.), (N.S. Tech.), Lieut., R.C.E.M.E., (now discharged), Milton, Queen's County, N.S.

Wilson, Robert Galbraith, (N.S. Tech.), service engr., service dept., Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Wurtele, Douglas Barnett, Graduate, (R.M.C.), Officer, Test & Development Unit, R.C.A.F., Ottawa, Ont.

Transferred from the class of Junior to that of Member

Bridgewater, Albert Williams, B.Sc.; B.Sc.; M.Sc., (Civil), (Saskatchewan), structl. designer and dftsman., office of chief engineer, Canadian Pacific Railway Co., Montreal, Que.

Hammond, Rowland Ernest, M.A.Sc., (Toronto), co-ordinator, radio communications divn., Dominion Electrohome Ind. Ltd., Kitchener, Ont.

Lingley, Harold Percy, B.Sc., (Civil), (N.B.), asst. engr., Public Works Dept., Canada, Saint John, N.B.

Noonan, Richard, B.Sc., (Elect.), (Manitoba), pres. & genl. mgr., Pioneer Electric Limited, Winnipeg, Man.

Rouc, John Edward, B.Eng., (Elect.), (N.S. Tech.), A Lieut. Cdr. (L), R.C.N.V.R., Halifax, N.S.

Schofield, Robert John Graham, B.Eng., (Chem.), (McGill), Pearl St., Somerville, N.J. (recently dyer and chemist, Canadian Cottons Ltd., Hamilton, Ont.).

Timms, Reginald Harold, B.A.Sc., (Civil), (Toronto), vice-pres. and asst. mgr., Timms Construction, Welland, Ont.

Transferred from the class of Student to that of Member

Brown, George Cameron, B.Eng., (Elect.), (McGill), designer, plant engrg., Bell Telephone Co. of Canada, Quebec City, Que.

Dessaulles, Jean, B.Sc., C.E., (Ecole Poly.), industrial power sales engr., C. & D. dept., Shawinigan Water & Power Co., Three Rivers, Que.

Gordon, John Abraham, B.Eng., (McGill), training course, Canadian General Electric Co., Peterboro, Ont.

Taylor, Harry, B.Sc., (Mech.), (Sask.), service engr., Aluminate Chemicals Ltd., Moncton, N.B.

Walker, Howard James, B.Sc., (Elect.), (McGill), distribution engr., Shawinigan Water & Power Co., Three Rivers, Que.

Transferred from the class of Student to that of Junior

Geake, Lloyd Woodrow, B.Sc., (Sask.), Lieut., R.C.E.M.E., (now discharged), 389 Douglas Ave., Toronto 12, Ont.

Peckover, Frederick Lionel, B.A.Sc., (Civil), (Toronto), jr. research engr., National Research Council, Ottawa, Ont.

Richards, James Leslie, B.Sc., (Elect.), (Queen's), Lieut., R.C.E.M.E., Billings Bridge, Ottawa, Ont.

Ward, John, B.A.Sc., (Toronto), jr.engr., Ontario Hydro-Electric Power Commission, Toronto, Ont.
Wilkins, Ernest Bertram, B.Sc., (Civil, (Alberta), Lieut., R.C.E., Lethbridge, Alta.
Wrong, James Stuart, B.Sc., (Civil), (Queen's), engr., F. E. Cummings, genl. contractor, Ottawa, Ont.

Admitted as Students

Borth, Laurence A., (Queen's), 81 Nelson St., Kingston, Ont.
Bradford, James Walter, B.A.Sc., (Civil), (Toronto), 17 Morton Rd., Toronto, Ont.
Baker, J. D. (Univ. of Toronto, Ajax), 35 Fairleigh Crescent, Toronto, Ont.
Carrol, John Murray, (Queen's), 118 Earl St., Kingston, Ont.
Clermont, Louis-Philippe, B.Eng., (Chem.), (McGill), Mgr., Pointe Claire Lumber Co., Ltd., Pointe Claire, Que.
Davis, Donald Frederick, (Toronto), Northern Electric Co., Montreal, Que.
Haflidson, R. S., Senator-Rouyn Limited, Noranda, Que.
Love, Andrew Eric Armour, (N.S. Tech.), 35 Whitney Ave., Sydney, N.S.
Neale, William A., B.Sc., (Mech.), Toronto, Link-Belt Ltd., Toronto 8, Ont.
Oliphant, William John, B.A.Sc., (Mech.), 22 Classic Ave., Toronto, Ont.
Ross-Ross, Philip Arthur, (McGill), 516 Sydney St., Cornwall, Ont.
Scott, Ivyl M., B.Sc., (Civil), (Alberta), 1140-7th St., Santa Monica Calif.

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

Alberta

Member

Webster, Gordon William B.Sc., (Chem. Engrg.), Alberta, prod. engineer, Home Oil Co., Limited, Millarville, Alta.

Saskatchewan

Juniors

Edwards, John Bevan, B.Sc., (Mech.), Lieut., R.C.E.M., 120-8th St., E., Saskatoon, Sask.
Middleton, Jack Spencer Gordon, asst. city engr., City of Swift Current, Sask.
Treleaven, Leonard James, B.Eng., (Agri.), Sask., jr. hydraulic engr., P.F.R.A., Swift Current, Sask.
Watson, Howard Douglas, B.Sc., (Geo.), Sask., asst. engr., Mines Branch, Dept. of Natural Resources, Regina, Sask.

Students

Buhr, Donald Alan, (Saskatchewan), Langham, Sask.
Daniels, Ray Percy Levi, (Sask.), 96 First Ave., Yorkton, Sask.
Robb, Murray Doig, (Sask.), 42 - 20th St., Prince Albert, Sask.
Saldat, John Hans, B.Sc., (Mech), Sask., 327 Ave. "J", Saskatoon, Sask.

Student to Junior

Holmes, Loyde Thomas, B.Sc., (Civil), Sask., res. engr., Dept. of Highways, Regina, Sask.

Nova Scotia

Members

Devereaux, William Allan, B.Sc., (Mech.), Toronto, branch mgr., Bailey Meter Co., Ltd., Halifax, N.S.
Keddy, Harry MacKay, sales engr., Wm. Stairs Son & Morrow Ltd., Halifax, N.S.
Lahey, J. Walter, B.Sc., (Civil), N.S. Tech. Coll., Town Engineer, Dartmouth, N.S.
Paul, Roy Barry, B.A.Sc., Toronto, engr., Canadian Gypsum Co., Ltd., Halifax, N.S.

New Brunswick

Member

Isner, Bennett W., B.Eng., (Elect.), N.S. Tech. Coll., Canadian Gypsum Co., Ltd., Hillsboro, Albert County, N.B.

Junior to Member

Davis, Samuel, B.Sc., (Civil), N.B.; M.Sc., (Structl.), M.I.T., c/o H. F. Weigel, Saint John, N.B.

Student to Member

Levesque, Paul Carmel, B.Sc., (Elect.), N.B., district elect. engr., New Brunswick Electric Power Commission, Grand Falls, N.B.

Student to Junior

Colpitts, Rolfe Reynolds, B.Eng., (Mech.), N.S. Tech. Coll., Lieut., R.C.E.M.E., Sussex, N.B.

Affiliate to Member

Hargreaves, Welsford Thomas, resident engr., i/c constrn., Dartmouth Airport, Hillsboro, Albert County, N.B.

Quebec

Junior to Member

Hammon, Ernest Roy, B.Sc., Manitoba; Graduate, R.M.C.; S.M., (Civil), M.I.T., engr., H. E. McKeen & Co., Montreal, Que.

Personals

News of the Personal Activities of members of the Institute

E. D. Gray-Donald, M.E.I.C., was elected president of the Canadian Transit Association at its Forty-First Annual Meeting held at the Fort Garry Hotel in Winnipeg on June 13th. He is chief engineer, Quebec Power Company and Quebec Railway, Light & Power Company. Born in Amoy, China, in 1900, he was educated at George Watson's College, Edinburgh, Scotland, McGill University, Montreal, and Laval University, Quebec, obtaining the degree of B.Sc. (Elect.) at McGill in 1926, and that of M.Sc. at Laval, in 1934. He entered the service of the Quebec Power Company and Quebec Railway, Light and Power Company in 1926 as assistant engineer, and his subsequent appointments have been as follows: 1928—assistant superintendent, Power Division; 1930—superintendent, Power Division; 1937—assistant general superintendent; 1938—general superintendent; 1942—chief engineer.

H. S. Van Scoyoc, M.E.I.C., retired from the Canada Cement Company Limited at the end of June. He has been advertising manager for the firm for many years, having joined it in 1912 as inspecting engineer. He was later given charge of the consulting engineer service and promotional departments, while serving also as consulting engineer to the Toronto-Hamilton Highway Commission. In 1930 he was appointed manager of publicity and at his retirement he was advertising manager. He is prominent in advertising affairs, having been president of the Association of Canadian Advertisers, of the Montreal Publicity Association, of the Associated Advertising Clubs of the World and the Canadian Advertising and Sales Association.

Dr. Charles Camsell, M.E.I.C. has been awarded the founders' medal of the Royal Geographical Society for 1945 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.

Dr. R. S. L. Wilson, M.E.I.C., is retiring as dean of the faculty of applied science of the University of Alberta. He joined the university staff in 1919 as professor of civil and municipal engineering, receiving the appointment as dean in 1929. He is a graduate of McGill University, Montreal, and lectured there in mathematics and civil engineering from 1916 to 1919. He was on the council of the Institute from 1922 to 1924 and in 1929.

A. M. Hudson, M.E.I.C., has been appointed chief of the mechanical division of War Assets Corporation, with headquarters in Montreal.

Mr. Hudson is from Norfolk, England, and was articled in engineering. He came to Canada in 1910 to begin an extensive career in sales, engineering and construction work at Montreal, Toronto and elsewhere, including service with the Ontario Government. In 1940 he joined the Department of Munitions and Supply becoming chief of the gauges division and chief of the central inventory records division. In December 1944, Mr. Hudson joined War Assets Corporation as administrative engineer in the real estate division, and in July 1945 was transferred to the mechanical division. He served in World War I with the C.E.F., being demobilized as a captain after four years service.

LeSueur Brodie, M.E.I.C., has recently been promoted to the position of general sales supervisor for the Bell Telephone Company of Canada's western area with headquarters in Toronto. Mr. Brodie joined the army with the rank of captain in September, 1939, when "B" Corps signals, R.C.C.S. was being formed in Montreal. He re-enlisted in 1941 after a short time in civilian life, gaining his majority in September 1942. A lieutenant-colonel in 1943, he served overseas and in Canada as technical staff officer, grade 1, in charge of telecommunications with the Royal Canadian Electrical and Mechanical Engineers.

Mr. Brodie graduated from McGill University, Montreal, with a B.Sc. in engineering physics in 1926 and subsequently served in the Bell Telephone Company's engineering department until 1931, when he was transferred to Toronto as division sales engineer. In 1935 he became exchange rates engineer at Montreal, where he remained until his enlistment. During 1940 and 1941 he was manager at Brantford and, latterly, he has been Toronto Division sales manager.

(Fryer)

W. H. Small, M.E.I.C.

W. H. Small, M.E.I.C., has been elected chairman of the Lakehead Branch of the Institute. Born in Benzonia, Mich., he attended Michigan State College, graduating in 1908 with a B.Sc. degree in civil engineering. He was first employed as a manual training instructor by the school board at Port Huron, Mich., and in 1909 accepted a similar position in Louisville, Ky. He came to Canada in 1912 as draughtsman for Barnett-McQueen Construction Company, Fort William, Ont., and in 1914 worked with C. D. Howe as designing engineer. Back in the United States in 1916 he was draughtsman for the Webster Manufacturing Company at Tiffin, Ohio, until his return to Canada and to the Barnett McQueen company as chief draughtsman in 1917. He was promoted in 1934 to chief engineer and is now vice-president and chief engineer of the firm.

A. J. Girdwood, M.E.I.C., is the newly elected chairman of the Peterborough Branch of the Institute. He was born at North Bay, Ont., and studied engineering at the University of Toronto, receiving a B.A. Sc. degree in 1934. After following the Canadian General Electric Student Course in 1935 he entered that company at Peterborough, Ont., as designing engineer. He was appointed to his present position as senior engineer in 1945.

C. Brakenridge, M.E.I.C., has retired from the position of city engineer of Vancouver, B.C. Prior to his appointment in 1924, he had been for several years in private consulting practice in Vancouver after having served as assistant city engineer. He was chairman of the Vancouver Branch of the Institute in 1922, and represented the branch on the Council in 1923, 24, and 25.

A. R. Ketterson, M.E.I.C., engineer of bridges for the Canadian Pacific Railway since 1937 and an engineering department employee for thirty-nine years, retired recently. Born at Greenock, Scotland, in 1881, he received his education at Glasgow, finishing at the Royal Technical School there. He retired from a distinguished army career in 1919 with the rank of major. His first position with the C.P.R. was as bridge inspector in Montreal in 1907.

G. E. Shaw, M.E.I.C., will succeed Mr. Ketterson as engineer of bridges for C.P.R. at Montreal. He has been assistant engineer of bridges since 1941 and associated since 1925 with Canadian Pacific. He is from Windsor, Ont., and received his early education in the border city. He graduated from McGill University with the degree of Master of Science in civil engineering and joined the C.P.R. at Montreal in May 1925 as a draughtsman.

A. C. Northover, M.E.I.C., is employed as development engineer with the North Over Canada Product Promotion at Toronto. He had previously been designing engineer with the Marathon Pulp Mills of Canada at Toronto.

W. B. Scoular, M.E.I.C., has accepted a position with the Ontario Paper Company Limited at Thorold, Ont., having severed connection with the Powell River Company Limited in Vancouver, B.C., where he had been located since 1944.

Dr. Karel B. Rybka, M.E.I.C., has taken over the consulting practice of the late Walter J. Armstrong, M.E.I.C., in Toronto. He has been in charge of the Toronto office since 1934.

Albert Leduc, M.E.I.C., who after six years of service with the Canadian Army recently retired with the rank of lieutenant-colonel, has returned with the engineering division of the City of Montreal. He is responsible for the modernization of street lighting.

J. F. Cunningham, M.E.I.C., who has been with the Department of Public Works of Canada as senior inspector of dredges with headquarters at Selkirk, Man., has been transferred to Edmonton, Alta. Retaining his position as senior inspector of dredges, he is now in the Edmonton district engineer's office and will be concerned with development and maintenance of navigation on the MacKenzie River.

W. E. Locke, M.E.I.C., has been appointed assistant resident manager at the Ocean Falls plant of Pacific Mills Limited. A graduate in mechanical engineering of the University of British Columbia, he was formerly resident engineer for the firm.

R. S. Lawrence, M.E.I.C.

R. S. Lawrence, M.E.I.C., the newly elected chairman of the Lethbridge Branch, is from Sydenham, London, England. He studied at the Crystal Palace Engineering School and gained admission to the Institution of Civil Engineers, London, England. He travelled to Portuguese S.W. Africa in 1909 and was assistant engineer for the Benguella Railway Company and proceeded in 1911 to Venezuela, South America, where he was assistant engineer for the Bolivar Railway Company for a year. In Canada, from 1913 to 1915, he was surveyor and draughtsman for the City of Calgary, when he enlisted in the C.E.F., serving as a lieutenant until 1917. He entered the employ of the Canadian Pacific Railway as assistant engineer in the Department of Natural Resources at Lethbridge, Alta., in 1917 and remained with the firm in the Irrigation Office at Lethbridge until April this year. With the Alberta government, Department of Water Resources, Mr. Lawrence is now superintendent of the northern division of the St. Mary and Milk River Development.

A. R. Hailey, Jr.E.I.C., has been appointed secretary-treasurer of the Peterborough Branch of the Institute. Born at Vancouver, B.C., he attended the University of British Columbia, receiving a B.A. Sc. degree in 1941. The same year he entered the employ of Canadian General Elctric Company as testman at Peterborough, Ont., where he is still located.

F. G. Haven, M.E.I.C., has transferred from the Dominion Department of Public Works, Winnipeg, to the Dominion Department of Mines and Resources, engineering and construction service. He is located temporarily at Grimshaw, Alta., as inspecting engineer on the Dominion-Provincial section of the Grimshaw-Great Slave Lake highway project.

R. F. P. Bowman, M.E.I.C., who was with the railway troops, R.C.E. overseas has now returned to the Canadian Pacific Railway at Brandon, Man.

W. J. Bright, M.E.I.C., who was overseas with the R.C.E. for four and a half years and won the D.S.O. in Italy, has returned to his previous position with the Canadian Johns-Mansville Co. Ltd., as sales engineer for Western Canada.

H. P. Cadario, M.E.I.C., has returned from the army to the Hydro Electric Power Commission of Ontario at Toronto.

W. A. Capelle, M.E.I.C., who went overseas with the R.C.E. in 1940 and returned as a lieutenant-colonel in 1945, has resumed his position in the Department of Public Works of Canada at Winnipeg, Man.

J. R. Carson, M.E.I.C., who was overseas with the R.C.E., has accepted a position with the National Harbours Board at Halifax.

C. B. Charlewood, M.E.I.C., has been discharged from the army and can be reached through British Columbia House in London, England.

H. G. Conn, M.E.I.C., who served overseas as a lieutenant-colonel in the R.C.E.M.E., has returned to the staff of Queen's University, Kingston, Ont.

Charles Hershfield, M.E.I.C., has been discharged from the R.C.N.V.R. and appointed to the staff of the University of Toronto as a special lecturer.

E. S. Kent, M.E.I.C., who served in the R.C.E., has returned to his former position as chief engineer with Gouin & Co. Ltd., Winnipeg.

Edward Notman Kingsland, M.E.I.C., who served in the R.C.A.F., has returned to his position with Williams & Wilson Ltd., Montreal.

Hugh Lamb, M.E.I.C., who was overseas for three years with the R.C.A.F., is now engaged in the administration of the Veterans Land Act in Montreal.

John N. Langman, M.E.I.C., has been released from the R.C.A.F., and is now with the King Paving Co. Ltd., in Oakville, Ont.

J. P. Leroux, M.E.I.C., who was overseas in 3 Bn. R.C.E. has returned to his former position with the Dept. of Transport of Canada, (Civil Aviation Branch), Montreal.

ndrew Russell, M.E.I.C., has been demobilized from the navy nd returned to Imperial Oil Limited at Sarnia, Ont.

V. D. Schofield, M.E.I.C., who served overseas for four years in e R.C.E.M.E., has accepted a position with Slack Bros. in Vaterloo, Que.

V. I. Shuttleworth, M.E.I.C., has retired from the R.C.A.F., and ccepted a position with War Assets Corporation at Winnipeg.

I. C. Sherman, M.E.I.C., has retired from the R.C.E.M.E. with e rank of colonel after thirty-five years service, and has accept- d a position with the John Inglis Co. Ltd., in Vancouver, B.C.

. H. Skelton, M.E.I.C., who served in the R.C.A.F., on the Cana- ian Joint Staff at Washington, has accepted a position with e Quebec Hydro-Electric Commission in Montreal.

. K. Smith, M.E.I.C., has been discharged from the R.C.E. and is ow with Imperial Oil Co. Ltd., in Toronto.

. W. Smith, M.E.I.C., was released from the R.C.E. to take an ppointment on the staff at the University of New Brunswick.

. W. Snyder, M.E.I.C., who was overseas for five years with the .C.E., has returned to his former position with the Canadian Vestern Natural Gas, Light, Heat & Power Co. in Calgary.

Vm. C. Wilkinson, Jr.E.I.C., has resigned his position as vice- resident and chief engineer of the Wired Radio Company of anada Limited (affiliated with Canadian Line Materials Lim- ted), Toronto, Ont. He is taking up residence in Australia and arries with him a wide experience in the communication field, aving held the position of transmitter development engineer vith the Canadian Marconi Company in Montreal for four ears after his graduation from the University of New Bruns- vick in 1937. During the war years, he was research engineer vith the radio branch of the National Research Council in Ottawa.

. S. Cuthbertson, Jr.E.I.C., is in Canton, Ohio, with the Timken Roller Bearing Company. Since October last he has been following course of training and study preparatory to assuming charge of he tool engineering department of the company's Canadian plant t St. Thomas, Ont. He had previously been a junior engineer vith Northern Electric Company Limited in Montreal, Que.

. L. T. Ellis, Jr.E.I.C., is in the employ of the Carborundum Company of Niagara Falls, N.Y., as assistant to the engineer in harge of design and maintenance of air conditioning equipment. He had been with the R.C.A.F. in Toronto, since 1943, and was ssistant engineer with Weathermakers (Canada) Limited in Tor- nto prior to his enlistment.

. E. Kirkpatrick, Jr.E.I.C., has been discharged from the R.C.A. vith the rank of major, and is now with the Consolidated Paper Corp. at Grand'Mère, Que. He joined the artillery in 1940, going verseas, and later returned to Canada to work with the United Kingdom Inspection Board. Overseas again in 1943, he worked n rocket designs and saw service with a rocket battery.

W. D. Harkness, Jr.E.I.C., is in Jalesco, Mexico, as assistant woods nanager for Cia. Industrial de Atenquique. He was formerly with he Bathurst Power and Paper Company at Bathurst, N.B.

. C. Bryce, Jr.E.I.C., who was overseas for three years in the navy, as joined the Dominion Engineering Works at Lachine.

Basil Arthur Burgess, Jr.E.I.C., has retired from the R.C.N.V.R. and ccepted a position with the Bowen Machine Co. Ltd.

A. M. Cameron, Jr.E.I.C., on retirement from the R.C.N.V.R., has resumed his connection with International Nickel Co. Ltd., at Copper Cliff, Ont.

Alastair D. Cameron, Jr.E.I.C., who served overseas with the R.C.A. as a special technical officer, is now with Dominion Bridge Co., Lachine, Que.

M. C. Caron, Jr.E.I.C., who served in the R.C.N.V.R., as an elec- trical officer, is now with the Consolidated Paper Corporation at Grand'Mere, Que.

H. V. Cosson, Jr.E.I.C., has retired from the navy and is employed at Canada Creosoting Co. Ltd., North Vancouver, B.C.

F. S. Hutton, Jr.E.I.C., who served overseas with the R.C.E. rail- way troops, has returned to his former position with the Canadian National Railways, Stratford, Ont.

John L. Jomini, Jr.E.I.C., has retired from service in the R.C.A. and is re-established in civilian life in Shawinigan Falls, P.Q.

J. McLean Jordan, Jr.E.I.C., who served in the R.C.E. overseas, has been appointed county engineer for the United Counties of North- umberland and Durham, and is located at Cobourg, Ont.

B. F. Junkin, Jr.E.I.C., has been demobilized from the navy and has joined the Bell Telephone Co. in Montreal.

R. J. Kane, Jr.E.I.C., has retired from the navy and accepted a position with the Dominion Bridge Co. at Lachine.

H. A. Lancefield, Jr.E.I.C., who served in the R.C.A.F. is now with the Matthews Conveyor Co. Ltd., in Calgary.

Cornelius Rempel, S.E.I.C., has taken a position with the Manitoba Paper Company at Pine Falls, Man.

W. A. Bowman, S.E.I.C., who served overseas in the R.C.E. with a bridge company, R.C.A.S.C., is now working for C. D. Howe Co., in Port Arthur, Ont.

J. S. Wrong, S.E.I.C., is employed as engineer for F. E. Cummings, general contractor, Westboro, Ont. He had been associated with Proctor and Redfern, consulting engineers, Toronto.

J. A. Brown, S.E.I.C., has retired from the R.C.N.V.R. and accepted a position with the Spruce Falls Pulp and Paper Co. Ltd., Kapuskasing, Ont.

D. R. S. Browning, S.E.I.C., who was under training for the C.I.C. is now with Howard Smith Paper Mills in Cornwall, Ont.

J. M. Casault, S.E.I.C., has left the army and gone to the University of Alberta, Edmonton.

R. C. Cline, S.E.I.C., has been released from the R.C.E.M.E. to return to American Car Co., Niagara Falls, Ont.

Abbey Cohen, S.E.I.C., has been discharged from the R.C.E.M.E. and is at present with War Assets Corporation in Montreal.

R. R. Colpitts, S.E.I.C., has retired from the R.C.E.M.E. and ac- cepted a position with the Canadian International Paper Co. Ltd., in Dalhousie, N.B.

K. G. Cook, S.E.I.C., who was in the R.C.A., has accepted employ- ment with Cresswell Pomeroy Co. in Montreal.

A. F. Holloway, S.E.I.C., has been demobilized from the navy and is now a lecturer on the staff at Queen's University, Kingston, Ont.

Bruce F. Johnston, S.E.I.C., has returned from overseas service with the R.C.A.F. and is continuing his studies at McGill University, Montreal.

Edward Lewis Jones, S.E.I.C., who was overseas with the R.C.E. for over four years, is now with the Phillips Petroleum Co. in Bartles- ville, Oklahoma.

C. W. Kerry, S.E.I.C., who was overseas in the R.C.A., has returned to McGill University as a student.

L. L. Langille, S.E.I.C., who served in the R.C.N.V.R., is now with the Canadian National Railways in Montreal.

J. G. Longley, S.E.I.C., has been discharged from the R.C.A. and returned to his former position with Canadian General Electric Co. Ltd., in Toronto.

E. B. A. LeMoistre, S.E.I.C., has returned from overseas, where he joined the R.C.A.F. and is now back at McGill University, Montreal.

J. H. C. Mulherin, S.E.I.C., is now employed by the Montreal Engineering Company Limited, at Montreal.

A. D. Hamilton, S.E.I.C., is now with the Ontario Paper Company at Thorold, Ont. He was formerly with the Dominion Rubber Company Limited in Montreal, Que.

S. J. Simons, S.E.I.C., recently discharged from the R.C.E. with the rank of captain, has entered the employ of the Ontario Paper Company Limited, Thorold, Ont., in the central engineering division.

John Huxley Hargrove, S.E.I.C., served overseas for three years as a meteorological officer in the R.C.E. and has now returned to C. D. Howe Co. Ltd., in Port Arthur.

Marc Hurtubise, S.E.I.C., who attained the rank of captain overseas with the R.C.E.M.E., has now returned to the Dominion Bridge Co., Montreal.

Paul Selwyn Jagger, S.E.I.C., who was in the R.C.E.M.E., is now with the Barrett Co. in Montreal.

J. H. Nicholls, S.E.I.C., after service in the army has gone to South America. He is at Guayaquil in Ecuador.

J. R. O'Grady, S.E.I.C., who was under training for the R.C.E., re- turned to complete his course at Queen's University in 1946.

D. W. Patterson, S.E.I.C., has retired from the R.C.N.V.R., and accepted a position with the Aluminum Co. of Canada Ltd. in Toronto, Ont.

R. L. Payne, S.E.I.C., who served for a year and a half in the Merchant Navy, is attending McGill University.

J. N. Proulx, S.E.I.C., who served in the R.C.E.M.E., is now with the Department of Public Works, Quebec.

R. A. Ritchie, S.E.I.C., has been discharged from the R.C.E.M.E., and accepted a position with Canadian & Dominion Sugar Co. Ltd., in Montreal.

Ivan F. Ranolds, S.E.I.C., has been discharged from the R.C.A.F. and is now employed with the H.E.P.C. of Ontario.

Obituaries

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

Simon Fraser McLeod, M.E.I.C., senior inspector of boilers in the Calgary district for the Provincial Government, died suddenly at his home in Calgary on Friday, May 17th, 1946.

Mr. McLeod was born in Westville, N.B., in 1889. He moved to Rossland B.C., in 1903, and later to Coleman and Lethbridge, Alta., where he entered the Department of Public Works of Alberta in 1928, was appointed provincial boiler inspector, and transferred to Red Deer, Alta. In 1938 he was appointed inspector of boilers for the Calgary District.

He was the holder of a first class steam engineer's certificate for Alberta. Prior to his connection with the Department of Public Works he was master mechanic and chief engineer for the McLeod River Coal Company, Mercoal, Alta., from 1924 to 1928, and was connected with the International Coal and Coke Company, Coleman, Alta., and the West Canadian Collieries, Blairmore, Alta., from 1909 to 1923.

He joined the Institute as an Associate Member in 1934, and became a member in 1940.

John Broy Cochrone, M.E.I.C., died at his residence in Ottawa on April 14th, 1946.

Born in Cacouna, Que., in 1860, he attended Royal Military College, Kingston, Ont., a member of the first graduating class, 1880. He joined the staff as an instructor with the rank of captain and later became assistant professor and finally professor of chemistry and physics. Transferred to Ottawa in 1914, he was in charge of the Military Surveys Division with the rank of major, and a year later was appointed assistant director of the geographical section, a part of the directorate of military operations and intelligence. He retired some fifteen years ago with the rank of lieutenant-colonel.

Mr. Cochrane joined the Institute in 1905 as a Member.

J. R. Roberts, M.E.I.C., died December 26th, 1945, in Toronto, Ont.

Born in Burlington, Vt., in 1890, he attended the University of Vermont, graduating in 1912 with a B.Sc. degree in civil engineering. He went to Montreal, Que., that year and was employed as instrumentman by Norman D. Barclay who had the contract with Canadian National Railways to survey the Town of Mount Royal, Que. In 1913 he was employed as superintendent for the Paterson Manufacturing Company Limited, Montreal, and the next year was appointed engineer in charge of their road department. He then served overseas for two years and on his return in 1919 he associated himself with the Barrett Company Limited in Montreal, and in 1920 was named chief engineer for the paving department of the Societé Samtor, Paris, France, the French branch of the Barrett Company. Transferred to Detroit and to Toronto, he was manager of the company's tarvia departments at those locations until 1931 when he became Ontario sales manager of Canadian Bitumuls Company Limited at Leaside, Ont. Mr. Roberts retained that position up to the time of his death.

He joined the Institute as a Junior in 1916, transferred to Associate Member in 1917, and to Member in 1940.

Joseph E. Hinchcliffe, M.E.I.C., of Belle River, Ont., died on March 10th, 1946, after a brief illness.

Born at MacLeod, Alta., in 1897, he attended McGill University, Montreal, receiving a B.Sc. degree in civil engineering in 1926. The same year he entered Canadian Bridge Company Limited, Walkerville, Ont., and was employed as detailer and checker until 1933. He was draughtsman and checker with Hamilton Bridge Company Limited at Hamilton, Ont., from 1934 to 1938, when he returned to Canadian Bridge Company. He later resided at Amherstburg, Ont., and Belle River, Ont. He was a veteran of World War I, serving with the 121st and 7th battalions.

Mr. Hinchcliffe joined the Institute as a Student in 1924, transferring to Junior in 1928. He became an Associate Member in 1934 and a Member in 1940.

E. A. Bemon, M.E.I.C., who was with the Chesterville Lardner Lake Gold Mining Company Limited at Kearns, Ont., died in Toronto on November 21st, 1945.

Mr. Beman was a graduate of the University of Saskatchewan with a B.E. degree in 1928 and was associated with the Department of Highways as a resident engineer in Regina, Sask., in 1931, and in Swift Current, Sask., in 1932. Two years later he became associated with the Kingfisher Gold Mines Limited at Wadhope, Man., and was subsequently with the Kenora Prospectors and Miners Ltd., at Machin, Ont., with the Elora Gold Mines Ltd., at Manitou Lake, Ont., and with the Wood Cadillac Mines at Kewagama, Que. He was employed by Pandora, Ltd., at Cadillac, Que., in 1941, and accepted his position as chief engineer with Chesterville Larder Lake Gold Mining Company in 1942.

He joined the Institute in 1931 as an Associate Member, becoming a Member in 1940.

Jocques P. Brillon, M.E.I.C., of the Quebec Streams Commission was one of a group drowned recently in the vicinity of Mingan, Que., while doing power survey work.

Born in Montreal in 1909, Mr. Brillon was educated at Loyola College and Ecole Polytechnique, Montreal, and at the Massachusetts Institute of Technology, Cambridge, Mass., receiving degrees of B.Sc., C.E., and M.Sc. in electrical engineering, the last in 1933. For two years he worked with Ricard and Royer, consulting engineers, Quebec, Que., and in 1937 joined the Aluminum Company of Canada, located at Arvida, Que.

He served in the R.C.A.F. as a flight lieutenant during the war, first concerned with aeronautical engineering, then stationed as chief engineer at the No. 9 B. & G. School at Mont Joli, Que., and later at No. 16 S.F.T.S., Hagersville, Ont. He later was posted at Headquarters, Ottawa.

Mr. Brillon became a Member of the Institute in 1945.

R. S. McCormick, M.E.I.C., of Sault Ste. Marie, Mich., died on March 18th, 1946.

Born in Quaker City, Guernsey County, Ohio, in 1873, he was educated at Saginaw and Ann Arbor, Mich., and commenced a career of fifty-five years in railroad work in Michigan and Ontario. He was assistant engineer with the Grand Trunk Railway, Battle Creek, Mich., in 1895-1897, and worked in the same capacity in Detroit, Mich., in 1897-99. He was locating engineer with the Algoma Central and Hudson Bay Railway at Sault Ste. Marie, Ont., from 1899 to 1903, and division engineer for the Saginaw district, Pere Marquette Railway in 1903-1905. In Fort William, Ont., in 1905 he was employed by the Grand Trunk Railway as location and construction engineer, and in 1909 accepted a similar position for the Algoma Central and Hudson Bay Railway at Sault Ste. Marie, Ont., becoming chief engineer in 1910. He retired from Algoma Central in June 1945 as general superintendent and chief engineer.

He joined the Institute in 1913 as a Member. Life membership was granted to him by Council on March 23rd this year, before his death was made known to the Institute.

V. H. McIntyre, M.E.I.C., of Toronto, Ont., died on April 28th, 1945.

Born at Toronto in 1900, Mr. McIntyre graduated from the University of Toronto with a B.A.Sc. in 1923. He was then employed for five years in the engineering department of McGregor-McIntyre Limited, Toronto, and after some months with the Ontario Hydro Electric Power Commission went to London, Ont., where he was in charge of sales and design for the London Structural Steel Company. He was president of V. H. McIntyre Limited from 1932, which firm designed, fabricated and erected timber structures.

Mr. McIntyre joined the Institute in 1942 as a Member.

George B. Hull, M.E.I.C., of Altadena, Cal., died on March 24th, 1946, in Mobile, Ala.

Born at Wallingford, Conn., in 1876, Mr. Hull was educated there and at Yale University, and the Armour Institute, Chicago, Ill. Joining the Alberta Railway and Irrigation Company at Lethbridge, Alta., in 1898, he went to Kamloops, B.C., in 1902 in connection with the Fruitlands Irrigation System, and to Calgary, Alta., in 1904 as division engineer with the Canadian Pacific Railway. From 1910 to 1920 he was with the Department of Public Works of Canada during which time he was responsible for the design and construction of wharves along the British Columbia coast to the Alaska boundary and as district engineer located at Prince Rupert, B.C., he was in charge of administration of the Harbors and Rivers Act. He spent two years in Iraq as district irrigation officer for the Euphrates Division at Baghdad, Mesopotamia, and in 1922 returned to Canada where he was division engineer for the Lethbridge Northern Irrigation District.

Subsequent years found him in the United States as assistant engineer for Leeds and Barnard, Consulting Engineers at Los Angeles, Cal., and with the Department of Water and Power in the same city, and from 1925 to 1936 he was vice-president and chief engineer with the Sinaloe Land Company, at Sinaloa, Mexico. In California in 1936 he was supervisor of the highway planning survey for the Division of Highways, Sacramento, and in 1937 was project engineer for the W.P.A. at Los Angeles.

Mr. Hull was in the United States Army corps of engineers in 1941 and 1942, after which he served the Department of Agriculture for some time at Los Angeles, as associate hydraulic engineer. Once more associated with the Sinaloe Land and Water Company in 1943, he was vice-president, located at the Los Angeles office. In 1944 he was appointed inspector of construction for the U.S. Navy at Seal Beach, Cal., and in 1945 general inspector, for the U.S. Navy at Inyokern.

Joining the Institute as an Associate Member in 1909, Mr. Hull became a Member in 1940.

News of the Branches

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

LAKEHEAD BRANCH

A. J. Mickelson, M.E.I.C. - *Secretary-Treasurer*
R. B. Chandler, M.E.I.C. - *Branch News Editor*

W. H. Small was elected chairman of the Lakehead Branch of the Institute at the annual dinner meeting held Tuesday evening, May 28th, in the Village Inn, Port Arthur. Vice-President of the Barnett-McQueen Co. Ltd. of FortWilliam, Mr. Small succeeds W. C. Byers of Port Arthur.

S. E. Flook was named vice-chairman and A. J. Mickelson was re-elected secretary-treasurer. The following executive was chosen: W. E. McLennan, A. D. Norton, and S. T. McCavour of Fort William; O. J. Koreen, J. N. McNeil and J. M. Fleming for Port Arthur; R. W. Emery of Marathon; and S. C. Wilcox of Kenora.

Ex-officio officers are W. C. Byers, past-chairman; and R. B. Chandler, councillor.

Other professions represented at the dinner were Thunder Bay Dental Association, Dr. J. M. Spence; Thunder Bay Law Association, B. Shaffer; medical profession, Dr. J. N. Senn, a visitor in Fort William.

Sound films depicting construction of the Golden Gate bridge at San Francisco were shown through courtesy of the Bethlehem Steel Corporation.

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 on May 31st at the National Museum, Professor Magnel of the University of Ghent, Belgium, outstanding authority in the field of concrete design, gave a talk on **Pre-Stressed Concrete** before the Ottawa Branch. The talk was illustrated with slides and motion pictures.

Professor Magnel has been in the United States in a consulting capacity for a business concern and during his visit to Canada, on his return trip, the Engineering Institute invited him to talk to the branches on his itinerary.

The speaker was introduced by Col. J. P. Carrière, an acquaintance of Prof. Magnel's in Belgium.

PRESIDENTIAL VISIT TO EDMONTON

Head table, right to left: Hon. N. E. Tanner, Minister of Lands and Mines, Mrs. Hayes, F. R. Burfield, the president, and Mrs. J. W. Porteous.

Dean R. S. L. Wilson and the executive meet for luncheon with the president.

Above—the students are nearly all returned men.

Institute stalwarts and their wives.

CALGARY BRANCH GREETS PRESIDENT AND MRS. HAYES

Head table with Chairman H. R. Younger presiding.

THE PRESIDENT AT LETHBRIDGE

It was a very good meeting. Upper left picture, the head table, left to right: G. J. Currie, James McMillan, the president, P. E. Kirkpatrick, G. A. Gaherty.

PRESIDENT HAYES INAUGURATES THE KOOTENAY BRANCH

Head table at the inaugural dinner, left to right: Miss M. McLaren, G. A. Gaherty, Lorne Campbell, Mrs. Montgomery, G. J. Currie, Mrs. Diamond, the President, Chairman S. C. Montgomery, Mrs. Hayes and R. W. Diamond.

Mr. and Mrs. R. W. Diamond entertain in their garden.

R. W. Diamond entertains the visiting officials at the golf club. Left to right: R. R. McNaughton, W. S. Kirkpatrick, the president and Mr. Diamond.

At South Slocan the power developments were visited with Lorne Campbell as host.

PRESIDENT HAYES AT SARNIA

At left, the head table. Left to right: C. F. Davison, Mrs. Davison, Mrs. Macpherson, the president, Chairman G. L. Macpherson, Mrs. Dyer, F. F. Dyer.

PRESIDENT AND MRS. HAYES AT LAKEHEAD

Head table, right to left: W. C. Byers, Mrs. S. E. Flook, R. B. Chandler, Mrs. Small, Chairman W. H. Small, the president, Mrs. Hayes, G. J. Currie, Mrs. Byers.

PRESIDENTIAL VISIT TO SASKATOON

Upper left picture shows the head table with E. K. Phillips presiding and Vice-President R. A. Spencer at extreme right.

PRESIDENT'S VISIT TO THE SAGUENAY

Upper left: Yvon Cousineau, Norman McCaghey, the president, Chairman B. E. Bauman, Vice-President G. F. Layne. Upper right: G. J. Currie, Adam Cunningham, A. C. Johnston.

SAULT STE. MARIE BRANCH GREETS THE PRESIDENT

Upper left, head table, left to right: A. M. Wilson, the president, Chairman W. D. Adams, D. Holbrook. Upper right, left to right: Messrs. Holgate, Russell, Dalton, Kleburg, Pickering, Kelly, Rahilly. At left, right to left: Messrs. Fitzgibbon, Cowie, Watt, Holder, Brown, Brown, McQuarrie.

THE PRESIDENT AT WINNIPEG

The president speaks, with Tom Storey and Dr. Fetherstonhaugh on his right and Chairman George Fanset and the general secretary on his left.

As usual there was a large turn out at Winnipeg.

VANCOUVER BRANCH

A. M. Eyre, S.E.I.C. - - - *Secretary-Treasurer*
P. B. Stroyan, M.E.I.C. - - *Branch News Editor*

A special dinner meeting of the Vancouver Branch was held in the Sports Pavilion in beautiful Stanley Park on Wednesday evening, May 22nd, to honour Mr. J. B. Hayes, president of the Institute on the occasion of his tour of the branches. Mr. Hayes was accompanied by Mr. G. J. Currie, councillor for the Halifax Branch and Dr. L. Austin Wright, general secretary of the Institute.

R. C. Pybus, chairman of the Vancouver Branch, introduced the guests and expressed the pleasure of the membership at being honoured by this visit.

Mr. Hayes related some of the impressions gathered on his trip across the continent, and related experiences in a humorous and philosophical vein reminiscent of the late Stephen Leacock.

Mr. Currie carried greetings for the Halifax Branch and also produced a bottle of Atlantic sea-water which he proposed to empty into the Pacific Ocean. (It was not anticipated that the deleterious effect would prove particularly serious and therefore no action was taken to discourage this questionable practice).

Mr. Wright was somewhat handicapped by having to confine his remarks more or less to Institute affairs and in a few brief words brought the members up-to-date on matters pertaining to the welfare of the Institute. Several other distinguished guests accompanied the party and among those introduced to the meeting were Mr. J. A. McCrory, past vice-president of the Institute, Mr. Kenneth Reid, councillor for the Victoria Branch and Mr. J. M. Udell of Montreal.

The sixty members attending had the privilege, after the dinner, of meeting the guests, and thanks for the excellent arrangements were expressed to J. P. Fraser, vice-chairman of the Branch, and to Alan Eyre, secretary. Cigars were furnished by Mr. Pybus on the occasion of yet another addition to the long line of his descendants.

PRESIDENT AND MRS. HAYES VISIT VANCOUVER

Chairman Ralph Pybus and the president.

The executive meets with the president.

Left to right: Arthur Scott, Mrs. Hayes, " Dutch " MacPherson, Ralph Pybus and Norman Sherman.

Left to right: P. H. Stroyan, " Dutch " MacPherson, Gordon Stirrett, and the general secretary.

SASKATCHEWAN BRANCH

D. W. Houston, M.E.I.C. - - *Secretary-Treasurer*
Stewart Young, M.E.I.C. - - *Branch News Editor*

A special meeting of the Saskatchewan Branch, was held in the King's Hotel, Regina, on Friday evening, June 7, 1946, to meet President J. B. Hayes. Accompanying Mr. Hayes were General Secretary L. A. Wright and Councillor G. J. Currie, Halifax. The meeting was preceded by a dinner at which forty-five members were in attendance.

Prior to his address, President Hayes presented the Duggan Medal and Prize of the Institute ($100) to H. L. Lexier, Regina. Mr. Lexier, a graduate in mechanical engineering of the University of Minnesota, was awarded the medal for his paper on "Metallurgy and Machine Design."

The president, in his address, dealt with conditions in Halifax during the war, describing the difficulties which had to be overcome in adapting port facilities for wartime purposes. He gave his audience a word picture of some of the great battleships that steamed in and out of the harbour.

G. J. Currie conveyed greetings both from the Halifax Branch of the Institute and from the Association of Professional Engineers of Nova Scotia and extended a cordial invitation to attend the Maritime Professional Meeting to be held in Digby, N.S., next September.

Dr. L. A. Wright, gave an outline of activities of the Institute generally, and of the Council, dealing in particular with the Harry Bennett Educational Fund. After explaining the purpose of the fund he advised that substantial progress had been made towards the objective of $25,000, one branch more than trebling its quota.

On Saturday afternoon, Mrs. J. B. Hayes was guest of honour at a tea in the Isabella Room, Hotel Saskatchewan, attended by the wives of the members. Receiving with Mrs. Hayes were Mrs. F. E. Estlin, wife of the chairman of the Branch, Mrs. H. S. Carpenter and Mrs. L. A. Thornton. The tea table was centered with a bouquet of vari-coloured sweet peas and Mrs. D. A. R. McCannel, Mrs. J. W. D. Farrell, Mrs. H. Ross MacKenzie and Mrs. Stewart Young presided. Mrs. M. J. Spratt was in charge of the arrangements and, seeing to the pleasure of the guests were Mrs. A. P. Linton, Mrs. D. W. Houston and Mrs. J. G. Schaeffer. Mrs. G. L. MacKenzie, Mrs. A. H. Douglas, Mrs. R. W. Jickling and Mrs. H. L. Roblin served.

THE PRESIDENT AT REGINA

The president presents the Duggan Medal of the Institute to H. L. Lexier.

VICTORIA BRANCH GREETS PRESIDENT AND MRS. HAYES

Chairman S. R. Weston with Mrs. Hayes on his left and the president on his right, followed by Mrs. Weston, "Skip" Currie, and Mrs. R. C. Farrow.

East meets west. Councillor Reid of Victoria presents Councillor Currie of Halifax with some salt water from the Pacific in return for the same commodity brought by Mr. Currie from the Atlantic.

Mr. and Mrs. John Galbraith of Toronto are central figures in this shot.

Serious business.

Library Notes

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

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

A.S.M.E. Mechanical Catalog and Directory; 35th Annual Volume, 1946:

N.Y., American Society of Mechanical Engineers, 1945. 824 pp., illus., fabrikoid.

Le Bois; Matériau de la Construction Moderne:

J. Campredon. Paris, Dunod, 1946. 153 pp., illus., paper.

Civil Engineer's Pocket-Book:

John C. Trautwine. Philadelphia, Claxton, Remsen & Haffelfinger; London, Trubner, 1874. 849 pp., illus., leather. (Presented to the Library by H. B. Dickens, M.E.I.C.)

Electronics in Industry:

George M. Chute. N.Y. and London, McGraw-Hill, 1946. 461 pp., illus., cloth.

Heating and Ventilating for Architects and Builders:

R. K. Cornell. London, Paul Elek, c1946. 56 pp., illus., cloth.

Job Evaluation Methods:

Charles Walter Lytle. N.Y., Ronald Pr., c1946. 329 pp., illus., cloth.

Laying Out for Boiler Makers and Plate Fabricators; 5th ed rev.:

Edited by George M. Davies. N.Y., Simmons-Boardman, c1944. 522 pp., illus., cloth.

Métrologie Générale; Grandeurs et Unités:

Maurice Denis-Papin and Jacques Vallot. Paris, Dunod, 1946. 428+45 pp., illus., fabrikoid.

Modern Plastics Encyclopedia, 1946:

N.Y., Plastics Catalogue, c1946. 1,389 pp., illus., cloth.

Moteurs D'Avions:

R. Marchal, Préface de P. Dumanois. Paris, Dunod, 1946. 2 volumes, illus., paper.

Principles of Physics; Volume 2—Electricity and Magnetism:

Francis Weston Sears. Cambridge, Mass., Addison-Wesley Pr., 1946. 434 pp., illus., cloth.

Rights of Trains; a Complete Analysis of Single Track Standard Code Rules; 3rd ed rev.:

Harry W. Forman. Revised by Peter Josserand. N.Y., Simmons-Boardman, c1945. 561 pp., illus., cloth.

Scientific Societies in the United States:

Ralph S. Bates. N.Y., Wiley; London, Chapman & Hall, c1945. 246 pp., cloth.

Story of the Helicopter:

Devon Francis. N.Y., Coward-McCann; Toronto, Longmans, Green, c1946. 182 pp., illus., cloth.

PROCEEDINGS, TRANSACTIONS, ETC.

American Society of Mechanical Engineers:

Transactions, Volume 67, 1945.

Canadian Institute of Mining and Metallurgy; and The Mining Society of Nova Scotia:

Transactions, Volume 48, 1945.

TECHNICAL BULLETINS, ETC.

American Public Works Association. Standard Specifications for Public Works Construction:

G—Bituminous Pavements: G1-46—Sheet Asphalt Pavement. G2-46—Bituminous Macadam Pavement. G3-46—Asphaltic Concrete Pavement. G4-46—Cold Laid Asphaltic Concrete Pavement.

American Society of Civil Engineers. Manual of Engineering Practice:

No. 27—Pile Foundations and Pile Structures. Prepared by the Joint Committee on Bearing Value of Pile Foundations of the Waterways Division, Construction Division, and Soil Mechanics and Foundations Division. Adopted January 18, 1946.

Codes of Practice Committee. British Standard Code of Practice:

CP (B) 542—Painting, Staining and Varnishing Wood and Treatment with Preservatives. CP (B) 543—Cement Bitumen Mixtures for Flooring (Tentative). CP (B) 549—Provision of Electric Lighting in Dwellings. CP (B) 559—Decoration-Painting. CP (B) 560—Private Electric Generating Plant. CP (B) 582—Installation of Gas Heated Appliances for Laundering and Ancillary Domestic Purposes.

Electrochemical Society. Preprints:

89-17—Sodium Hexametaphosphate as a Corrosion Inhibitor for Ottawa Tap Water, by Morris Cohen. 89-18—Technology of Germanium, by Robert I. Jaffee, E. W. McMullen and Bruce W. Gonser. 89-19—Preparation of Berullium Powder, by Jack M. Tien. 89-20—Electrowinning of Chromium from Trivalent Salt Solutions, by R. R. Lloyd, W. T. Rawles, and R. G. Feeney. 89-21—Electron Emission and the Photovoltaic Effect; Study of the Photovoltaic Effect for the Electrode: Solution of Sodium in Liquid Ammonia, by A. L. Ferguson and G. H. Kissin. 89-22—Reaction of the Leclanché Dry Cell, by L. C. Copeland and F. S. Griffith. 89-23—Corrosion in Crevices, E. H. Wyche, Lorraine R. Voigt, and F. L. La Que. 89-24—Transference Number of Nickel in a Nickel Sulfate Solution, by C. J. B. Zitek and H. J. McDonald. 89-25—Acidic Atmosphere Evaluation of Cleaning on the Corrosion of Steel, by Chester W. Smith. 89-26—Control of Sulfur in Electrolytic Manganese, J. Koster. 89-27—Passivation of Stainlsss Steel, by E. M. Mahla and N. A. Nielsen. 89-28—Corrosion Tests of Multi-Arc Welded High-Strength Aluminum Alloys, by Loren W. Smith. 89-29—Ductile Zirconium from Zircon Sand, W. J. Kroll, A. W. Schlechten, and L. A. Yerkes. 89-30—Effect of Working on the Physical Properties of Molybdenum, by J. W. Marden and D. M. Wroughton.

Institution of Mechanical Engineers. Advance Papers:

Boiler Installations on the Continent, and Future Problems, by J. H. Bock.
. . . Centrifugal Pumps—an Alternative Theory, by H. H. Anderson.
. . . Conference on Machinability. (Symposium.)
. . . Efficiency and Cavitation of Fluid Machines, by H. H. Anderson.
. . . Mechanical Principles of the Screw Extrusion Machine, by Z. Rogowsky.
. . . Nomenclature of the Cutting Edge, by Max Kurrein and F. C. Lea.
. . . Some Comments on the Improvements in the Thermal Efficiencies of Non-Reheating Plants at Higher Operating Conditions, by J. R. Finniecome.
. . . Theoretical Investigation into the Porting of a Two-Cycle High Mean Effective Pressure Internal Combustion Engine, by George Parker.
. . . Transfer Moulding, by M. Freund.

Instituto Nacional de Tecnologia. Publications:

No. 95—A Bomba Atomica, B. Gross.

Iowa Engineering Experiment Station:

Bulletin 161—Tire Wear and Cost on Selected Roadway Surfaces, by R. A. Moyer and Glan L. Tesdall. Ames, Iowa State College Bulletin, 1945.

North-East Coast Institution of Engineers and Shipbuilders. Advance Paper:

Two Aspects of the Dynamic Launching Problem, by Cedric Ridgely-Nevitt, and Arthur R. Anderson. May 3, 1946.

Princeton University. Industrial Relations Section. Selected References:

No. 9, May, 1946.—National and Regional Collective Bargaining.

Road Research Laboratory. Library Bibliography:

No. 31B/JMW, May, 1946. British Specifications and Codes of Practice for Roads and Bridges, Materials, and Methods of Test.
. . . No. 50, May, 1946. Selected List of British and American Books on Roads, Aerodromes, and Bridges.

Statens Kommitté for Byggnadsforskning. Meddelanden: (State Committee for Structural Research. Bulletin.)

Nr 1, 1945—Byggnadsforskningen i Sverige; En Sammanstallning, by Nils Tengvik. Nr 2, 1945—Mekaniserad Bostadsproduktion; Enoch Tvavaningshus, by Erik Friberger. Nr 3, 1945—Vridning och Vridningsinspanning vid Betongkonstruktioner (Torsion and Torsional Restraint by Concrete Structures), by Henrik Nylander. Nr 4, 1946—Byggnadskostnader och Byggnadsmaterialmarknader; Studier Rorande utvecklingen i Sverige, by Harald Dickson.

Universal Oil Products Company. U.O.P. Booklet:

No. 260—Ignition Accelerators for Compression-Ignition Engine Fuels, by J. S. Bogen and G. C. Wilson. (Reprinted from Petroleum Refiner, July 1944.)

University of Minnesota. Engineering Experiment Station. Bulletin:

No. 24—Factors Affecting Heat Transmission Through Insulated Walls, by F. B. Rowley and Clarence E. Lund.

PAMPHLETS, ETC.

Alberta Oil Review for 1945:
J. L. Irwin. Edmonton, Dept. of Economic Affairs, 1946.

Aviation in Poland; a Brief Historical Outline:
Edited by Peter Jordan. London, MaxLove, 1946.

Building the Holston Ordnance Works:
Harry Englander, N.Y., Fraser-Brace Engineering Co., 1946.

Effect of Heat Treatment on the Endurance Limit of Alloyed Gray Cast Iron:
T. E. Eagan. (Preprint No. 46-38. American Foundrymen's Association, May 1946.)

Films on Scientific Subjects; a Partial list including Physics, Chemistry, Mining and Engineering, Astronomy and Geology:
Ottawa, National Film Board of Canada, February, 1946.
. . . Supplement No. 1, April, 1946.

Housing Problem:
An address delivered before the Montreal Kiwanis Club, May 23, 1946; P. C. Armstrong. Montreal, 1946.

Institute of Industrial Administration:
Certificate Examinations (Group Course); Syllabuses, General Arrangements, January, 1946.
. . . Education for Management, by L. Urwick. (Reprinted from Technical Journal, February, 1946.)
. . . Institute Awards, 1946.
. . . Reading Course for the Examinations of the Institute of Industrial Administration; revised January, 1946.
. . . Rules for Examination and for Submission of Theses. April, 1946.
. . . Two Years' Certificate Group Course of Technical Institutions in Foremanship and works Supervision; revised January, 1946.

International Labour Organization:
27th Session of the International Labour Conference, Paris, October 1945; International Maritime Preparatory Technical Conference, Copenhagen, November, 1945; Industrial Committees on Coal and Inland Transport
Ottawa, King's Printer, 1946. (Printed as a Supplement to the Labour Gazette, December, 1945.)

Joint National Conference of the Construction Industry of Canada:
Proceedings, Ottawa, February, 1946. (Reprinted from the Labour Gazette, March, 1946.)

Operations of the Consolidated Mining & Smelting Co. of Canada, Ltd.:
A series of Articles: John B. Huttl. (Reprinted from Engineering and Mining Journal, April-September, and November, 1938.)

Production of Ammonium Sulphate from Coke Oven Gas:
Frans Wethly. (Reprinted from Blast Furnace and Steel Plant, August, 1945.) (Bound in with:

Recent Improvements in Coke Oven Design and Operation:
Louis N. Wilputte and Frans Wethly. N.Y., Wilputte Coke Oven Corp., 1946.

What Price Supervision; How Management can Build a Stronger Supervisory Force:
R. D. Bundy. N.Y., National Foremen's Institute, c1946.

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.

ARCH DESIGN SIMPLIFIED:
W. A. Fairhurst. London, Concrete Publications Ltd., 1945. 61 pp., illus., 9½ x 6¾ in., cloth, 12s.

A text-book on the rapid and economical design of arch bridges, including 33 tables and illustrative designs. The tables provided are based on economical arch curves and variation of cross section. A calculation chart has also been designed to enable the work to be carried out in a systematic way. The tables are based on arch curves set out to coincide with the pressure line for dead loading plus half the distributed live load (Ministry of Transport equivalent load standard), but with suitable precautions they may be used for arch curves set out for dead load only.

The book is divided into the following four parts: Part I—Arch Curve; Part II—Tables for Arch Design; Part III—Design of a Filled-Spandrel and an Open-Spandrel Arch; Part IV—Derivation of Formulae.

BUSINESS JOURNALISM; Its Function and Future:
Julien Elfenbein. New York and London, Harper, c1945. 341 pp., illus., 8½ x 6 in., cloth, $4.00.

This book was designed to serve as a text-book in schools of journalism, marketing, and business administration. It is divided into two parts.

In Book One the author defines the field of the Businesspapers giving the background of industry served, and shows the relation between the marketplace and the business press and also the relation between the trade associations and the business press. He outlines the development of the trade press and the flowering of the specialized press.

In Book Two the author deals with the organization of a Businesspaper publishing business and describes the functions of the publisher, the advertising sales manager, the circulation sales manager, the sales promotion manager, and the editor. In the concluding chapter the future of Business Journalism is developed.

The six appendices included consist of: I—American Businesspaper, before 1900; II—Agenda of Three Wartime Washington Conferences; III— Functions of Businesspaper Advertising; IV—Editorial Style Manual for Businesspapers; V—Outline of Exact Duty Specifications on a Large Businesspaper Editorial Staff; VI—Terminology: Technical Terms, Abbreviations, and Journalese.

HIGH VACUUM TECHNIQUE; Theory, Practice, Industrial Applications, and Properties of Materials; 2d ed. rev.:
J. Yarwood. New York, Wiley; London, Chapman & Hall, c1945 140 pp., illus., 9¼ x 6 in., cloth, $2.75.

This work introduces the latest developments in apparatus, describes important industrial processes, and attempts to bring together in one volume the diverse facts regarding the relevant properties and uses of materials encountered in all types of vacuum work. At the same time the standard technique is described to give logical sequence to the text so that the physics student can appreciate the theory and practice of the art.

A considerable enlargement in the second edition of this monograph has been undertaken in order to amplify those sections considered to be most directly useful to the technician, with special emphasis on the most recent work. The new sections included deal with the performances of vacuum pumps, the construction of vacuum systems, and extra methods of measuring low pressures, and pumping speed. In addition, those parts of the text discussing the oil-diffusion pump, gas-filled tubes, and the properties of materials have been increased in size and rearranged. Twenty-six new diagrams appear in this edition, and also a bibliography dealing exhaustively with the most important papers that have appeared in connection with the technique. Some corrections of the former text have been made.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

AMERICAN MACHINISTS' HANDBOOK and Dictionary of Shop Terms:
By F. H. Colvin and F. A. Stanley. 8th ed. rev. & enl. McGraw-Hill Book Co., New York and London, 1945. 1546 pp., diagrs., charts, tables, 7 x 4 in., cloth, $5.00.

This standard reference work for the machinist, toolmaker, and designer of machine parts provides a comprehensive collection of useful tables and data. The various phases of machine-shop work are covered thoroughly, including screw threads, gearing, measuring and fitting. Additional chapters are devoted to metals and other materials, knots and slings, shop trigonometry, and railroad shop data. There is a seventy-page illustrated dictionary of shop terms.

American Society for Testing Materials, 1944 Supplement to the BIBLIOGRAPHY and ABSTRACTS on ELECTRICAL CONTACTS:
Prepared by Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys, American Society for Testing Materials, Philadelphia, Pa., 1945. 30 pp., 9 x 6 in., paper.

The original "Bibliography and Abstracts on Electrical Contacts", published in 1944, covered the period from 1835 to 1942. This first supplement contains some eighty items within that period which had not previously been included, and carries on through 1943 into 1944. As before, an author and subject index are provided. A wide range of material is considered, and the abstracts are extensive enough for adequate determination of the particular value of the original articles.

Le BOIS, Matériau de la Construction Moderne:
By J. Campredon, preface by M. Leloup. Dunod, Paris, 1946. 153 pp., diagrs., charts, tables, 8¼ x 5¼ in., paper, 240 frs.

The author first deals with the structure and physical properties of wood. He then describes various methods of treatment of wood to increase its value as a structural material, such as impregnation, compression and lamination. The last section covers the new uses for which wood has been made available, such as built-up beams, and sections formed by the application of heat and pressure.

ELECTRIC CIRCUITS and MACHINES, an Introduction to Practical Electricity:
By E. C. Lister, McGraw-Hill Book Co., New York and London, 1945. 358 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.50.

(Continued on page 462)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

June 29th, 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 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 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

DAMECOUR—CHARLES, 419 Belanger St., Montreal, Que. Born at Montreal, April 12th, 1921. Educ.: B.Eng., (Mech.), McGill, 1943; 1941, (6 mos.), tool designer, Canadian Vickers Limited; 1943 to date, Lieut., R.C.E.M.E.

References: R. H. Patten, R.B. Killam, J.A. Coote, A.E. Bowden.

DAVIS—JOHN CASWELL, of Winnipeg, Man. Born at Montreal, Que., August 19th, 1888. Educ.: B.Sc., McGill Univ., 1912; R.P.E., Manitoba; 1912-30, design and instaln. of automatic fire protection equipt., Grinnell Co. of Canada, Ltd.; 1931 to date, president and mgr., J. C. Davis Ltd., design and instln. automatic fire protection equipt., Winnipeg, Man.

References: T. H. Kirby, D. M. Stephens, E. V. Caton, W. D. Hurst, C. V. Antenbring, N. M. Hall.

DOHERTY—THOMAS BEATTY, 150 Cecil St., Sarnia, Ont. Born at Sarnia, Ont., June 7, 1913. Educ.: B.Sc., (Chem. Engrg.), Queen's, 1936; S.M., (Chem Engrg.), M.I.T., 1938; with Imperial Oil Limited, Sarnia, as follows: 1934-35, (summers), tech. & research dept., 1938-39, dfting. dept., 1939-40, process engrg., development dept.; 1940-45, Lieut., R.C.E.; 1945 to date, engineer, process & development dept., Imperial Oil Limited, Sarnia, Ont.

References: G. W. Christie, R. W. Dunlop, G. L. Macpherson, A. Russell, C. P Warkentin, W. A. Williams.

EASTWOOD—GEORGE GARNET McDONALD, of Cornwall, Ont. Born at Cornwall, Ont., April 24th, 1913. Educ.: B.A.Sc., Toronto, 1937; R.P.E., Ontario; with Canadian Westinghouse, as follows: 1937-39, apprentice course, 1939-40, elect. dftsman, switchboard layout, 1942-45, same work, and handling important war orders for Army, Navy and Air Force; 1945 to date, elect. engr., asst. to chief engr., responsible for all elect. equipt., Courtaulds (Canada) Limited, Cornwall, Ont.

References: D. Ross-Ross, D. W. Callander, H. A. Gooch, A. A. Moline. E. J Bartley.

HARRISON—WILLIAM EDWIN, 516 London Road, Sarnia, Ont. Born at Parkhill, Ont., Dec. 23, 1907. Educ.: B.Sc., (Mech.), Queen's, 1930; 1930-37, engrg. & sales, Bailey Meter Co., Cleveland, Ohio & Montreal; with Imperial Oil Limited, Sarnia, as follows: 1937-42, instrument dept., 1942 to date, chief instrument engr., i/c instrument dept.

References: G. W. Christie, F. F. Dyer, J. P. Heatley, J. W. MacDonald, H. B. Thompson, W. A. Williams.

KJERSGAARD—HUGO, 3442 Durocher St., Montreal. Born at Frederikshavn, Denmark, Nov. 5, 1900. Educ.: Den Polytekniske Laereanstalt (Danmarks Tekniske Hojskole); in 1923, passed first part of exam., and in 1925, passed preparatory tests of second and last part of exam. for grade of civil engr.; 1927, Tracer-Sanderson-Parker, consultg. engrs.; design engr., Wilson & Kearns, Montreal, consultg. engrs.; 1934-37, mech. dftsman., Canadian Industries Ltd.; with the preceding, a gradual gain of experience, in theoretical & practical problems within field of heating & ventilation; 1937 to date, Walter J. Armstrong, consultg. engr., Montreal, as asst. mech. engr., specializing in steam generating plants, heating, air conditioning, plumbing & all associated work, i/c of mech. work in Mr. Armstrong's absence, responsible for dealing with clients & contractors, write specifications, supervise & approve work in field, plan & design new work, advise, check & instruct dfting. room staff in connection with calculations & woork on dfting. boards, etc.

References: R. K. Rybka, J. A. Kearns, R. L. Meek, L. B. McCurdy, V. Jepsen, H. C. Johnston, A. B. McEwen.

LYONS—MANSON AINSLIE, 322 Linwood St., St. James, Man. Born at Delhaven, N.S., Nov. 14th, 1879. Educ.: S.B. (Civil Engrg.), M.I.T., 1910; R.P.E., Manitoba; 1910-14, rodman, transitman, Halifax and Eastern Rly.; 1910-11 large valve design, Neponset, Mass.; 1911-12, transitman on irrigation work and rly. location, C.P.R.; 1912-14, instru'man., various drainage work, Prov. of Man.; 1912-36, chief engr., Good Roads Board, Man., bridge design, highway location and constrn; 1936-40, Asst. Deputy Minister of Public Works and Highway Commission, Prov. of Manitoba, and from 1940 to date, Deputy Minister.

References: W. P. Brereton, J. W. Sanger, F. V. Seibert, G. E. Cole, W. M. Scott, C. H. Attwood.

MAGGS—PERCY JAMES, Wetaskiwin, Alta. Born at Liskeard, Cornwall, England, Aug. 12th, 1901. Educ.: B.Sc., Eng., City and Guilds College, London, 1926; R.P.E., Alta.; with British Thompson-Houston Co., Rugby, Eng., as follows: 1920-24, apprentice, 1926-27, elect. heating design engr.; with Calgary Power Co., as follows: 1928-29, elect. constrn., 1929-30, waterworks constrn., 1930-41, waterworks supt.; 1941-45, Active Service, R.C.E.; 1945 to date, waterworks supvisor, Calgary Power Co., Ltd., Westakiwin, Alta.

References: H. B. Sherman, H. Randle, J. McMillan, D. A. Hansen, P. L. Debney

McBRIDE—JAMES MONTGOMERY, Calgary, Alta. Born at Prince Albert, Sask., July 25, 1922. Educ.: B.Sc., (Elect.), Alberta, 1944; 1941, (5 most), survey for Calgary Power Co., 1943; Instructor, R.C.N. Naval. Elect. Artificers' Course at Univ. of Alta.; 1943, Active Service at Sea; 1944, Graduated with degree of B.Sc., (Elect.), Alberta, and returned to Active Service, 1945, (3 mos.), elect. engr., Canada Packers, Edmonton; 1946 to date, sales engr., Electrical Contracting and Machinery Co., Calgary, Alta.

References: P. F. Peele, W. L. Crook, I. F. Morrison, J. E. B. Cranswick.

SMITH—ROY HAMILTON, Sarnia, Ont. Born at Durham, N.S., Sept. 20th, 1898. Educ.: B.Sc. (Chem. Engrg.), McGill, 1921; summer course in petroleum, engrg., M.I.T., 1931; R.P. E., Ontario; with Imperial Oil Limited, as follows: 1923-26, lab. supvr., experimental work on new process for lubricating oils, design, engrg. & operation of new Lube oil plants, 1926-27, chief chemist, Ioco refinery, 1927-28, refinery supt., Colombia, S.A., 1928 to date, engrg. & development dept., Sarnia. During this latter period, 1942-44, advisory to Polyner Corp. on synthetic rubber plant design, engrg. & constrn.

References: G. L. Macpherson, T.Montgomery, C. P. Warkentin, G. W. Christie J. W. MacDonald, R. W. Dunlop.

TESKEY—ROBERT HUGH, of Black Diamond, Alta. Born at Carmangay, Alta., Oct. 8th, 1922. Educ.: B.Sc., (Chem.Engrg.), Alberta, 1944; 1944, (part), jr. field engr., Alta., Petroleum & Natural Gas Conservation Board; 1944 to date, chemical engr., Madison Natural Gas Co., Black Diamond, Alta.

References: H. LeM. Stevens-Guille, J. W. Young, R. G. Laird, G. D. Phelps, F. K. Beach.

WILLIAMS—DONALD DRYSDALE, 359 Laurier Ave., W., Montreal 8, Que. Born at Montreal, Sept. 30th, 1919. Educ.: B.Eng., (Mech.), McGill, 1941; 1941-43, responsible for scheduling prod. of steel castings, procuring material from outside suppliers, Dominion Engineering Works, Lachine, Que.; 1943-45, R.C.N.; 1945 to date, design engr., responsible for design of steam plant extension, and i/c steam services for new steam dist. system at Courtaulds.

References: J. G. Notman, C. A. Robb, R. A. Rankin, A. R. Roberts, J. D. Young

WYMAN—RUSSELL ASQUITH, of Arvida, Que. Born at Winnipeg, Man., August 20th, 1912. Educ.: B.Sc., (General Course), Manitoba, 1934; extension work (reading) at Universities of Minnesota, Northwestern & Toronto (no degrees); tour of mines in western U.S.; 1931-37, sampler, Gabrielle Mines Ltd., supvr. of surface exploration, Smelter Gold Mines Ltd.; sub-chief, Canadian Geological Survey; assayer, geologist, mill supt., Tashota Goldfields Ltd., 1937, assayer, Phoenyx Molybdenite Ltd., Hard Rock Gold Mines Ltd.; 1937-41, engr., Hewmont Mining Corp.; 1941 to date, engr., Demerara Bauxite Co., Ltd., supv., ore plant dept., Aluminum Co. of Canada, and research engr., Arvida, Que.

References: B. E. Bauman, M. L. Carey, J. F .Braun, F. T. Boutilier, G. M. Mason, H. R. Fee.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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, to act as technical assistant in handling patent matters in industrial concern, operating or research experience in chemical manufacturing. Under 30 years. Salary \$190-\$240, depending on experience. Apply to File No. 3336-V.

CHEMICAL ENGINEER, recent graduate, with aptitude for sales work, is required by an industrial organization in Montreal. Apply to File No. 3537-V.

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. Salary open. Apply to File No. 3549-V.

CIVIL

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 ENGINEER with considerable experience is required by a Montreal firm for work in construction of radio stations. Salary from \$225. Apply File No. 3506-V.

CIVIL ENGINEER, recent graduate, required by a firm of consulting engineers in Montreal, to assist Engineer in charge of field work in Ont. Salary \$175 up. Apply File No. 3518-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 with experience as structural designers and draughtsmen are required by an engineering firm in Montreal. Salary from \$300—\$400 according to experience. Apply File No. 3520-V.

CIVIL ENGINEER to be town engineer of a town in Southern Ontario. Salary according to qualifications. Apply File No. 3527-V.

CIVIL ENGINEER to take charge of project engineering required by a firm of industrial engineers in Quebec. Should be bilingual and have experience in heavy construction. Salary according to capacity. Apply File No. 3531-V.

CIVIL ENGINEER with road construction experience required as assistant to county engineer in Central Ontario. Salary \$4000 plus travelling expenses. Apply File No. 3533-V.

CIVIL ENGINEER with paper mill experience for a pulp and paper company in the Lake St. John area. Salary from \$225. Apply to File No. 3548-V.

ELECTRICAL

ELECTRICAL ENGINEER, graduate, young man with at least one year of construction experience since graduation, bilingual, is required for work in connection with the erection of wood pole, steel tower transmission lines and sub-stations in various parts of the province of Quebec. Apply to File No. 3332-V.

ELECTRICAL DESIGNER for an industrial plant in the Montreal area, power and lighting layouts, from recent graduates up, probably permanent position, salary from \$200 according to qualifications. Apply File No. 3504-V.

ELECTRICAL ENGINEERS, preferably experienced for sales and service of motors, transformers, control equipment, etc., with an industrial firm in Montreal. Salary according to qualifications and ability. Apply File No. 3512-V.

ELECTRICAL DRAUGHTSMAN with considerable experience in industrial light, heat and power layouts is required by a consulting engineer in Montreal. Salary from \$200 according to experience. Apply File No. 3528-V.

MECHANICAL

MECHANICAL ENGINEER, graduate with 4 or 5 years' experience in heating and ventilating layouts is wanted by a consulting engineer in Montreal. Apply File No. 3243-V.

MECHANICAL DRAUGHTSMAN is required in Montreal by a firm engaged in the manufacture of conveyors, crushers, elevators, etc. Applicants should be 25-40. Salary according to experience. Apply File No. 3276-V.

MECHANICAL ENGINEER familiar with power plants and equipment, boilers and stoker operation to take charge of well established business in Ontario and Quebec. Give age, experience, married or single. Apply File No. 3515-V.

MECHANICAL ENGINEER with considerable industrial experience is required for the staff of a firm of consulting engineers in Montreal. Salary about \$250. Apply File No. 3525-V.

MECHANICAL ENGINEER, to assume charge of factory maintenance staff and help design new machines and develop new ideas in conjunction with research and methods departments, wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from \$250. Apply File No. 3538-V.

MECHANICAL DRAUGHTSMAN with over five years experience in piping layout and similar work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

MECHANICAL ENGINEER, age 35-40, with considerable experience in the design of heavy construction equipment, required by a machinery maker in central Ontario. Salary from \$350 according to experience. Apply to File No. 3541-V.

MECHANICAL ENGINEER with at least five years industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary \$275-\$325. Apply File No. 3553-V.

MECHANICAL ENGINEER, recent graduate, for the engineering staff of a pulp manufacturer in Eastern Quebec. Apply to File No. 3547-V.

MECHANICAL ENGINEERS 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.

MISCELLANEOUS

PLANT ENGINEER either mechanical, civil or electrical graduate, basic experience of 2 to 3 years. To take charge of plant, equipment and machinery, age 25 to 30, preferably married, travelling may be necessary. Apply to File No. 3217-V.

INSTRUCTIONAL STAFF in physics and mathematics are required for a university in the Maritimes. Apply to File No. 3432-V.

DESIGN ENGINEER with several years experience in the pulp and paper industry, required for machine layout, piping, etc., by a paper company in the St. Maurice Valley. Possibility of permanent employment. Salary about \$300. Apply to File No. 3452-V.

FORESTRY ENGINEER graduate, 25 to 35 years, required by a large paper company in the Prov. of Quebec. Good opportunity for advancement. Salary open. Apply to File No. 3462-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-V.

GRADUATE ENGINEER with practical experience in plant layout and installation of equipment required for a mining and industrial plant. Veteran preferred. Salary from \$200-\$250. depending on experience. Apply to File No. 3510-V.

INSTRUCTORS for teaching duties beginning with the session 1946-47. Applicants should be engineering graduates from recognized universities. The grades required will be assistant professors, lecturers and demonstrators in civil and mech. engineering. Salaries will depend on experience and general qualifications. Apply to File No. 3516-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.

GRADUATE ENGINEERS with experience in mechanical and chemical process layouts are required by an engineering firm in Montreal. Salary from \$300-400 according to experience. Apply to File No. 3520-V.

COMBUSTION ENGINEER for sales and service with a coal distributing firm with headquarters in Montreal. Salary open. Apply to File No. 3522-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 qualificatons. Apply to File No. 3524-V.

INDUSTRIAL ENGINEER, bilingual, with considerable experience, is required by a firm of industrial engineers in Quebec. Salary according to capacity. Apply to File No. 3531-V.

SALES ENGINEER, recent graduate, required by a Montreal firm for sale of machinery and supplies, tool steels, etc., in Western Canada. Experience not essential Salary plus commission. Apply to File No. 3534-V.

SENIOR DRAUGHTSMAN is required immediately by a Calgary and Turner Valley Oil Company. Work will be mainly geological draughting. Single man preferred. Salary dependant upon qualifications. Apply to File No. 3536-V.

CHEMIST OR RESEARCH ENGINEER, to take charge of Control Development and Research staff. Must have supervisory ability and be able to show results. Wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from \$200. Apply to File No. 3538-V.

DESIGN ENGINEER with several years experience in hydro-electric work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

JUNIOR ENGINEER OR DRAUGHTSMAN, preferably with experience in the design of heating and ventilating layouts, required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3545-V.

CIVIL OR MECHANICAL ENGINEER with experience in municipal engineering required as Assistant Supt. of Waterworks, Saskatchewan City. Salary dependent on experience and qualifications. Apply to File No. 3546-V.

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

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

CHEMICAL

CHEMICAL ENGINEER with soms pulp and paper experience required for ths technical department of a paper mill in Lake St. John area. Apply to File No. 3470-V.

CIVIL

CIVIL OR MECHANICAL ENGINEER, not necessarily a graduate, age 24-30, some experience in concrete and steel draughting, some sales ability, required to work with a consulting engineer and contractor in Montreal. Salary open. Apply to Box No. 3339-V.

TWO CIVIL ENGINEERS, preferably but not necessarily graduates, are required to act as structural steel draughtsmen or checkers for a company engaged in this sort of work in Alberta. All applications should indicate education, experience and salary expected. Apply to Box No. 3365-V.

CIVIL ENGINEER with five to ten years experience in reinforced concrete design is required by a firm of consulting engineers in Montreal. Salary open. Apply to Box No. 3387-V.

TWO CIVIL ENGINEERS are requirsd to act as senior and junior structural designer respectively with a steel company in southern Ontario. Salary open. Apply to Box No. 3389-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programms in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 psr year for junior position. Apply to Box No. 3394-V.

CIVIL ENGINEER graduate with several years experience in construction work, preferably bilingual is required by a construction company in Montreal to take chargs of a project as resident engineer in Quebec. Salary open. Apply to Box No. 3421-V.

CIVIL ENGINEERS with construction experisnce for field work on contracts with a firm of Montreal contractors. Salary open. Apply to File No. 3437-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in the Montreal area. Apply to File No. 3446-V.

CIVIL ENGINEER with experience on foundations, steel work and erection of plant. Preferably R.P.E. in B C. Required for construction work on B.C. coast. Salary according to qualifications. Apply to File No. 3448-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 with executive experience for position of Town Manager in progressive New Brunswick town. Good salary to right man. Apply in writing giving full details qualifications and experience. Apply to File No. 3481-V.

CIVIL ENGINEER DRAUGHTSMAN, age 25-35, for consulting engineer's office near Toronto. Applicant should have some knowledge of municipal sewerage and waterworks problems. Apply to File No. 3489-V.

ELECTRICAL

ELECTRICAL ENGINEER, graduate with some experience in electronics, age 25-35 is required by a company in Montreal at a salary of $250. Apply to File No. 3236-V.

ELECTRICAL ENGINEER with some experience with machinery and/or electrical installation work, with ability to get along with people, and interested in investing some capital, is required for executive work with a small company on the west coast for work in connection with the electrical machinery requirements and installation of lighting and power plants in the province. Salary open. Apply to Box No. 3352-V

TWO ELECTRICAL ENGINEERS with a minimum of four years' experience with commercial radio equipment are required by a firm in Montreal. Applicants must have good personality and ability to meet public. Please do not apply unless qualified. Salary open. Apply to Box No. 3395-V

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 Box No. 3415-V.

ELECTRICAL ENGINEER 5 to 10 years experience on general electrical design wiring of buildings, industrial plants and sub-stations, preferably a graduate, is wanted by a firm of consulting engineers in Montreal. Salary $250-$400 a month. Apply to Box No. 3420-V.

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

ELECTRICAL ENGINEER with some mechanical experience, age 30-35, required for the gas division of a public utility in Western Canada, salary according to qualifications. Apply to File No. 3494-V.

ELECTRICAL ENGINEER with extensive experience as superintendent of entire electrical equipment for a townsite and paper mill in Western Ontario. Salary from $400-$500 according to experience. Apply to File No. 3497-V.

MECHANICAL

GRADUATE MECHANICAL OR AERONAUTICAL ENGINEER with at least five years experience in aircraft, preferably in mfg., must have a fair knowledge of mechanical a/c installation and be familiar with heat and ventilating installations, controls, de-icing, hydraulics and landing gear. Apply to File No. 3300-V.

MECHANICAL ENGINEER, age about 35-40 with experience in thermo-dynamics, mechanical and chemical work is required to be chief engineer of a company in the Toronto area. Preference to ex-service man. Salary about $400-$600. a month. Apply to Box No. 3308-V.

TWO OR THREE MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

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

MECHANICAL ENGINEER with paper mill experience is required to act as assistant mechanical superintendent of a large paper mill located in a city in western Quebec. Salary open. Apply to Box No. 3400-V.

JUNIOR MECHANICAL ENGINEER with some experience on mechanical design. Preference to ex-service men. Salary from $200 to $250. Location Quebec City. Apply to File No. 3401-V.

CHIEF ENGINEER, age 35 to 40, preferably graduate mechanical, with expsrisnce in shop and production planning, running drafting office, etc., and ability to get along with people, is required by a factory in Sherbrooke ,Quebec. Salary $5,000 to $6,000 a year. Apply to Box No. 3410-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three ysars experisnce, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-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, age 35 to 45, preferably married, with good background of shop training and experience in the manufacture of farm machinery. Salary from $350 according to qualifications. Apply to File No. 3463-V.

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 considerable experience in plumbing, heating ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

MECHANICAL ENGINEER, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEER aged 30 to 35, capable of investigating maintenance and conveyors, motors and drives etc. This position includes studies toward improved plant maintenance and will also entail draughting, some routine keeping of records and allied engineering work. Salary $225 to start. Apply to File No. 3477-V.

MECHANICAL ENGINEER, recent graduate, for mechanical draughting work in paper mill in the Lake St. John area. Salary open. Apply to File No. 3478-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

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

MISCELLANEOUS

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in Western Ontario. Salary would be $300 to $350. Apply to File No. 3227-V.

ENGINEER SALESMAN, fluently bilingual, not necessarily a graduate but with some good experience on truck mechanical work and some sales background, age 35-40, is required by an automobile manufacturer for work in the Montreal area. Preference will be given to ex-service men and R.C.E.M.E. and workshop experience would be useful. Salary $250 to $350. Apply to File No. 3266-V.

ENGINEERING ACCOUNTANT, young graduate age 25-35, with engineering background and taste for accounting, is required to act as assistant to the secretary treasur of a manufacturing concern in Montreal. Apply to File No. 3272-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of high grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose photograph to Box No. 3303-V.

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual with some practical experience is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

INSTRUMENTS ENGINEER with five years experience in aircraft construction and installation design, of which at least 2 years should have been specialized as above, is required to act as design group leader for a company in the Montreal area. Apply to File No. 3316-V.

TECHNICAL SALES ENGINEERS are required by an oil company in the Montreal area. Candidates must be bilingual and experience may range from recent graduate up. Salary will be $150-$250 depending on qualifications. Apply to File No. 3320-V.

TWO DRAUGHTSMEN with a minimum of three years draughting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V.

MECHANICAL, ELECTRICAL OR CIVIL ENGINEER, recent graduate who must have fluent knowledge of Spanish, preferably under 30, is required by a firm in the Montreal area for technical work in connection with production. Some travelling. Salary open according to qualifications. Apply to Box No. 3373-V.

DRAUGHTSMAN familiar with reinforced concrete and structural steel is required by a consulting firm in Montreal. Salary open. Apply to Box No. 3387-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Salary open. Apply to Box No. 3406-V.

ENGINEERING SALESMAN with pleasing personality, bilingual, 25 to 35 years old, not necessarily a graduate, but with some engineering background and if possible some knowledge of lubrication is required by a large company in Montreal. Salary open. Apply to Box No. 3422-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

CIVIL AND ELECTRICAL ENGINEERS, age 30 to 40. 5 to 10 years experience, for estimating, design and general engineering for large public utility in Toronto area Apply to File No. 3429-V.

CHIEF DRAUGHTSMAN to take charge of engineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

QUALIFIED DRAUGHTSMAN, thoroughly capable in design and layout of industrial piping, steam, water, air etc. Salary open. Apply to File No. 3435-V.

TWO CIVIL OR MECHANICAL ENGINEERS, recent graduates, preferably ex-service men, are required by a pulp and paper company in the Province of Quebec, to be trained as logging engineers and woods operations supervisors. Previous experience in the woods an asset but not essential. Salary $200 to $225 with board and lodgings. Apply to File No. 3442-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. No. 3443-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.

GENERAL PLANT SUPERINTENDENT, or manager in complete charge, to organize and operate a shipbuilding plant in the Maritimes, with knowledge of both hulls and engines, mainly for repairs and revisions. Salary from $5,000. Apply to File No. 3454-V.

GRADUATE ENGINEERS IN CIVIL, MECHANICAL, ELECTRICAL OR CHEMICAL, from recent graduates up with 2 to 5 years general experience (including overseas service) required for petroleum refinery engineering. Salary according to qualifications. Apply to File No. 3455-V.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

SALES ENGINEER of ability, preferably graduate mechanical, with some experience in marine engineering and sales, to develop sales and applications for a heavy outboard propelling unit for use on heavy inland water transport. Salary from $300 depending on qualifications. Apply to File No. 3457-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal Salary open. Apply to File No. 3482-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-V.

CIVIL OR MECHANICAL ENGINEERS from recent graduates up required for various mills by a pulp and paper firm in Eastern Canada. Salary from $200 according to qualifications. Apply to File No. 3488-V.

STRUCTURAL STEEL ENGINEER with both field and office experience for employment in various parts of Canada as owner's representative on building construction. Salary according to experience. Apply to File No. 3490-V.

DESIGNING ENGINEER preferably with pulp and paper mill experience wanted for a paper mill in Newfoundland. Salary would be from $250-400 depending on qualifications. Apply to File No. 3491-V.

INDUSTRIAL MINERALOGIST, with Ph D. or M.Sc. in geology, mineralogy, chemistry or metallurgy and knowledge of commercial processing of industrial metals, laboratory investigations and publishing of results. Must have at least five years experience with special reference to industrial minerals. Starting salary from $275 in prov. mines dept. Apply to File No. 3492-V.

GEOLOGISTS, with Ph. D. in economic or mining geology and intimate knowledge of structural geology, diamond drilling and geophysical methods. Must have at least five years practical experience, ability to publish results of original investigations and use of aerial photographs. Starting salary from $275. in Prov. Mines Dept. Apply to File No. 3492-V.

MECHANICAL OR CIVIL ENGINEERS required as assistant engineer in Meat Packing firm with plants throughout Canada. Duties to consist of general industrial maintenance work, including building construction, steam, refrigeration and electrical installations. Positions available in Western Canada at salary of $195 to $240 depending on experience. Apply to File No. 3495-V.

MECHANICAL OR ELECTRICAL ENGINEER with at least three years experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $200 according to experience. Apply to File No. 3498-V.

CHEMICAL OR MECHANICAL ENGINEER with construction experience in the chemical field, a knowledge of hydrocarbons and at least five years experience since graduation is required by a chemical firm in Western Ontario. Salary from $250. Apply to File No. 3502-V.

Situations Wanted

CIVIL ENGINEER, age 40, McGill '29, B.Sc., married, experienced surveyor and field engineer, two years on inspection of airfield construction, location immaterial, available on short notice. Apply to File No. 741-W.

CIVIL & MINING ENGINEER M.E.I.C., R.P.E., age 45, married, seeks permanent position with large industrial concern as Maintenance and Construction or Townsite Engineer. Experienced on heavy construction, dams, shafts and tunnels, wharves, buildings, sewers, services, townsite development, general maintenance and administration. Apply to File No. 901-W.

PLANT ENGINEER, graduate, M.E.I.C., age 42, qualified to take responsible charge of layout of plant and equipment, structural and mechanical design and organization of plant maintenance. Wide experience with chemical processes. Have successfully handled skilled and unskilled labour on construction, maintenance and plant operation. Prefer location in Ontario. Minimum salary $5000. per year. Apply to File No. 1621-W.

MANUFACTURING EXECUTIVE, mechanical engineering graduate with twenty years experience in manufacturing, engineering, production control, purchasing, storekeeping, incentive systems, budgets, cost and general accounting is now available. Apply to File No. 1871-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C. Practical experience includes eight years in tool engineering, production engineering and works planning and nine years in plant layout, general machine design and development work of patented mechanical projects. Successful record in responsible and executive positions. Good organizer. Desires either suitable position, or development work based on own patents, with large mechanical manufacutring concern or well established firm of consulting engineers. Apply to File No. 2502-W.

MECHANICAL ENGINEER, Jr. E.I.C., age 23, single, with degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy. Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

MECHANICAL ENGINEER, Jr.E.I.C., single, age 27, graduate Royal Naval Engineering College (Practical Engineering Prize) wishes work of practical nature, mainly outdoor. Interested in operation or construction of steam, hydro or internal combustion machinery. Eight years in R.C.N., including operational, overseeing and instructing. Medical discharge. Seven months on shipyard staff. Prefer to remain near Pacific Coast but would consider temperate climate like New Zealand, South Africa, southern England. Apply to Box No. 2589-W.

ELECTRICAL GRADUATE '46, N.S.T.C., S.E.I.C., 23, single, available upon graduation anywhere in Canada. Interested in electronics, communications, industrial promotion and management. Experience in one of Canada's largest radio manufacturer's test department and electrical draughting. Apply to Box No. 2607-W.

GRADUATE MECHANICAL-ELECTRICAL ENGINEER, 53 years old, with broad background in U.S. and Canada would like position in small or medium-sized organization as assistant to manager in operations but with freedom to do research and development touching any phase of the business. Apply to Box No. 2608-W.

ELECTRICAL ENGINEER, M.E.I.C., P. Eng. (Ont.), available with one month notice or less. Age 44, married, three children. Six months mining engineering experience, three years mechanical experience in large implement factory, supervision since 1940 for Inspection Board of U.K. and Canada of a large staff on inspection of electrical apparatus and equipment. Seeks position with considerable administrative responsibility based on electrical production or maintenance. Able to go anywhere on continent. Apply to Box No. 2614-W.

GRADUATE MECHANICAL ENGINEER, Prof. Eng. (Ont.) Jr.E.I.C., married, age 31. Experience covers machine shop apprentice, engineering design, chemical plant design, field engineer on construction work, plant operation and superintendent in large plants employing modern plant management methods. Past 8 years have been with present employer. Now wishes to make change to smaller company with opportunity of securing position of responsibility. Apply to Box No. 2629-W.

MECHANICAL ENGINEER, Jr. E.I.C., graduate Queen's 1937, age 33, married. Four years with a mechanical control company at design, customer contact, administration and shop liason work. One year with a beverage company at design, development and installation of special machinery and conveyor equipment. Four years with a steel plate fabricator on design, estimating and field work. Desire position as assistant to plant engineer in an established Ontario firm. Available now. Apply to File No. 2641-W.

GRADUATE CHEMICAL ENGINEER, McGill 1946, available immediately. Plant or sales work, single, healthy and ambitious, will travel anywhere. Apply to File No. 2661-W.

GRADUATE MECHANICAL ENGINEER, (Sask. '45) age 24, married, Jr. member of The Society of Naval Architects and Marine Engineers. Experience with moulded plywood, one year general mechanical engineering in processing plant. Good knowledge of yacht design. Require position with a firm connected with the boating industry, plywood, engines, hardware, plastics, etc. Prefer Vancouver location, available August 1st. Apply to File No. 2662-W.

ENGINEER now employed seeks better position; thoroughly bilingual; had many years experience teaching chemistry, mineralogy and geology and demonstrating in connected laboratories. Acted as mining engineer in mineralogy laboratory, writing reports on samples examined and conducting prospectors' classes; also had municipal engineering experience. Age 49; seeks position as executive, town manager, construction superintendent, sales engineer. Veteran of both wars. Apply to File No. 2663-W.

CHEMICAL ENGINEER, S.E.I.C., B.A., B.A.Sc. '44, M. Eng. (McGill), age 26, single, two years experience, desires employment in Research or production control Prefer Quebec and particularly Montreal area. Highest references from former employers. Apply to File No. 2671-W.

CIVIL ENGINEER, M.E.I.C., A.C.I.M., age 33, married, Major R.C.E. Civil experience includes two years building maintenance, three years frame construction, three years application and sales of mechanical equipment. Six years army service mostly on engineer works services. Desires permanent responsible position, plant engineering or light construction. Travel anywhere. Apply to File No. 2674-W.

ENGINEER, Prof. Eng. (Civil), M.E.I.C., thoroughly experienced in structural and mechanical design, estimating and sales work, will undertake worthwhile agency or representation for manufacturer in B.C. Apply to File No. 2687-W.

CHEMICAL ENGINEER, single, age 23, B.E., McGill '46, S.E.I.C. No significant industrial experience. Interested in a position in sales engineering, production or plant control. Services available immediately. Apply to File No. 2688-W.

GRADUATE MECHANICAL ENGINEER, (McGill '45) age 22, single, seeks employment with a Canadian, American or British firm operating in South America. Growing knowledge of Spanish. Experience in construction and aircraft industries, as well as in Royal Canadian Electrical and Mechanical Engineers. Available on one month's notice. Apply to File No. 2690-W.

AIRLINE ENGINEER with degree in Mechanical Engineering (McGill). Eight years' experience with major Canadian and foreign airlines. Has been concerned with practically all technical phases of a major airline operation, including engineering, maintenance, operations, statistics, operating costs, flight testing and training of flight personnel. Administrative experience, 500 hours' experience as flight crew on Trans-Atlantic operation. Age 33. Married, one dependent. Interested in responsible position with major airline or organization concerned with air transportation in general. Apply to File No. 2691-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. Interested in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

ELECTRICAL ENGINEER, B.Sc., M.E.I.C., age 33, single, with experience in sales, purchasing, office management and production control. Very good connections with industrial plants in Ontario and Quebec. Available after July 20th. Location preference: Toronto, Montreal and Hamilton. Apply to File No. 2694-W.

SENIOR CIVIL ENGINEER, M.E.I.C., P.E.Q., with considerable experience in all building construction and specialization in reinforced concrete; seeks first class opening. Able to supervise work and qualified to take full charge of and execute contracts. Apply to File No. 2695-W.

ELECTRICAL ENGINEER, Queen's 1946, S.E.I.C., R.P.E., Ont., S.I. Radio E, veteran of R.C.N.V.R., age 24, completely bilingual, available immediately, will go anywhere. Apply to File No. 2696-W.

ELECTRICAL ENGINEER, honour graduate 1944, University of Toronto, desires position in electrical manufacture or construction. Two years' service as electrical lieutenant, Royal Canadian Navy. Experience in street-railway systems, radar, radio and ship electrics. Available now. Please contact File No. 2689-W.

NON FERROUS METALLURGIST AND GENERAL WORKS MANAGER seeks change. Experience: Fuel and electric melting furnaces, copper refining furnaces, splashing machines, water cooled moulds. Sheet-stripps-rod hot and cold rolling mills. Hydraulic extrusion presses, shapes tubes bars rods. Wire and bar drawing. Hot plating bi-metals. Tinning, ropery. Metal recovery. Processing copper, nickle, aluminium and all their alloys: Leaded and non-leaded brasses, aluminium-phosphor and guilden-bronzes. Phosphor copper and solution treatable copper-chromium alloys. Copper nickel and nickel brasses. Duralumin. Organiser, improver. Metallurgical, mechanical, chemical education. University degree. Apply to File No. 2701-W.

ELECTRONIC COMMUNICATIONS ENGINEER. B.Sc. (honours), M.I.E.E. (London), 14 years experience research, design and development, British, aged 36, at present employed in England at £840 gross, desires job in Canada at around equivalent salary. Has intimate knowledge of telephone and radio industries, own proved design methods for electronic equipment and theorectical and practical knowledge of pulse transmission system. Any location with reasonable living conditions for family of four. Details of career and references with Institute. Apply to File No. 2692-W.

LIBRARY NOTES

(*Continued from page 454*)

This text, prepared for a brief course offered in the specialized training program at Iowa State College during the years 1942-4, gives a general picture of the electrical field and covers the fundamentals with which the practical man must be familiar. The treatment is as non-mathematical as is practicable.

ELECTRICAL MEASURING INSTRUMENTS, Measurement and Surveys:

By E. S. Lincoln. Essential Books, 270 Madison Ave., New York, 1945. 284 pp., illus., diagrs., charts, tables, 8¼ x 5¼ in., cloth, $3.00

Part I of this practical text covers the operating principles of all types of industrial electric measuring instruments, including integrating and graphic instruments. Ranges, damping, sensitivity, accuracy, etc., are dealt with, and tables are given for quick reference in the selection of instruments. Part II covers instrument transformers and procedures for making electrical measurements. Details are given in Part III for making electrical surveys of an entire system from which proper operation of equipment and useful economics may be determined.

ELECTRONICS FOR ENGINEERS:

Edited by J. Markus and V. Zeluff. McGraw-Hill Book Co., New York and London, 1945. 390 pp., illus., diagrs., charts, tables, 11 x 8½ in., cloth, $6.00.

The articles, charts and graphs presented in this volume have been selected from those that have appeared in "Electronics" because constant demand has shown their permanent reference value. One hundred and forty-two articles have been edited and collected in 27 chapters by subject, making consultation easy. Designers and builders will find the data useful and convenient.

HANDBOOK OF NONFEROUS METALLURGY, Recovery of the Metals

Prepared by a Staff of Specialists, D. M. Liddell, Editor-in-chief. 2 ed. McGraw-Hill Book Co., New York and London, 1945. 721 pp., illus., diagrs., charts, tables, 9 x 5¾ in., cloth, $7.00.

The second volume of this standard two-volume reference work is devoted primarily to the reduction and refining of metals. Within its 700 pages the metallurgical processes by which the various nonferrous metals are effectively recovered from their ores are described in detail by specialists. Information on deposits, extraction methods, properties and uses is included. Footnotes and chapter bibliographies offer other valuable sources of information. This second edition has been revised to include recent improvements, and certain changes have brought the two volumes into closer conformity with their respective subtitles.

INGENIÖRS VETENSKAPS AKADEMIEN, Handlingar Nr. 184. On the Deflection Theory of Suspension Bridges:

By S. O. Asplund. Ingeniörs Vetenskaps Akademien, Stockholm, Sweden. 1943. 201 pp., illus., diagrs., charts, tables, 9¾ x 7 in., paper, apply.

This paper treats of the effect of vertical loads upon the main girders of suspension bridges, taking into account the distortions of the system. Solutions of the fundamental differential equation of the deflection theory have been carried out far enough to result in general expressions directly adaptable to influence line use. Applications to one span and three span bridges are worked out, and model tests are evaluated by comparison. There is a bibliography.

Introduction to INDUSTRIAL CHEMISTRY:

By W. T. Frier and A. C. Holler. McGraw-Hill Book Co., New York and London, 1945. 368 pp., illus., diagrs., charts, tables, 8 x 5¼ in., cloth, $3.00.

An elementary textbook, intended especially for industrial night schools and for students of limited scientific background. The aim is to enable the student better to understand the processes going on around him by using them as a substitute for laboratory experimentation.

MODERN PLASTICS ENCYCLOPEDIA, 1946:

Plastics Catalogue Corporation, 122 East 42nd St., New York. 1,389 pp. + 10 charts, illus., diagrs., charts, tables, 11¼ x 8 in., cloth, $6.00 ($7.00, Canada).

This standard compendium of information on plastics covers a wide field, beginning with a review of recent progress. Methods of identifying and testing plastics are described, the varieties are discussed at length, and their qualities are considered from a practical viewpoint. Other sections deal with engineering design; methods of molding, extruding and casting; fabricating, finishing and assembling; machinery and equipment; laminates, plywood, and vulcanized fiber coatings; synthetics and rubberlike plastics. There is a large amount of useful tabulated data including ten large folded charts in a special envelope.

LE PLAN DE FABRICATION AERONAUTIQUE:

By M.-P. Guibert, preface by J. Roos. Dunod, Paris, 1945. 126 pp., diagrs., charts, tables, 10 x 6½ in., paper, 255 frs.

A general plan for assembly line production of airplanes is established on a statistical and mathematical basis for the more efficient use of the facilities involved. The treatment is highly detailed, and much of the material is presented graphically by diagrams.

PLASTICS MOLD ENGINEERING, the Fundamentals of Plastics Mold Design and Construction

By J. H. DuBois and W. I. Pribble. American Technical Society, Chicago, 1946. 494 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $7.00.

The early chapters describe types of molds, tool-making equipment and methods, materials for mold making, and plastics product design. The succeeding chapters are devoted to detailed description of individual molds and specific molding processes. The book is profusely illustrated by sketches, photographs, and working drawings, and some forty pages of useful reference tables are provided.

SYMPOSIUM ON MAGNETIC PARTICLE TESTING, American Society for Testing Materials

Philadelphia District Meeting, January 22, 1945. 260 So. Broad St., Philadelphia, Pa., 1945. 122 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.25.

Eight papers by authorities and two tentative methods for testing are contained in this symposium. Topics covered by the articles include the equipment, specifications and procedure for magnetic particle inspection, the application of the method to the testing of aircraft parts, and the inspection of castings and forgings.

TELETRANSMISSIONS PAR ONDES PORTEUSES dans les Réseaux de Transport d'Energie à Haute Tension:

By A. Chevallier, preface by E. Mercier. Dunod, Paris, 1946. 111 pp., illus., diagrs., charts, tables, 10 x 6½ in., paper, 390 frs.

This book covers the theory and practice of teletransmission by carrier waves in high tension networks. Connections, methods of modulation, radiations from high tension lines, transmitting and receiving equipment, wave ranges and filters are some of the topics covered. Separate chapters are devoted to telephony, selective protection of high tension lines, and impulse frequency telemetering.

NOTICE

To facilitate reorganization, the Library will be closed until September 3rd, 1946.

AN URGENT REQUEST

Would members who do not file the *Journal* kindly return their June 1946 copy to headquarters.

On account of difficulties at the printers, fewer copies have been printed than had been ordered and the needs of several libraries have not been filled.

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 29 | MONTREAL, AUGUST 1946 | 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

COVER PICTURE

A picture of The Pines hotel seen from the harbour at Digby, N.S. This will be headquarters for the Maritime Professional Meeting which will be held on September 5th, 6th and 7th under the joint auspices of the Associations of Professional Engineers of Nova Scotia and New Brunswick and The Engineering Institute of Canada.

PRE-COMPRESSED CONCRETE DESIGN

COLONEL J. P. CARRIÈRE, M.E.I.C.
City manager and engineer, City of Hull, Que.

Paper delivered before the Montreal Branch of The Engineering Institute of Canada on March 7th, 1946

Introduction

The purpose of this paper is to outline the basic theory of pre-compressed concrete design, some of its practical applications and some of the equipment employed in producing it.

Pre-compressed concrete represents a new technique in the use of steel and concrete, combined to form a new type of building material.

Before examining the relative values of the materials involved in pre-compressed concrete, let us review an elementary principle of mechanics.

Taking a simple example, let us consider a straight beam of rectangular cross-section and composed of homogeneous material, simply supported at each end and subjected to a concentrated load at the centre. (Fig. 1).

The stresses in the beam consist of:

(a) Compression at the top where fibres shorten;
(b) Tension at the bottom where fibres stretch.

These stresses are greatest at the extreme outer fibres (top and bottom), diminish in intensity as we get closer to the centre and are nil at the neutral axis.

This phenomenon takes place whatever the position or shape of the beam.

In the light of this observation, we may deduce that the ideal construction material is one which resists tensile and compressive stresses equally well.

Characteristics of Concrete and Steel

Concrete is simply artificial stone, but it is cheaper than natural stone, because it can be moulded to shape, doing away with the expensive processes of quarrying and cutting. Like stone, it resists compressive stresses well, but tensile stresses very badly.

Steel has been known since antiquity but was not being used as a construction material before 1880. It resists compressive and tensile stresses equally well. It is limited in its application as a construction material because of its:

(a) high cost;
(b) failure to resist corrosion;
(c) ease of deformation;
(d) and the fact that it is often not esthetic.

Characteristics of Reinforced Concrete

It is natural that, having available both steel and concrete, with opposite characteristics, engineers should have attempted to combine them, in order to obtain a material possessing the best qualities of both.

The first attempt resulted in what is known as reinforced concrete, which has long been used successfully, notwithstanding certain defects.

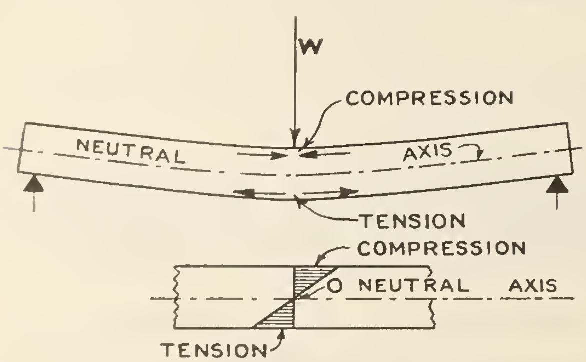

Fig. 1.

Reinforced concrete is essentially a grouping of materials wherein the concrete resists compressive stresses and the steel resists tensile stresses. It is not an intimate combination of elements, but simply a compromise which allows concrete to be used for members subjected, in part, to tension by the placing of steel bars in such concrete structural members where the tensile stresses actually occur. Only the steel resists these tensile stresses; the concrete simply follows the deformations in the steel. The tensile strength of concrete is always left out of stress calculations because of its slight importance and the uncertainty of its action.

The success of reinforced concrete has been due to the fact that it is relatively inexpensive, that it can replace timber and steel, and that it is fireproof.

The concrete in reinforced concrete must follow the deformation of the steel reinforcement to which it adheres. Since the limit of elasticity of concrete in tension is very much lower than that of steel, it usually works beyond its elastic limit and therefore cracks. Cracks in reinforced concrete are almost inevitable.

Cracking has been reduced considerably by various methods, but nevertheless, even in the best reinforced concrete structural members, these minute cracks tend to enlarge under the combined influence of variations in temperature, atmospheric agents and repeated loading and unloading. These cracks open the door, so to speak, to exterior agents, especially humidity which is extremely damaging to the steel reinforcing.

Ideal Building Material

Three qualities are desired of construction materials:

(a) Permanency;
(b) Tensile strength;
(c) Compressive strength.

Concrete possesses two of these qualities, permanency and compressive strength; pre-compressing is a process developed to give it the required third tensile strength.

For the last 15 years, M. Edouard Freyssinet, noted French engineer, has concentrated his efforts to the development of this new technique. His example has been followed by many other engineers and construction men, and many of the most recent developments are due to the efforts of Professor Georges Magnel of the University of Ghent, Belgium.

What is Pre-Compressed Concrete?

The pre-compressing of concrete consists of subjecting structural members, before the application of loads or simultaneously with the application of loads, to artificial and permanent compression stresses, exactly opposed to the tensile stresses resulting from the loads. Pre-compression and loads are so calculated as to be in equilibrium.

This results in the neutralization of tensile stresses within the concrete by transforming tension into "decompression".

A simple example will illustrate this technique.

It is required to build a slab bridge of 50 ft. span, and 10 ft. width abutting on solid rock of infinite depth; the live load to be 350 lb. per sq. ft. (Fig. 2).

With ordinary reinforced concrete we will require a slab 52 in. deep and an area of steel reinforcing of 45 sq. in. (say 3.8 tons of steel).

The maximum unit shear stress in the concrete will be 48 lb. per sq. in.

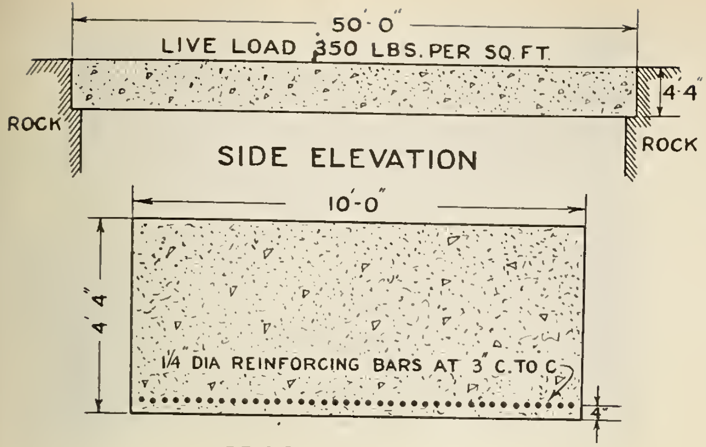

Fig. 2.

It is possible to make such a slab without reinforcing by compressing it between the abutments.

Let us examine a slab only 36 in. deep. (Fig. 3).

The dead load will be 450 lb. per sq. ft., live load 350 lb. per sq. ft.

Maximum bending moment due to the total load is 31,250,000 in.-lb. Maximum bending moment due to dead load only is 16,875,000 in.-lb.

Since the section modulus of the slab is 25,920 in.^{3}, the maximum unit working stress in the concrete, when the slab is fully loaded, is therefore 1,200 lb per sq. in., and when there is no live load 650 lb. per sq. in.

Now let us compress the slab against one abutment by means of suitable jacks resting on the rock of the other abutment, with a pressure of 200 tons per ft. of width so as to induce compressive stresses of 1,200 lb. per sq. in. at the bottom of the slab and of 650 lb. per sq. in. at the top.

When thus pre-stressed, the distribution of stresses in the slab will be: (Fig. 4).

Fully Loaded Slab

At top=1200+650=1850 lb. per sq. in. compression.
At bottom=1200—1200=0.

Unloaded Slab (Dead Load Only)

At top=650+650=1300 lb. per sq. in. compression.
At bottom=1200—650=550 lb. per sq. in. compression.
Max. unit shear stress=59 lb. per sq. in. opposed by an axial compression of

$$\frac{1200-650}{2} = 275 \text{ lb. per sq. in.}$$

Resulting in a net maximum tensile unit stress due to shear of 12 lb. per sq. in.

Thus, by reducing the thickness and removing all the steel reinforcement, we have a slab which will carry the same load with a maximum unit shear stress of 12 lb. per sq. in, and no tensile stresses at all.

This example has been used for the sole purpose of illustrating a theory. It is seldom, if ever, possible to compress structural members against natural rock abutments of the required strength.

Other means must be used to induce pre-compression in the concrete.

The most popular method employed at the moment consists in passing unbonded steel rods through the member and "tensioning" them against the ends. Let us apply this method to our slab.

If we attempt to use ordinary reinforcing steel working at 20,000 lb. per sq. in. to get our required pressure of 200 tons per ft. width of slab, we will require 20 sq. in. of steel per ft.

There is not enough room in the slab to place that much steel. Furthermore, the shrinkage and plastic flow of concrete cause an eventual loss of pre-compression which would neutralize that obtained with normal reinforcing steel.

We must use steel which can be subjected to working stresses of 80,000 lb. per sq. in.; with such steel we will require 5 sq. in. per ft., which can be placed in the slab quite easily.

This represents only 1/9 of the steel required for the reinforced concrete slab, and as this high tensile steel does not cost nine times the price of ordinary reinforcing steel, there is a saving in cost as well as in weight of steel.

We now have a slab in which all appreciable tensile stresses have been eliminated and in which concrete is subjected to compressive stresses only, the maximum unit stress in compression being 1,850 lb. per sq. in.

There is no reason why we may not design concrete structural members to resist even much greater compressive stresses.

We can eliminate the slight tensile stresses due to shear by placing pre-compressing steel rods vertically if we so desire.

With regard to the steel, it is to be noted that the stress variations due to loading and unloading are neglible.

In the present case, since we are subjecting the steel to a unit stress of 80,000 lb. per sq. in. for pre-compressing, the elongation will be=

$$\frac{80{,}000 \times 50 \times 12}{30{,}000{,}000} = 1.6 \text{ ins.}$$

When we apply the live load, the unit stress at the outer fibres of the bottom of the slab becomes zero which corresponds to an elongation of the steel of—

$$\frac{12 \times 1200 \times 50 \times 12}{5 \times 30{,}000{,}000} = .058 \text{ ins.}$$

which is equal to 3.6 per cent of the original elongation of 1.6 in. As a mater of fact, since the steel is placed a little inwards of the outer fibres, the unit stress and the elongation will be less than given above and we can say that the elongation of the steel, due to live load, is of the order of 3 per cent. This means that fatigue stresses are practically non-existent.

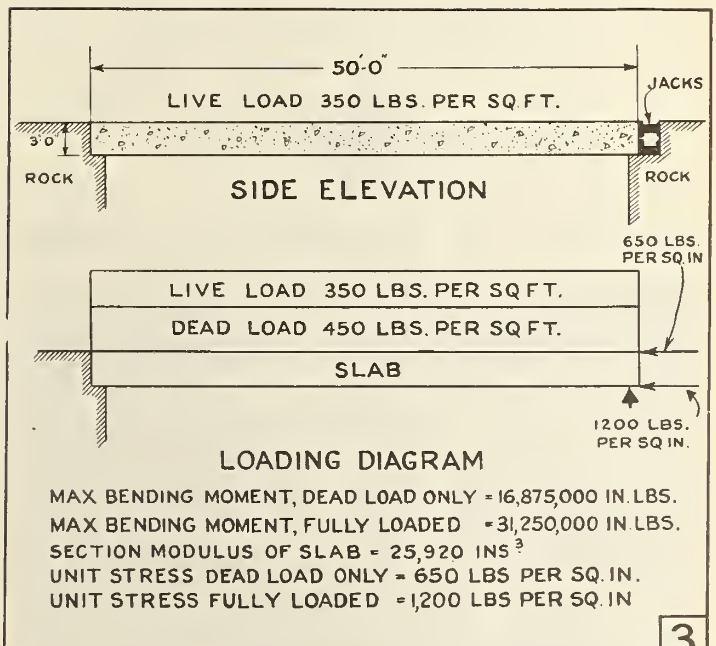

Fig. 3.

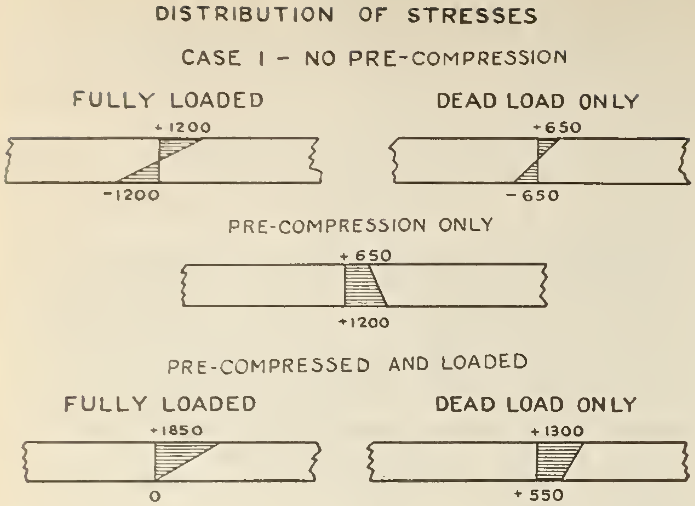

Fig. 4.

The Choice of Steel

The type of steel used for pre-compressed concrete in Europe is produced in the shape of drawn wire of a maximum diameter of 5 mm. (roughly ¼ in.), having an elastic limit of 100,000 lb. per sq. in. and a yield point of 134,000 to 145,000 lb. per sq. in. It contains 0.7 per cent of carbon and 0.8 to 1.2 per cent of manganese and it is drawn and tempered.

Its modulus of elasticity is the same as that of structural steel; a high working stress is allowed, (80,000 lb. per sq. in.), so that it will not lose more than 15 to 20 per cent of its tension due to shrinkage and plastic flow of concrete.

It will be noted that the allowable working stress is 80 per cent of that of the elastic limit, and an explanation is necessary to outline the reasons for such a discrepancy with the working stresses allowed in ordinary reinforcing steel.

In ordinary reinforced concrete, the reinforcing steel is not stressed to more than 50 per cent of its elastic limit, because:

(a) The variations in stresses in the steel during the life of the structure are considerable; for example, in our slab, the unit stresses vary from 650 lb. per sq. in. with dead load only, to 1200 lb. per sq. in. when live loads are applied. This represents an increase of 84 per cent. Repeated loadings bring in the question of fatigue.

(b) The reinforcing steel is subjected to maximum stresses only when the structure is loaded, that is at a time when the rupture of one of the bars, due to some fault, might cause complete failure.

(c) Concrete cannot follow the deformation of the steel in tension, especially in the case of repeated loadings, at higher working stresses than 50 per cent of elastic limit, and usually not even to that extent.

In pre-compressed concrete, these reasons do not apply.

(a) We have seen that the variation in stresses, due to loadings, is of the order of 3 per cent of the stresses under dead load; this eliminates the question of fatigue.

(b) The steel is subjected to maximum stresses during the pre-compressing period. From then on, under permanent loading, tension decreases due to the combined effects of shrinkage and plastic flow of concrete. This decrease is of the order of 15 to 20 per cent under normal circumstances.

Although not discussed in the example, by reasons of simplicity, this factor must be considered in designing pre-compressed concrete structures.

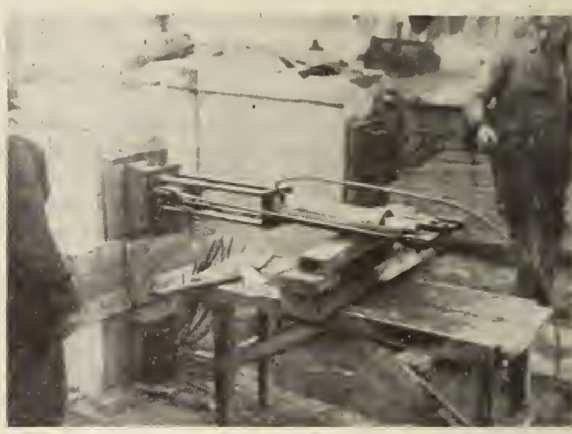

Fig. 6—Pre-stressing the wires for a beam made of pre-cast blocks by the Magnel method; work carried out by Royal Canadian Engineers for operation Pluto.

Rupture of faulty wires will, therefore, occur during the pre-compressing operations when they can be replaced without difficulty.

(c) Finally, the question of the concrete having to follow the deformations of the steel in tension does not present itself as the concrete remains in compression all the time.

Certain engineers, both in America and in Europe, feel that under the conditions of loading in most pre-compressed concrete structures, it is quite safe to stress the steel up to its elastic limit, which would lead to a greater economy of steel. Time will tell if such a practice is recommendable.

Experimental research is being carried out in the development of steels with higher elastic limits than that mentioned in this paper; their incorporation in pre-compressed concrete will no doubt also lead to new construction methods.

Losses of Pre-Compression

After pre-compressing, concrete shrinks. It is not intended to discuss the phenomenon in this paper beyond stating that the shrinkage of concrete will cause a reduction of tensile stresses in the steel.

Similarly, temperature stresses will cause deformation which, under certain circumstances, might be important.

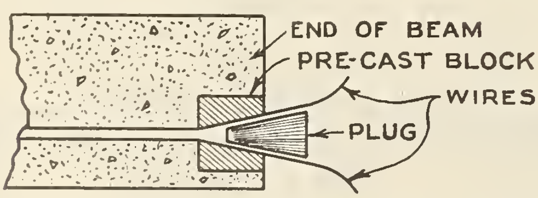

DIAGRAM OF FREYSSINET ANCHOR

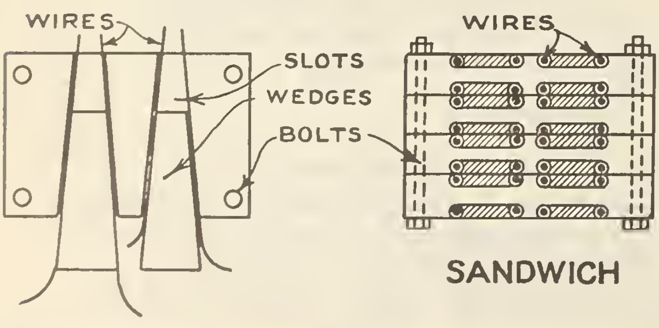

DIAGRAM OF MAGNEL ANCHOR

Fig. 5.

Fig. 7—One beam in place between abutments.

The values given above and in examples have been used to illustrate certain points, and are not intended as actual design calculations. Necessary allowances must be made in the design to overcome these expected losses of pre-compression.

Anchorage System

The steel used being hard and fragile, it is out of the question to use methods of anchoring which would necessitate notching the wires. This suggests that the wires must be locked in place by friction.

M. Freyssinet of France is using friction anchors of his own design which consist of setting precast concrete blocks in the ends of beams during the moulding operations; these precast blocks are provided with openings in the shape of truncated cones. The wires pass through these openings and rest against their walls; they are locked in place by means of pre-cast plugs driven into the opening which wedge the wires between the walls of the openings and the plugs. This type of anchorage system is being produced to take from 8 to 32 wires, (see Fig. 5).

Professor Magnel of Belgium has designed a method of anchorage also based on friction which he calls " sandwich type ". This consists of steel plates provided with wedge shaped slots on both faces into which wires are locked by means of steel keys. (See Fig. 5). Each plate can accommodate 8 wires and series of plates can be " sandwiched " over one another to accommodate multiples of 8 wires.

With the Freyssinet anchors, all the wires are stressed at the same time; the piston of a hydraulic jack rests against the pre-cast block through which the wires protrude; the wires are secured to a ring fixed to the body of the jack; when the required tension in the wires has been obtained the plug is driven in to lock the wires in place, by means of an auxiliary piston provided in the main piston of the jack.

With the Magnel anchors the wires are tensioned in a similar manner, except that they are pulled in pairs and that the wedges are driven in by hand with an ordinary hand hammer. (See Fig. 6).

In certain cases, the wires are held in place by bond with the concrete. The results of tests carried out with that type of anchorage, although not yet absolutely conclusive, suggest that wires of a diameter of 5 mm. will hold the concrete in pre-compression when bonded with the concrete.

Construction Method

When making monolithic structural members, forms are built as for normal, reinforced concrete, and the wires are placed in the forms in the shape of cables with the wires laid parallel. In order to prevent bond between concrete and the steel, bituminous paper is wound around the cables to provide a layer about ¼ in. thick, which is held in place by small wire bindings.

Professor Magnel uses flexible conduit commonly used in electrical installations as sheaths for the cables.

After the concrete has set sufficiently, the wires are tightened in place, then a cement paste is injected in the sheaths housing the cables to protect them against corrosion.

An interesting construction method was adopted by the Ministry of Transport of England in 1940. The Ministry wished to augment its reserve of emergency bridging materials and, because of the shortage of timber and steel, decided to construct a number of pre-compressed concrete beams in lengths of 15 to 50 ft. The shape found most economical consists of hollow rectangular beams for lengths up to 40 ft. and the others consist of H sections 12 in. wide.

It was also decided to bond the steel with the concrete and do away with end anchors completely. In order to effect this, wires were stretched between anchors 600 to 800 ft. apart, and three to four rows of beams were laid out. The wires were stretched between the anchors by means of jacks and the beams were cast around the stretched wires. After the concrete had set sufficiently, the pressure of the jacks was released, and the wires were cut flush with the ends of the beams which were subsequently stored until required.

In the type of structure such as the slab bridge used for an example, it is sometimes impossible to place the cables along the lower fibres of the slab upon its full length for many practical reasons.

To overcome this, the cables are raised at the end to assume parabolic curves in accordance with the requirements of the loading.

Pre-Compressing of Pre-Cast Blocks

Pre-compressed concrete beams can be made up of precast blocks in which holes have been left to receive the necessary cables.

A simple demonstration of the principle involved has probably been made unconsciously by most readers. When it is desired to shift books from one shelf of a bookcase to another, we usually handle more than one or two books at a time by applying pressure at each end of a number of them with our hands; as long as we maintain the necessary pressure the books form a beam of independent sections.

Pre-compressed concrete beams are made in just the same way with pre-cast blocks. A light coat of cement paste is usually applied between the blocks to overcome unevenness of the ends of blocks, but stability depends entirely on pre-compression induced by the pre-compressing cables.

Fig. 8—Pre-compressed concrete beams erected in Belgium to form a bridge between grain elevators.

Royal Canadian Engineers erected such beams during the construction of Pluto, the gasoline pipe lines from England to Germany. The beams were used to cross the Albert Canal, north of Brussels and are 65 ft. long, (see Figs. 6 and 7).

These beams consist of solid concrete end blocks roughly 3 ft. 4 in. long, 3 ft. 8 in. high, and 16 in. wide, and intermediate hollow blocks 1 ft. 8 in. long, and of the same height and width as the end blocks. The flanges of the intermediate blocks are 4¾ in. thick and the webs 2¾ in. thick.

There are 56 wires 5 mm. dia. in the beams; they were stretched in pairs to a tension of 80,000 lb. per sq. in. by means of hydraulic jacks and are locked in place at the ends by means of "sandwich type" anchors.

In this case, the beams were assembled on a level piece of ground and were swung into position by means of derricks as would have been done with steel beams or girders.

Figure 8 shows similar beams erected in the same manner by a Belgian engineering firm to form a bridge between grain elevators.

M. Freyssinet of Paris employed pre-cast blocks to build a highway bridge over the Marne River at Luzancy. This bridge has a single span, 180 ft. long. In this case, a temporary falsework timber beam was used to assemble the pre-cast blocks in place. The new bridge contains 17 tons of steel and replaces a demolished reinforced concrete bridge of the same capacity which contained 225 tons of reinforcing steel.

It will be noted that the blocks in such structures need not necessarily be of concrete. Prepared granite blocks, for example, would do just as well.

Pre-compressed concrete is being applied to many other types of construction, especially in Europe where steel and timber are scarce. It is being used for such things as telegraph poles, railway ties, high pressure pipes of various types, silos, grain elevators, dams, roofs, etc.

Conclusion

Much research and experimentation remains to be carried out into the use of pre-compressed concrete, but even at the present time, it can be used to great advantage in a variety of structures. Further development of this new technique depends on continued co-operation between engineers, manufacturers and builders. Given this co-operation, pre-compressed concrete is bound to become one of the great construction materials of the future.

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DISCUSSION

P. L. Pratley, M.E.I.C.[1]

Any attempt to commit to writing, after an interval of several weeks, the ex-tempore comments offered in discussion of a technical paper, must of necessity be somewhat weak in "fidelity", but the writer is glad to accede to the request that such an attempt be made.

For the sake of brevity and clearness, the use of the first person may occasionally be allowed to creep into these notes.

The speaker of the evening was firstly congratulated on having on an earlier occasion expressed his preference for the term "pre-compressed" concrete, rather than "pre-stressed", as being more exact and more expressive, although the latter terminology has been widely adopted in the growing literature on this subject. The writer agreed most thoroughly with this preference and hoped that it can be adopted in Canada right from the outset. Colonel Carrière in his reply to the discussion expressed his concurrence and has actually altered his manuscript to accord with this proposal.

The writer next drew attention to the fact that the principle and process of pre-compression was not in itself new, as the reverse application, namely "pre-tension" was fairly common and well-established. The principle is simply one of prevention—the undesirable condition is foreseen and positively avoided. In the case of steelwork the objective is to prevent certain slender members from becoming struts, and it is accomplished by introducing an initial tension sufficient to ensure that in the normal course of service and experience, any compression stress that might be induced in the member will never overcome this initial tension, and the member will not therefore be called upon to suffer the undesirable stress for which it is not designed. The incidence of compression is by this means transformed into a diminution of tension. Common examples are bracing rods in tower and bridge structures, guy-ropes in radio towers, and, recently, stay-cables in "weak-sister" suspension bridges. In New York, for example, at the Whitestone bridge, heavily "pre-tensioned" diagonal ropes of 2⅞ in. dia. have been introduced in pairs, between the tower-tops and the stiffening trusses, to aid in reducing objectionable vibrations.

If introduced in an unloaded condition to the structure in its normal shape, these stay-cables would be stretched as the point of attachment to the girders sank, but would be slackened and therefore useless as the point of attachment rose on the crest of an undulation. Therefore, to maintain tension and usefulness at all times a high initial tension is supplied so that, at no time during even the maximum vibration, is the stay slack. Similar but less "hefty" pre-tensioned stay-cables have been installed in other United States suspension spans of the vertically-slender type.

Manifestly, with concrete, the desirable stress is compression and the stress to be prevented is tension, so that pre-compression instead of pre-tension is impressed upon the member, and its experience in service is confined to a diminution of the original compression on those fibres or that flange which would otherwise suffer tension and become valueless.

The methods by which these pre-compression stresses are introduced into certain selected portions of concrete beams or girders are various, and have grown up as personal preferences or as the results of circumstances, external conditions, or shortages of this or that material. Some interesting experiments are described in numerous papers delivered before the Institute of Civil Engineers and the Institution of Structural Engineers, in London and much valuable discussion has been provoked, especially in February 1941 when M. T. J. Guéritte addressed the first named body and presented further details and comments regarding tests on large beams, originally reported in early

[1] Consulting engineer, Montreal, Que.

1940 but not then published due to war restrictions. The claims for efficiency and economy were widely attacked by outstanding engineers, and references made to the apparently low factors of safety and the high permissible stresses, both in steel and concrete. The replies by M. Guéritte were illuminating and he brought out strongly and effectively the following points, which have been equally emphasized by Col. Carrière.

1. Pre-compressed concrete is not merely reinforced concrete, but a different structural concept.

2. The high stresses occur only in the preparatory and erection stages. All subsequent service involves reductions in critical stresses.

3. Principal combined unit stresses in tension and shear, calculable as produced in regions of heavy shear are definitely and surprisingly smaller than in ordinary reinforced concrete beams.

Dealing with these same matters, Colonel Carrière made it clear that reinforcing steel in the usual sense of the term is eliminated, so that the beam or girder is really a plain concrete member. Bond stress and modular ratio lose their importance and in many cases disappear. The full cross sectional area of the beam functions in compression under dead and live loadings.

Electrical methods of stretching the wires used for pre-compressing have generally given way to mechanical methods, and some ingenious devices have been developed for stretching the high tensile steel, whether rods or wires, so that the reaction from such stretching operates as the compressing agency on the lower flange of the concrete beam. I made reference to one method whereby the ends of wires were passed through $1\frac{3}{4}$ in. steel plates which were perforated with a series of tapered holes into which the wires were wedged under no more stress than could be supplied by hand tools. These plates were then pushed away from the ends of the beam by jacks whose outrun was sufficient to produce stress up to 170,000 lb. per sq. in. in the wires. (p. 527. Oct. 1941 *Journal* of the Inst. C.E.) This tension was accompanied by a corresponding compression in the concrete against which the jacks reacted, and the compression was distributed over the cross section in a manner dependent upon geometrical relations such as area, shape, and offset of load from neutral axis. In other systems the wires are pulled before wedging, as Colonel Carrière shows in his illustrations.

It was explained in M. Guéritte's papers, especially on p. 130. Apr. 1941 *Journal* of the Inst. C.E. that whereas 78,000 lb. per sq. in. was the initial unit stress used in 1936 for the beams tested and described by him, the practice in 1940-41 had risen to 154,000 lb. per sq. in. In the correspondence by Dr. Abeles p. 527. Oct. 1941 *Journal* Inst. C.E. the wires stressed initially to 170,600 are described as being of 0.069 in. dia., with ultimate tensile strength of 370,000 lb. per sq. in. and a limit of proportionality of 342,000. These properties indicate a very special type of wire not perhaps commercially obtainable in Canada yet.

Obviously care must be exercised during such pre-stretching operations; trained personnel are needed and much supervision. The load must be so applied that no bending moments arise, which are likely to induce tension in the *upper* flange or fibres of the beam, unless adequate provision has been made for this contingency. In the more ambitious cases, certain steel wires are inserted in these upper flanges and pre-stretched so that the concrete here is also pre-compressed. The designer has considerable freedom, once he is assured that mechanical equipment is available for controlling the "input" stresses, and by exercising his ingenuity he can provide for all temporary and permanent possibilities.

In transport and field handling, reverse bending moments are liable to occur, and he must either anticipate these conditions qualitatively and quantitatively, or the field forces must be instructed to follow carefully prescribed procedures, planned to control bending moments and eliminate reversals.

Early in 1940, the British Ministry of War Transport decided to build and stock a large number of pre-compressed concrete beams for emergency use in the repair of bombed structures. These were of various sections, some H, some I, some hollow box, and of spans from 15 to 50 ft. In these designs the wires were inserted near the bottom edge and kept in tension during the pouring of the concrete, being released after curing had been assured. On cutting the wires loose from the tightening devices, the bond stress would ensure joint action, and as the steel lost tension the concrete would pick up compression in the bottom flange, with some tension in the upper flange. By storing the beams as beams, the dead load tended to minimize this tension, and as soon as the beams were put into service the superimposed loads served to reverse or reduce the "input" stresses and leave every fibre in compression. Again, care had to be taken not to upturn the beams during transport or handling. Many of these beams survived the war and have since been used in railway practice as permanent structures, mostly for over-crossings. The beams are laid side by side and form a solid deck for ballast or slab. (See Nov. 1943, *Journal* Inst. C.E.)

Beams of this type can be cast in quantities in open yards or under cover. Wires, long enough for six or eight beams, are mounted and stretched at the right height above ground forms at a few feet interval. The concrete is poured around them in removable forms placed in sequence along each group of wires, and, after the concrete has set, the wires are cut just outside each beam-length. One of the more elaborate processes used for individual beams of special design or for experimental purposes is to build tubes into the concrete which is poured before any stretching of steel is attempted. Wires are then passed through the tubes, fastened to movable anchor assemblies of heavy plate or of built-up devices such as illustrated by Colonel Carrière, and then stretched by jacks to the required calculated amount. After stretching, the wires are securely fastened in the anchorages or the anchorages are themselves positively and immovably attached to the beams, so that the tension is permanently maintained in the steel and the corresponding compression permanently applied to the concrete. Welding, wedging, etc., are resorted to as means of attaching the ends of the wires to the anchors and precast cement blocks are frequently used to fill the space between anchor plates and beam ends, where the jacks were located during the stretching operation.

The effect of creep, shrinkage and deflection is inescapable, but research has made it possible to pre-calculate it fairly closely, and its magnitude is well illustrated in the records of tests and experiments described in the *Journal* of the Inst. C.E. for April 1941, Oct. 1941 and Feb. 1942.

As to the adoption of the pre-compressed beam or girder in Canadian construction, it must be borne in mind that competition with steel and reinforced concrete will be severe when materials are in normal supply again. If the cost of equipment and skilled labour could be distributed over a sufficiently large amount of work, then special conditions, such as restricted depths, speed of field work, reluctance to pour concrete at the site or under the temperature conditions, might offer opportunities for its adoption, but personally I am not over-optimistic regarding the prospects. Pre-cast, that is to say, shop-cast items such as standard beams and lintels, cross-beams for highway decks or poles for power lines might present the first field for the application of this principle in our neighborhood. Of course some particular bridge or building project might lend itself to pre-compressed concrete beam design, in the hands of a careful and competent engineer, as was undoubtedly the case in Europe under war or early-post-war conditions, and the experience of our R.C.E. units under expert engineer officers would then be a realizable asset. The knowledge of the art and their appreciation of the need of thorough organization should be a distinct advantage of which Canadian industry should be prepared to take note. The writer finally asked Colonel Carrière whether he had any more definite idea as to a possible Canadian field for this new and valuable material of construction, which he had so ably introduced to the membership both at the recent Annual Meeting and on this present occasion.

M. F. MacNaughton[2]

I enter this discussion of Colonel Carrière's paper with some hesitation, because I know comparatively little about pre-compressed concrete design, and I will limit my discussion to a presentation and interpretation of results of physical tests which we have recently carried out on some high carbon cold drawn steel wires which are being used in Canada as reinforcement in pre-compressed concrete.

About two years ago, Mr. E. P. Muntz, chairman of this meeting, asked us to arrange to carry out measurements of stress-strain relationships on some specimens of high carbon cold drawn wire when loaded beyond their elastic limits. About a year ago Mr. Muntz asked us to carry out a long time loading test on such a wire to determine cumulative creep when the wire was subjected to a continued load beyond its elastic limit. Some time was spent in designing and building the apparatus for this test, and, in the latter part of August, 1945, the test was started.

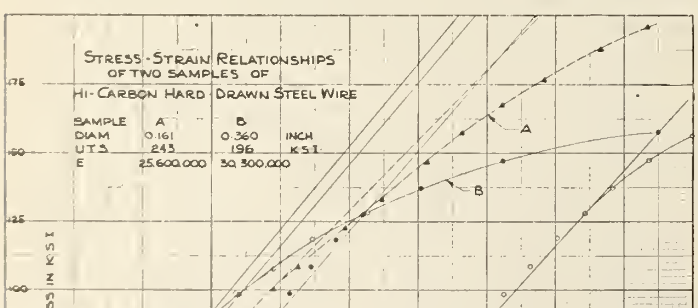
I note that Colonel Carrière states that European practice today utilizes steel with an elastic limit of 100,000 lb. per sq. in. and uses initial stresses of in the neighborhood of 80,000 lb. per sq. in. On the other hand, Dr. P. R. Pratley, in discussing the paper, quotes British authorities to the effect that working stresses of 155,000 lb. per sq. in. may be permissible.

These divergent views probably reflect conclusions based on the performance of steels of different properties and, possibly, composition. In adopting any conclusions to be applied to Canadian practice, the properties and characteristics of steels presently available in Canada, on a commercial scale, must, of course, be considered.

In support of this I present three graphs showing results of tests which we have made on Canadian steels.

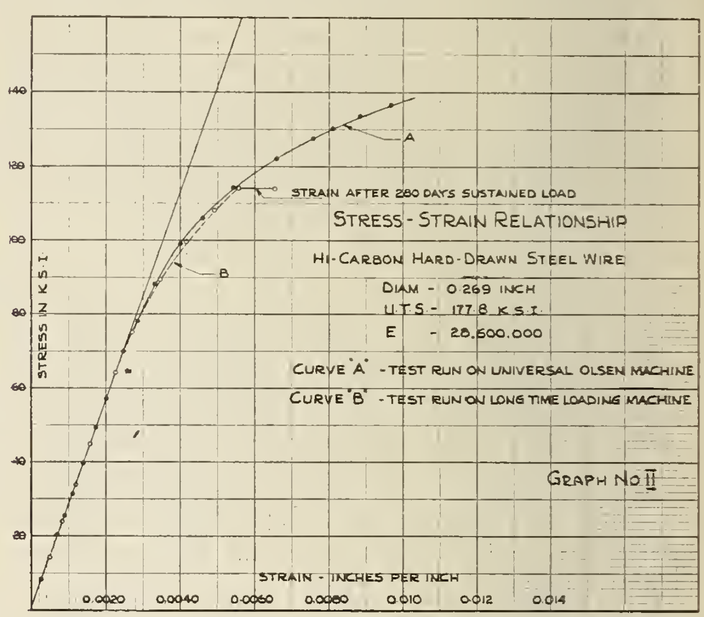
Graph I shows results of stress-strain tests on two samples of H.C.C.D. steel wire. Sample A had a diameter of 0.161 in., a U.T.S. of 243,000 lb. per sq. in., and an elastic limit of approximately 95,000 lb. per. sq. in. Sample B had a diameter of 0.360 in., a U.T.S. of 196,000 lb. per sq. in., and an elastic limit of approximately 78,000 lb. per sq. in. These two wires are entirely different as regards their physical characteristics, and cannot be classed as similar material.

[2] Consulting engineer, Milton Hersey Company Limited, Montreal.



Sample A, which has been drawn to a smaller diameter is higher in tensile strength and in elastic limit than Sample B. In both cases the elastic limit is about 40 per cent of the ultimate tensile strength. The values for E differ greatly, that for wire A being 25,600,000, while that for wire B is 30,300,000. This, of course, must be considered in designing pre-compressed concrete structures.

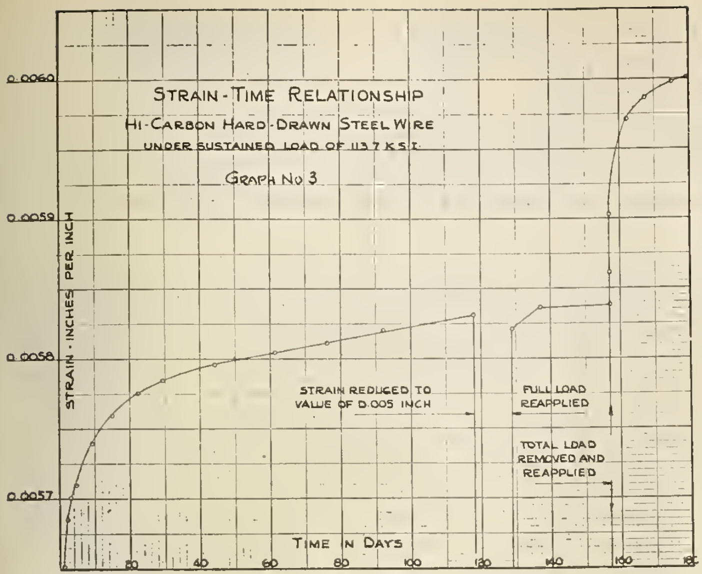
When the wires are stressed beyond their elastic limits, their behaviour is equally different. For example, consider their departures from proportionality at loadings equivalent to 75 per cent of their ultimate strengths, equal to 182,000 lb. per sq. in. for wire A and 147,000 lb. per sq. in. for wire B. At these loadings, the departure from proportionality, expressed as a percentage of the proportionality strain at the specified loading, is 17 per cent for wire A, and 48 per cent for wire B. It is apparent that wire A is not only stronger than wire B, but also, for proportional increments of loading above the elastic limit, is much more resistant to permanent deformation or "creep".



A simple stress-strain relationship was determined for wire A. Wire B, after five cycles of loading to 100,000 lb. per sq. in. and unloading, showed a permanent strain of 0.01 per cent of the original length. After further loading to 127,500 lb. per sq. in., followed by release of load, a permanent strain of 0.08 per cent was recorded, and the value for E had fallen to 29,000,000. After further loading to 157,000 lb. per sq. in. and release of load, a permanent strain of 0.385 per cent was recorded, and the value for E was 27,800,000. At the same time the elastic limit which originally was 78,000 lb. per sq. in., has been increased to approximately 115,000 lb. per sq. in. In arriving at this figure of 115,000 lb. per sq. in. it should be noted that the strain readings taken on reloading fall to the left of the descending stress-strain line, indicating some hysteresis effect in the steel itself, since this effect is not noted unless the steel is stressed beyond the elastic limit.

Thus it is apparent that these steels not only differ in their original properties, and behave in different manner when stressed beyond their elastic limits, but also suffer unequal changes in characteristics when stressed beyond their elastic limits.

Graph II shows the stress-strain relationship of a third sample of H.C.C.D. wire subjected to long time continued loading beyond the elastic limit. At 114,000 lb. per sq. in. loading, the proportional strain was .0040 in. per in. and



the immediate departure from proportionality was .0015 in. per in. After 280 days of sustained loading a further departure from proportionality, or creep, of .00108 in. per in. was observed making a total strain of .00658 in per in. During this period the immediate departure from proportionality was increased approximately 65 per cent by creep as a result of sustained load.

Graph III shows, on a very much magnified scale, the strain-time relationship of this phase of the test. After 118 days of sustained loading the lever arm was raised to a fixed position at .005 in per in. strain to protect the specimen from shock when full supervision was not possible. Full load was re-applied at 129 days. After 157 days the load was completely removed and re-applied.

It would seem that slight variations in stress, of the order which normally occur as a result of the fluctuations of live load in pre-compressed concrete structures, would have little effect on the rate of creep, provided the steel were not loaded too far beyond the elastic limit. Major increases or recessions in load would, however, greatly accelerate the rate of creep.

At the present time, after 280 days, this wire, stressed to approximately 65 per cent of its ultimate tensile strength, is increasing in length at the rate of slightly less than half a millionth in. per in. per day. For practical purposes, this rate of creep is probably not significant, though the fact that, with the exception of the effect produced by the unloading at 157 days, it has remained nearly constant since the fortieth day might suggest the desirability of continuing the test for a further period.

As has been pointed out by Colonel Carrière, maximum stresses in steel in pre-compressed concrete are developed at the time that the steel is pre-stressed, when the structure itself is not subject to excessive stress. From then on, as a result of shrinkage and plastic flow of the concrete, the stress in the steel gradually recedes. For this reason it may be quite proper, for initial stressing of the steel, to exceed the actual elastic limit. It may even be proper to design for working loads which exceed the elastic limit of the steel, provided that the effects of creep of the steel and change in elastic modulus, which occurs as a result of stressing beyond the elastic limit, are taken into account in the design. The designer might reduce or even eliminate these effects by adopting one of two expedients:

(1) He might select a more suitable steel for his purpose than the one immediately available. For example, wire A of Graph I would appear to be, by all counts, a more satisfactory material for reinforcement of pre-compressed concrete than wire B. Alternatively he might, if the material were available, select an alloy steel wire with a higher proportional limit than is provided by high carbon cold drawn steel wire.

(2) He might pre-stretch the wire, as received, to eliminate a large part of the creep resulting from continued long time loading. If the wire of Graph II had been pre-stretched at 122,000 lb. per sq. in. prior to testing, the greater part of the immediate departure from proportionality and a large part of the subsequent creep would not have taken place on subsequent loading to 114,000 lb. per sq. in. Had the wire been pre-stretched to 130,000 lb. per sq. in. prior to loading to 114,000 lb. per sq. in. the departure from proportionality and the creep at this loading would have been negligible.

Considering the information which has been developed in regard to these three wires, and the general dearth of information which is available in regard to this class of material, particularly when subjected to stresses beyond the elastic limit, it would seem prudent for the designer of pre-compressed concrete structures to obtain advance information regarding the essential properties of the reinforcing to be used and to check carefully the characteristics of each lot of material received to ensure that it conformed, within reasonable limits, to the design standard.

The Author:

At the outset, I wish to thank Dr. Pratley for supporting me when I expressed my preference for the term "pre-compressed" concrete against "pre-stressed" concrete. The support of such a distinguished engineer makes it much easier for the author to insist on this point which has its importance to students of the subject inasmuch as the term "pre-compressed" describes by itself the basis of the technique under discussion, whereas the term "pre-stressed" is vague and, in many cases, misleading.

As pointed out by Dr. Pratley, pre-stressing of building materials is not a new process, especially as regards "pre-tensioning" in steel structures; the important point is that we are faced with an accepted method of combining steel and concrete in our structures in a manner which is not entirely sound, either from the structural or economical point of view and that "pre-compressing" of concrete under given conditions offers an improved method of combining these materials to obtain greater efficiency and economy.

This is of capital interest to architects, engineers and builders, as well as to those useful members of society who provide the funds to erect our structures. The methods by which pre-compression of the concrete is obtained are only accessory to the principle involved. Certain methods have been applied with a measure of success; they are not perfect and present some undesirable aspects. Should we improve these methods or seek new ones? This is a question that the future will answer, the answer depending to a great extent on whether the originators of the present methods are left to improve their original ideas or whether engineers at large apply their inventive minds to research of other methods.

It is only natural that engineers who have applied the principle successfully by methods of their own design should aim at improving these methods rather than seek for new ones. As an example of this, I take the liberty of quoting Professor Magnel of the University of Ghent on the problem of creep in the steel, so ably presented by Mr. McNaughton.

After carrying out many experiments, Professor Magnel states:

"The greater part of the creep in hi-carbon hard drawn steel wire occurs in the early stages of loading over the elastic limit; therefore, such wire when intended for use in pre-compressed concrete should be pre-stressed in tension to a stress slightly higher than its elastic limit to eliminate the greater part of the creep before incorporating it in the concrete." (*Continued on page 482*)

THE APPLICATION OF THE GAS TURBINE TO RAILWAY LOCOMOTIVES

ARMIN K. LEUTHOLD, M.E.I.C.
Chief engineer, Brown, Boveri (Canada) Limited, Montreal, Que.

A paper presented before the Montreal Branch of The Engineering Institute of Canada on March 14th, 1946.

Although the steam locomotive is a very reliable, highly developed motive power unit, the railways and the locomotive manufacturers have for a long time been trying to find a more efficient traction machine. More than fifty years ago, the electric locomotive was created and it has been brought to a very high stage of development. Its applications in the various systems of transportation, such as main lines, mountainous country, subway systems, etc., have become so important and have been introduced all over the world to such an extent that one could not imagine doing without them.

In spite of this very extensive application of electric traction, there are, particularly in the heavy main line traction field, many lines left where electrification is not economical. Up to a few years ago, the steam locomotive reigned supreme on such lines. Then the Diesel electric locomotive appeared and has, within comparatively few years, achieved tremendous success. This applies especially to the United States where, because Diesel fuel oil is plentiful and comparatively cheap, more Diesel locomotives than any other kind of traction machines have been introduced by the railways. These locomotives are doing excellent work in switching, and main line passenger and freight service.

A still newer and simpler kind of motive power unit, the gas-turbine locomotive, has been created and, within a very short time, brought up to such perfection where it can be safely introduced on the railways.

The gas turbine which is incorporated in the first locomotive of this kind is one of the last links in a chain of developments that have been going on for many years. A first impulse was given to gas turbine development with the introduction of the Diesel engine supercharging groups which permitted to raise the Diesel engine output by 40 to 50 per cent and even more. As a result of further extensive research work on gas turbines, the Velox boiler then was originated, for which the combustion air is furnished by a gas-turbine driven air compressor. With over 130 gas-turbine compressor groups for Velox boilers and oil refineries and more than 2,000 gas-turbine driven superchargers for Diesel engines in operation, Brown Boveri & Company were able to gather valuable experience which led, in 1939, to the introduction of the first real gas-turbine as prime mover. A combustion chamber for the generation of the gas had to be created and this, together with better efficiencies of the turbine and the compressor, resulted in a gas-turbine group which could deliver considerable quantities of useful power at a reasonable efficiency.

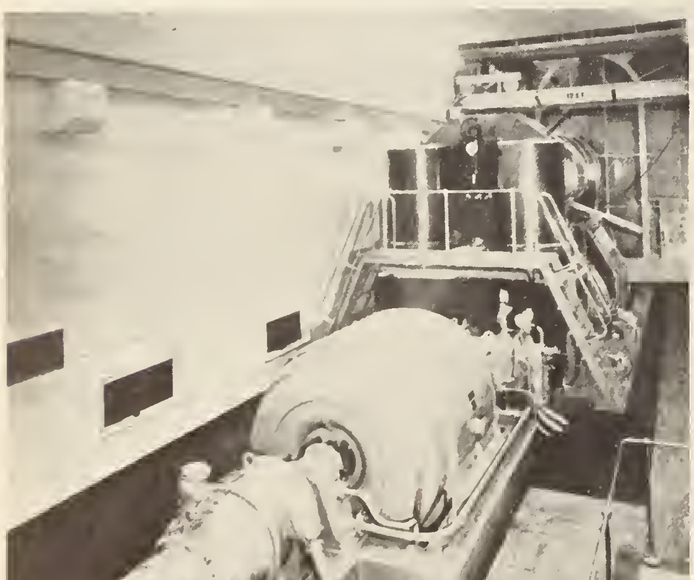


Fig. 1—First 4,000 kw. Gas-turbine Power Unit installed in bomb-proof standby power plant at Neûchatel, Switzerland.

First Gas-Turbine Power Unit

The 4,000 kw. gas-turbine power unit, which is illustrated in Fig. 1, may be looked upon as the forerunner of the gas-turbine unit as applied on the first gas-turbine locomotive. This first installation of its kind was a 4,000 kw. standby gas-turbine generator group installed in 1939 in a bomb-proof power plant of the City of Neuchâtel in Switzerland. The output of the gas turbine, in this case, is 16,000 kw. The air compressor utilizes about 12,000 kw., and 4,000 kw. are available for power production. This turbine group operates with a gas temperature at the turbine intake of about 1,020 deg. F. and the thermal efficiency of the turbine group, which is laid out in the simplest form possible, is 18 per cent at full load.

First Gas-Turbine Locomotive

In 1941, Brown Boveri & Company introduced, at the Swiss Federal Railway, the first gas-turbine locomotive ever built.

Figure 2 illustrates the principle of operation of this gas-turbine locomotive. On a common bedplate (G) are erected the gas turbine (B), the axial compressor (C), the reduction gear (E) with the power generator (F). The combustion chamber (A) is erected to the left of the gas-turbine, while the air pre-heater (D) is located above the gas-turbine set. The latter is connected to the compressor by an air pipe (8) with several expansion joints (9) which allow for different expansions of the air preheater and gas-turbine set.

The compressed air, which is pre-heated in an air heater, enters the combustion chamber partly as combustion air through the air nozzle ring (1) and partly as cooling air through the slits (2). The fuel enters through the injection nozzle (3). The cooling air enters into chamber (4) and reduces the combustion gas temperature to the admissible gas-turbine inlet temperature. This gas expands in the gas-turbine and passes afterwards through the air heater where finally it escapes through slits (6) in the locomotive roof to atmosphere.

The complete gas-turbine unit assembled on a common frame, ready for testing, is shown in Fig. 3. Various tests were carried out before the complete unit was fitted into the locomotive. The test data obtained were in very close agreement with the calculated values. The main particulars of this first gas-turbine locomotive are as follows. The guaranteed continuous output measured at the generator coupling is 2,200 hp. at a turbine speed of 5,200 rpm. and a generator speed of 812 rpm. The maximum speed of the locomotive is 65 mph. and the total length

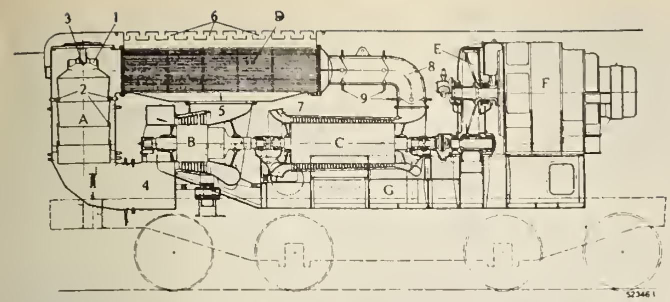


Fig. 2—Layout of the Gas-turbine Set of the Locomotive.

A. Combustion Chamber **C. Compressor** **F. Generator**
B. Gas-turbine **D. Air Heater** **G. Bedplate of Unit**
E. Gear

amounts to 53 ft. 10 in. The tractive effort at the wheel rim is at starting 29,000 lbs. at zero to 16 miles an hour; during one hour 17,000 lbs. at 30 miles an hour and continuous 11,000 at 45 miles an hour. The miximum service weight including fuel oil is 202,000 lb. The maximum axle load amounts to 35,200 lb.

In this simplest form of gas-turbine unit, a thermal efficiency between 14 to 18 per cent is obtained at half to full load of the unit, with a gas-turbine inlet temperature varying from 940 to 1,060 deg. F. The fuel consumption at full load is about one pound per horse-power hour at the wheel rim, i.e. it amounts to about 2,000 lb. of fuel per hour with 2,000 hp. at the wheel rim. On full-load operation, the gas-turbine develops approximately 8,200 hp., the compressor utilizes about 6,000 hp. and the remaining 2,200 hp. available at the generator coupling represents the useful power for traction and auxiliary purposes.

For various practical and technical reasons, the electrical transmission—as developed and successfully used in many cases with Diesel-electric units—was used with this first gas-turbine locomotive. Therefore, only the gas-turbine set was a new feature while the generator, motors, and switchgear could be adopted from the Diesel-electric locomotive without modification. Electric transmission was also preferred because such equipment had already proved very satisfactory for larger outputs, while hydraulic or mechanical transmission was not yet fully developed for larger outputs and therefore its application would have introduced uncertainties, which might have hampered the successful operation of this first gas-turbine locomotive. Furthermore, the gas-turbine which drives the generator through gearing can always be operated at the speed most suitable for the compressor and, therefore, the engine gives a relatively high efficiency at all speeds and loads. Furthermore no reverse turbine or corresponding reversing gear is necessary which would otherwise be required, in addition to the standard turbine, if mechanical transmission were used.

Regulation of the power developed by the gas-turbine locomotive with electrical transmission requires co-ordination of the power developed by the engine and that delivered by the motors or rather by the generator. This is effected by regulating the field of the generator by means of a servo-field regulator. This regulator is operated by an oil pressure governing system, which is illustrated in Fig. 4. The pump (9) supplies oil, under pressure, to the pressure lines common to all control devices and also during starting through the throttling orifice (31) to the bearing, while on normal operation the bearing lubrication is performed by the direct driven pump (8).

The driver, at either end of the cab, (A or B), can regulate simultaneously by the control wheel (14), the amount of fuel delivered by the pump (7) to the burner (12) of the combustion chamber via the oil pressure lines (18 and 19) by means of the servo-motor (20) and also the position of a speed governor sleeve (21) by means of the servo operated cam (22). By this operation, the speed varies with the oil pressure according to a definite law, the speed regulator, in turn, controlling through line (23) the servo-field regulator (24) and also the electrical output.

In case of a rising gradient where more power is required, the driver by rotating the handwheel (14) opens up the oil supply to line (18, 19) which means that the servo-motor allows more fuel to the combustion chamber and the cam sector (22) alters the position of the governor sleeve (21) so that the latter causes a speed increase of the set. The speed lags temporarily behind the value corresponding to the new governor setting due to the large inertia of the rotating masses of the turbine, compressor and generator, and therefore the servo-field regulator is influenced first by the speed governor in such a way as to remove load (as in the case of an overload) in spite of the fact that an increase in output is initiated. This operation therefore makes the excess of power, resulting from the increase in fuel quantity and from the reduction of the electrical load, available for accelerating the set which reduces considerably the temporary period of increased gas temperature and enables to attain in the shortest possible time the final speed at which the compressor supplies an air quantity corresponding to the increased fuel quantity. This action is further assisted by piston valve (26) coupled with the field regulator which causes, in the overload position, an additional increase in the supply of fuel oil by increasing the pressure in line (32). As soon as the speed of the set begins to exceed the new setting of the governor, the pressure begins to rise in the line (23) from the speed governor which causes the field regulator to be moved back again until equilibrium between the useful output of the gas-turbine and the load on the generator is established. When reducing the load, the same processes take place but in reverse sequence.

Lever (15) serves as a reversing switch for the motors and in the open position shuts off the governing oil supply from this driving stand when the other stand is used. The output and the speed which normally are fixed by the form of the cam sector (22) can be adjusted (if for any particular reason this should be desirable) by the screw knob (16) which establishes the relation between them and the fuel oil quantity. Lever (17) makes it possible to keep the light running speed high which might be desired in certain cases where a very short time to accelerate the set is required.

The control system also comprises a number of safety devices which prevent overspeeding of the set in case of a broken connection, protect the blading from harm

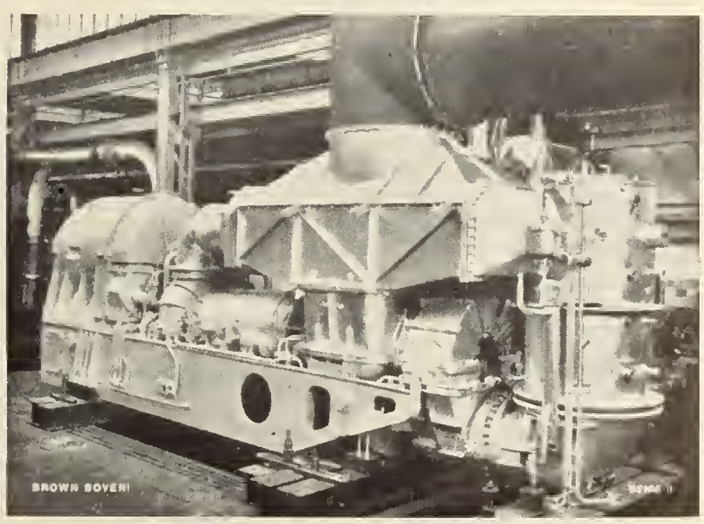


Fig. 3—Gas-turbine Generator Set on the test bed. The complete set is mounted on a common frame which also contains reservoirs for fuel oil and lubricating oil.

which would result from excessive temperature, shut-off the fuel should the governing oil pressure fall below a certain minimum or should the flame in the combustion chamber suddenly go out.

Operating Experience

On acceleration tests with a 321-ton train, the following data were obtained.

at a grade of .0% (level)	an acceleration of	0.500 mph per sec.
" " " " 1.2%	" " "	0.385 mph per sec.
" " " " 1.8%	" " "	0.276 mph per sec.
" " " " 2.6%	" " "	0.186 mph per sec.

While during the first year the number of test runs was relatively limited because of fuel shortage, this locomotive was operated during 1943-44 on a regular daily schedule over one of the longest secondary lines in Switzerland which is still not electrified. This line has a length of 47 miles and 21 stops, with light mixed passenger and freight traffic. The run includes switching operations at many stations, also numerous curves with resulting low average speed. It is far from ideal for a locomotive which is basically intended for long high-speed runs with few stops. During this period of service, the locomotive covered about 50,000 miles, far less than it could have travelled had oil fuel been freely available, but again much more than could have been hoped for, considering the severe wartime shortages in Switzerland. This run did not provide opportunities for trying out sustained operation at or near maximum speed but it did offer occasions for starting, acceleration, and stopping at much more frequent intervals than would occur under more nearly normal circumstances. It was therefore a much more severe test of the power plant and the control equipment than might be judged from the total milage alone. The number of control operations performed would normally be reached only in long-distance runs, aggregating at least 10 times the total milage covered.

This year of regular service confirmed the results of the earlier trial runs in regard to guaranteed performance. All requirements were fully met, no major disturbances of any kind occurred. Minor adjustments could always be completed during scheduled waiting periods, so that the availability record is excellent. The operating crews appreciate the simplicity of operation and the flexibility of the power plant. In view of this record, the locomotive has been definitely accepted by the Swiss Federal Railways and is now in service, together with other locomotives powered by internal-combustion machines.

In October, 1945, the Swiss Federal Railways loaned the locomotive, as shown in Fig. 5, to the French National Railways where it was operating daily on the line from Basle to Strasbourg, thus making one round trip of about 175 miles per day. On these runs, the fuel consumption measured over a long time was about 3 times less, namely 47.5 lb. per 1000 ton-miles, than it had been in Switzerland. This is entirely in accordance with the results of extensive operating cost studies. In North America, with heavier average loads on the turbine, higher speeds and fewer stops, the fuel consumption should drop to about 30 lb. per 1000 ton-miles. This is about double that which will be reached with the best traction Diesel engines. Depending now on the price ratio of Diesel and bunker oil, the fuel costs of the gas-turbine locomotive will be about the same or only slightly higher than that of a similar Diesel locomotive.

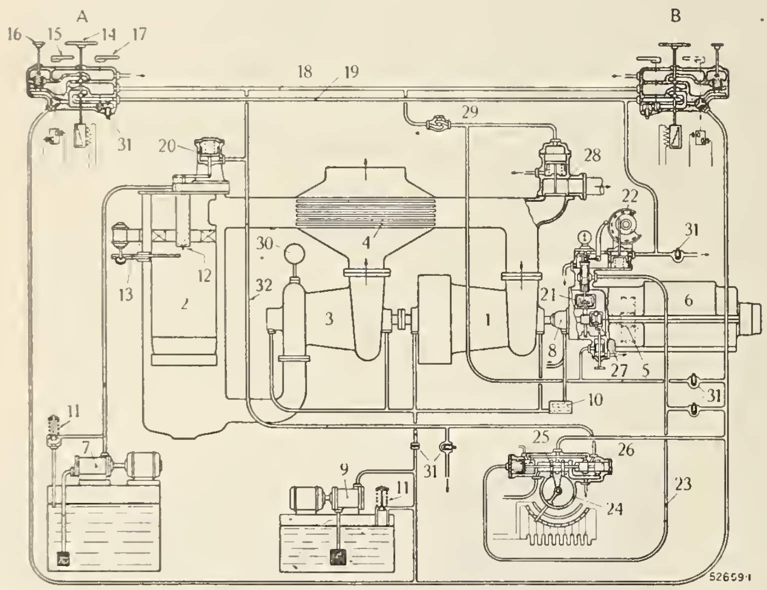


Fig. 4—The oil-pressure governing system of the Gas-turbine Unit for traction purposes.

A.B. Driver's cabs.
1. Compressor.
2. Combustion Chamber
3. Gas-turbine.
4. Air preheater.
5. Gearing.
6. Generator.
7. Fuel pump.
8. Control and lubricating oil pump.
9. Auxiliary pump.
10. Oil cooler.
11. Pressure limiter.
12. Fuel nozzle.
13. Remote-operated ignition rod.
14. Main control wheel with double valve and excitation resistor.
15. Reversing switch with oil stop cock and removable key.
16. Temperature adjustor.
17. Lever for adjusting lower or higher no-load speed (in readiness for service).
18. Pipe to fuel control oil system.
19. Speed control oil system.
20. Piston for fuel nozzle.
21. Speed regulator.
22. Cam for varying speed from driver's cab (displaces sleeve of regulator 21).
23. Hydraulic transmission of control impulse from 21 to field rheostat.
24. Field rheostat with rotary valve.
25. Control valve for 24.
26. Control valve for varying amount of fuel during regulating process.
27. Emergency governor for preventing overspeeds.
28. Blow-off valve.
29. Non-return valve.
30. Safety temperature regulator.
31. Oil baffle.
32. Oil pipe for fuel control system.

Economic Prospects of the Gas--Turbine Locomotive

Where traffic density is high, electrification generally receives first consideration especially in larger cities, otherwise either a steam, Diesel-electric or gas turbine-electric locomotive may be applied. It is therefore of interest to mention a few comparative figures for steam, Diesel-electric and gas turbine-electric locomotives. The data for steam and Diesel-electric units are taken from a paper presented before the American Society of Mechanical Engineers by Mr. E. E. Chapman, and giving an interesting comparison of steam and Diesel electric locomotives, in the light of modern American experience. To these figures, the corresponding data for a gas-turbine locomotive were added, based on careful estimates and operating figures available. The comparison is given in Table I.

In connection with Table I, the following remarks should be noted:

a) The cost of the gas-turbine locomotive is assumed on quantity production similar to steam and Diesel locomotives. It should be mentioned that these figures refer to pre-war conditions.

b) In the efficiency given for the steam locomotive, the steam turbo locomotive was not considered as this type has not been adopted to any extent. If supercharged four-cycle Diesel engines were considered, the Diesel efficiency would be higher than indicated.

Fig. 5—Passenger train driven by first gas-turbine locomotive at Gare de l'Est in Paris.

c) The equality of fuel cost for gas-turbine and Diesel locomotives applies to oil producing countries where the cost of bunker fuel oil is about one-half that of Diesel oil.

d) The lubricating cost of the gas-turbine is negligible, while for the Diesel engine, it amounts to a relatively high percentage of the fuel cost. The lubrication requirements of the wheel axles are not included, but they are, of course, the same as those of the other locomotives.

e) With the gas-turbine locomotive, no water is required for the gas-turbine power plant and, for the small starting auxiliary Diesel, an air-cooled auxiliary Diesel engine can be used.

g) Since the gas-turbine locomotive possesses no reciprocating parts, the time out for repairs and maintenance should be the smallest of the three.

h) The operating temperature range has been chosen at 850 to 1,100 deg. F. For this range of temperature, experience with a large number of exhaust gas-turbines on Velox boilers and combustion turbines for oil refining process has shown that there is practically no wear of the blading even after several years of operation. Also the greatest degree of security is ensured for the combustion chamber, due to the air cooling, which is supplied by the same compressor as the combustion air, and can therefore never fail whilst combustion is going on.

i) The gas-turbine locomotive can be applied for power braking whilst coasting downhill. If the fuel oil supply is reduced to such an extent that the flame just continues to burn, the motors are converted to generators by suitably exciting the fields and delivering their power to the main generator which, in this case, is operating as a motor driving the compressor and turbine. By opening, at the same time, the blow-off valve, which normally is actuated only by overspeed governor, the greater part of the air delivered by the compressor will escape to atmosphere, while enough air enters the combustion chamber to keep the burner alight with a small flame. In this manner, without requiring any additional apparatus, the motor power can be applied for braking.

TABLE I

Comparative Operating Figures for Various Types of Locomotives

Data	*Steam*	*Diesel*	*Gas-Turbine*
(a) Approx. cost per H.P. in U.S. $	35	87	75
(b) Efficiency at draw-bar %	6-8	26-28	15-16
(c) Fuel costs	100%	50-75%	50-75%
(d) Lubrication costs % of fuel costs	10%	20-30%	<1%
(e) Water costs % of fuel costs	10%	small	nil
(f) Milage per year	180,000	250,000	> 250,000
(g) Maintenance	lower	high	least
(h) Approx. life in years	30	15-20	25-30
(i) Power braking	none	full power	full power
(k) Starting effort	minimum	larger	larger

Gas-Turbine Locomotives of Large Capacities

Following the operating data obtained with the first gas-turbine locomotive and the wide experience gained with a large number of gas-turbines in operation on various applications Brown Boveri developed types of gas-turbine locomotives which are very suitable for heavy main-line service similar to that to be expected on American railroads. The prime mover for these locomotives is a gas-turbine group of 2500 hp. continuous rating, which in its main elements is similar to the first gas-turbine locomotive but incorporates several improvements in design resulting in a net output of 2500 hp. and a thermal efficiency of 20 per cent without going into the yet largely untried field of gas temperatures above 1100 deg. F.

This gas-turbine power unit of 2500 hp. can be used singly or in a wide variety of combinations. By coupling several of these units in various combinations and operating them by multiple unit control, larger units of an output of 5000 hp., 7500 hp. and 10,000 hp. can easily be obtained. Some of these units will now be considered more closely.

A 2500 hp. gas-turbine freight-locomotive designed for a maximum speed of 75 mph. is illustrated in Fig. 6. This locomotive is laid out as a truck-type unit such as has been built in great numbers in the United States for electric and Diesel-electric traction. The prime mover gas-turbine set is rated for an output of 2500 hp.

In accordance with the tractive effort and speed requirements of the American railroads, generators and traction motors larger than were used for the first gas-turbine locomotive are provided in this freight-locomotive. For the generator, a tandem group consisting of four armatures was chosen, resulting in each generator armature delivering electric energy to one traction motor only. The gear ratio of the motors is 71:27. The space above

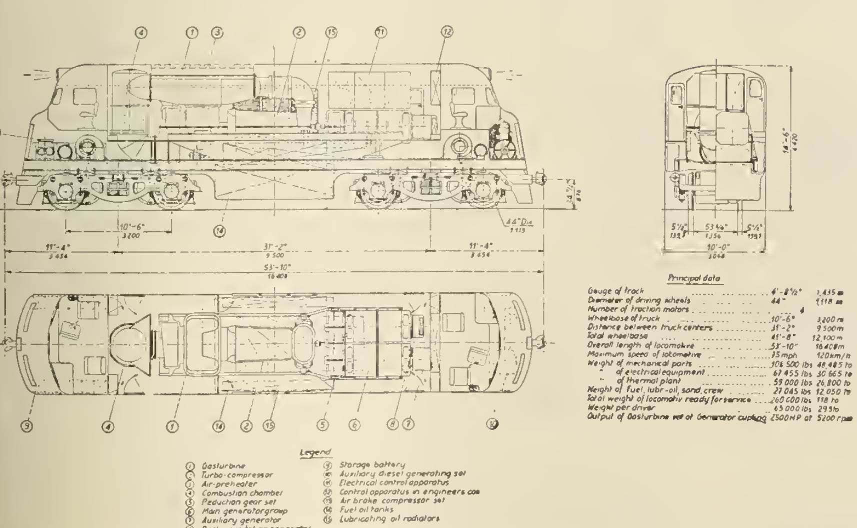


Fig. 6—Project of a 2500 hp. Gas-turbine-electric Freight-Locomotive.

the generator group is well suited for the mounting of the necessary control apparatus. The fuel oil capacity of this locomotive is, depending on the load conditions, sufficient for a run of approximately 500 to 600 miles. If a larger distance is to be covered without stopping for fuel, a fuel oil tender can be coupled to the locomotive.

A 2500 hp. gas-turbine passenger-locomotive, designed for a maximum speed of 112 mph. is illustrated in Fig. 7. For this locomotive, the same gas-turbine group as for the freight engine is used. This locomotive, which is also of the truck type, is designed, however, with 6 axles, of which 4 are equipped with traction motors. The generator and traction motors are the same as on the freight engine, the only difference being in the gear ratio of the motors which is 65 to 33 because this locomotive is to be used for a speed of up to 112 miles per hour. A steam boiler for train heating, of an approximate capacity of 3600 lb. of steam per hour, is located in the locomotive, and the necessary reservoirs for fuel oil and for feed water are provided. The combustion chamber of the gas-turbine and the steam boiler for train heating are fed by bunker C oil. The capacity of the reservoirs is sufficient for operation over approximately 500 to 600 miles.

A 5000 hp. gas-turbine passenger and freight locomotive, designed for a maximum speed of 112 mph., is illustrated in Fig. 8. In the cab of this locomotive are mounted two gas-turbine generator groups of design identical with that of the above mentioned locomotives. The running gear of this engine is built in such a way that two of the four trucks have 6 wheels and the other two have 4 wheels. The middle axle of the 6-wheel trucks are not fitted with driving motors. This type of engine is favoured because it permits the use of the same trucks, generator group and railway motors, as are intended to be used for the 2500 hp. freight and passenger locomotives.

As outlined above, the prime mover thermal plant and the electrical equipment are the same in all three types of locomotives, the difference between freight and passenger locomotives being mainly in the gear ratio of the traction motors. The 5000 hp. locomotive differs from the 2500 hp. unit only in so far as two complete power units are installed in one mechanical part. This standardization permits great freedom for the exchange of like parts between the locomotives and greatly reduces the amount of spare parts that should be kept and, furthermore, it speeds up repairs of damaged units.

When several of these units are operated in multiple, the following output ratings can be obtained: 5000 hp. with two 2500 hp. units; 7500 hp. with three 2500 hp. units; 10,000 hp. either with four 2500 hp. units or two 5000 hp. units. The control system of the locomotives is of the electro-pneumatic type and arranged in such a way that multiple unit operation of several units is possible.

Characteristics of the Gas-Turbine Locomotives

The tractive effort characteristics of the passenger and freight locomotives are shown in Fig. 9a and Fig 9b. It goes without saying that different gear ratios, generator, or motor sizes are selected if tractive effort and speed conditions other than indicated by the above curves are to be met.

The operating characteristics of the gas-turbine are given in Fig. 10 which shows the thermal efficiency, the speed of the gas-turbine, the temperature of the gases at the turbine intake and the air pressure after the compressor.

The influence of outside temperature on the gas-turbine output is illustrated in Fig. 11. These data show that, with decreasing ambient temperature, the output of the gas-turbine increases faster than the input of the compressor. The turbine can therefore deliver a higher ouptut to the generator at lower outside temperatures. In fact the gain is of such magnitude that the locomotive can, at 32 deg. F., if it is equipped with a heating-power generator, deliver its normal full output and a considerable amount of heating power for the same fuel consumption as it needs to deliver traction power only at about 70 deg. F. ambient temperature. This increase of power in winter time is furthermore very welcome because the train resistance increases also. Experience with steam locomotives which in winter time have to deliver large quantities of steam to the train for heating purposes, indicates that the useful traction output is often considerably lowered on account of these increased heating requirements.

Because the working medium of the turbine is air, its output is not only influenced by temperature changes of the surrounding air but also by the altitude at which it works. As a rule, higher altitudes mean lower air temperature so that, in most cases, a loss of power due to the lower air density at high altitudes is compensated by a gain in output due to the lower temperature. Each 1000 ft. increase in altitude decreases the output by approximately 3.5 per cent. Furthermore, each increase of 1000 ft. in altitude lowers the air temperature approximately 5.5 deg. F. which results in an increase of the useful output of 3.7 per cent; that is the loss of power by increasing altitude is compensated on account of the falling air temperature.

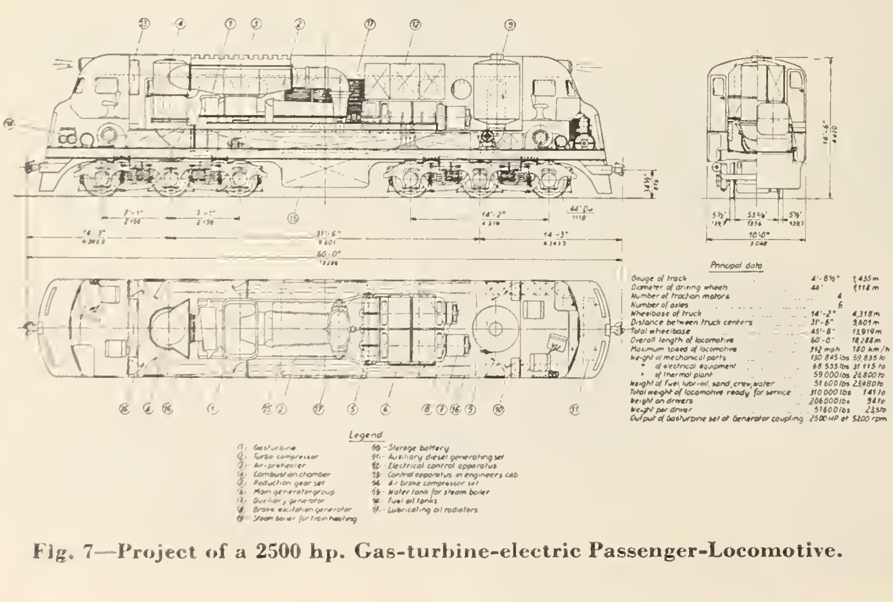


Fig. 7—Project of a 2500 hp. Gas-turbine-electric Passenger-Locomotive.

The fuel consumption and efficiency at various loads are shown in Fig. 12. The gas-turbine works at best efficiency if a certain speed is assigned to a certain output, i.e., with rising output, the speed is raised also until, at about 2500 hp., the maximum speed of 5200 rpm. is reached. The speed of the turbine is set by an electrical control apparatus that permits multiple unit operation of several units. For each speed point, the output of the turbine is kept constant, regardless of the speed of the locomotive, by means of a set of thermostats which regulate the excitation of the main generator in such a way that any increase in temperature above normal temperature tends to weaken it, that is to lower the generator output, and a drop somewhat below this temperature increases the generator field. With

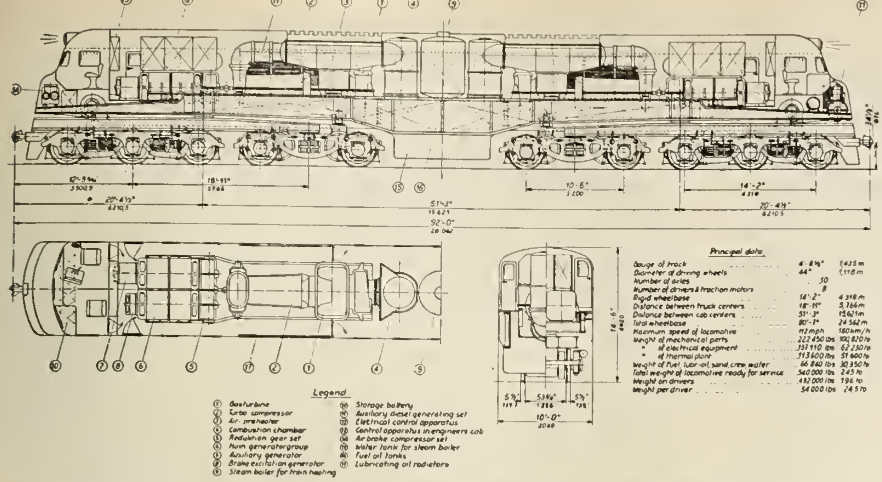


Fig. 8—Project of a 5000 hp. Gas-turbine-electric Passenger-Locomotive.

this arrangement, the gas-turbine always works at best efficiency.

In Fig. 13 is illustrated the thermal efficiency that would be obtained if the two separate power units of the 5,000 hp. locomotive, were operated in such a way that, up to 2,400 hp., only one unit carried the load. In order to obtain this high efficiency at low loads, it would be necessary to have each generator of the first unit supply power to two traction motors; when the second unit comes in to supply power above 2,400 hp. each generator will furnish current to only one traction motor.

Gas-Turbine Power Plant

The prime mover plant of the locomotive types considered above is designed very similarly to that of the first gas-turbine locomotive, i.e. it consists essentially of the gas-turbine, an air compressor directly coupled to it, an air preheater, a combustion chamber and the necessary auxiliary equipment such as fuel oil pumps, lubricating oil pumps, speed and fuel-oil regulators, gas-turbine shaft turning device and the necessary safety appliances that are essential for the protection of the unit against overspeed, too high temperature or lack of lubricating or control oil pressure.

Like an internal combustion engine, the gas-turbine must be started by means of some external power source. In order to accomplish this, a 200 hp. Diesel generator set is built into each locomotive. This Diesel generator set itself is started from the storage battery of the locomotive, which furnishes power to the generator, which then acts as a starting motor. The Diesel generator group starts the gas-turbine group and accelerates it up to a speed where sufficient air is furnished by the air compressor for the combustion of the fuel oil. When this speed has been reached, fuel oil is injected and electrically ignited. The turbine accelerates now very quickly up to its no-load speed, and the auxiliary Diesel generator can be stopped. The turbine is now ready to operate the locomotive. The starting time for the gas-turbine varies between 3 to 5 minutes.

The Diesel generator set is also used to feed one of the traction motors when it is desired to move the locomotive only a short distance at slow speed, such as moving it out of a shed, or to a train for coupling before the gas-turbine is started, or even for light switching work.

Sudden heavy overloads of the gas-turbine do not stop it, due to its great flywheel effect; they merely lower the speed of the machine until the output-regulating device has had time to adjust the fuel-oil supply and the excitation of the main generator.

The gas-turbine locomotive lends itself readily to electric braking; in fact, it is ideally suited for it. During braking, the motors furnish power to the generator, (instead of to resistors as would be necessary with other types of locomotives), which in turn drives the gas-turbine set. The air compressor absorbs all power that is delivered by the generator. The locomotive will be able to brake any train on a downhill grade at about the same speed as it can haul up the same grade.

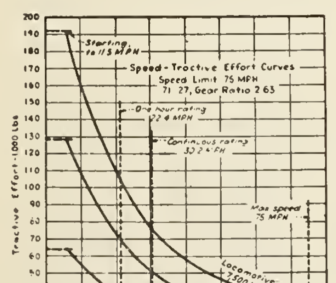
The gas-turbine is shut down by stopping the fuel-oil pump. In order to prevent the bending of the turbine shaft during the cooling period, a shaft-turning device is installed in the locomotive. A timing relay controls a shaft-turning motor of small output (fed from the storage battery) in such a way that the turbine shaft is turned ½ a revolution about every 30 minutes. This continues for a period of about 6 hours.

Lubricating-oil coolers are provided in the side walls of the locomotive. Unlike the lubricating requirements of a Diesel engine which may reach a high cost, the lubrication cost of the gas-turbine compressor unit is practically negligible. It will be necessary to renew the oil only after approximately 10,000 hours of operation. The gas-turbine and the compressor unit each contain only two bearings that must be lubricated. There are no crankshafts, no connecting rods, no pistons, no cylinder walls to lubricate, no cam-shafts with their bearings and no valves. In short, the gas-turbine is the simplest of all thermal motive-power units that are in use today.

The gas-turbine is normally operated with bunker C fuel oil. This oil does not lend itself to ignition at normal temperatures. The fuel oil therefore is heated up above a temperature of 175 to 200 deg. F. either by a fuel oil preheater, which is exposed to the exhaust gases of the turbine, or by a steam heater in the case where a boiler is installed on the locomotive. In the former case, the gas-turbine is started and operated for a few minutes with Diesel oil until the bunker oil has reached a temperature above 175 deg. F.

With regard to the electrical equipment, the following brief comments are of interest. In the 2500 hp. units, the direct-current generator group furnishes power to four forced-ventilated series-type traction motors. Overload relays and motor switches protect the motors and the generator from dangerous overloads. Field weakening of the traction motors is used in order to cover the full speed range of the locomotive without reaching unduly high voltages on the generator.

The generator group consists of four armatures, each delivering power to one traction motor. No series-parallel connection is used on the 2500 hp. unit, the motors being always connected to the same generator armatures over



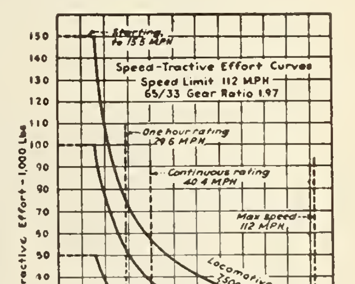


Fig. 9a—Tractive effort characteristics of Gas-turbine Locomotives of maximum speed 75 miles per hour.

Fig. 9b—Tractive effort characteristics of Gas-turbine Locomotives of maximum speed 112 miles per hour.

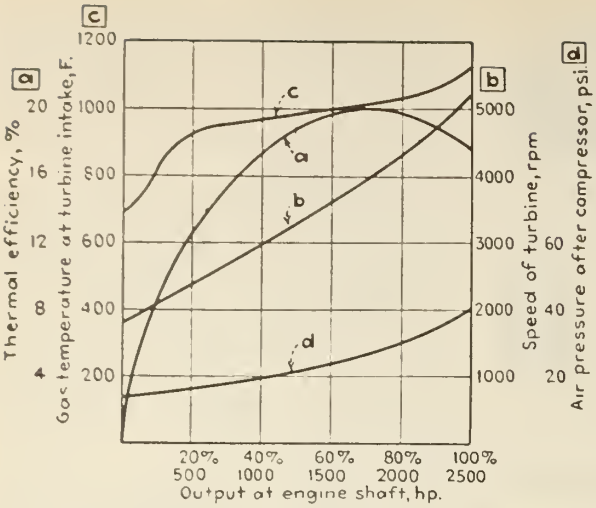


Fig. 10—Operating characteristics of 2500 hp. Gas-turbine Power Unit of Locomotive.

the entire speed range of the locomotive. The absence of such a series-parallel arrangement simplifies the design and assures smooth power control over the entire speed range. The generators are built as differential machines having both a self-exciter and a separately-excited winding. A starting winding is used to drive the gas-turbine set from the auxiliary Diesel generator set when starting. Output regulation is accomplished mainly by regulating the separately excited winding, which, in combination with the differential winding and the temperature-control device of the turbine, maintains a constant power output of the group for various locomotive speeds. For the operation of all auxiliary circuits, such as battery charging, traction-motor ventilating groups, fuel and lubricating-oil pumps, etc., an auxiliary generator of 75 kw. rating is directly coupled to the main generator. A voltage regulator is used to keep the voltage of the auxiliary generator constant for all speeds from no load to full load.

The traction motors, which are of the forced-ventilation type, can be either of the nose-suspended or entirely suspended rigidly mounted type. In the latter case, none of their weight rests on the driving axle. A flexible disk drive, as shown in Fig. 14, may be used to transmit the motor torque to the driving wheels. The motor torque is transmitted from the sleeve (1), which is attached to the rotor, over a carrier pawl (2) to the steel disc (4) and

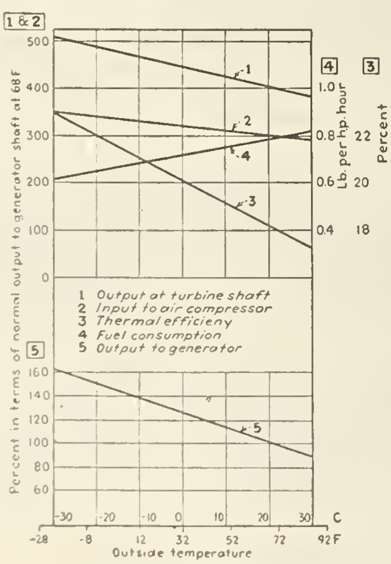


Fig. 11—Output, thermal efficiency, and fuel consumption of Gas-turbine Locomotive in relation to the outside temperature.

from there by another carrier pawl (5) to the torsion shaft (6). The other end of this torsion shaft is elastically connected over a second steel disc (9) and the two carrier pawls (7, 10) to the gear wheel shaft (11). By this means the disc drive can take up the relative movements between the motor, which is mounted in the spring supported truck frame and the gear wheels, the casing of which is rigidly attached to the driving wheel shaft. Such a drive has already been used in single-phase locomotives with pulsating motor torque and power up to 1000 hp. per axle, permitting the free vertical movement of the axle within the limits of the journal-box guides. Most important of all, this disc drive does not require any axle lubrication at all and does not influence the springing of the locomotive. The application of this very simple drive can be strongly recommended because it protects the motor from the heavy blows otherwise imposed upon it from the axle, and it reduces the unsprung dead weight to a minimum.

The mechanical parts designed for these locomotives are in accordance with the standard American locomotive-construction practice. The cab rests on a heavy under-frame which is either of welded or integral-cast construction. The 2500 hp. unit rests on two trucks of the 6-wheel type for the high-speed passenger locomotive. None of the

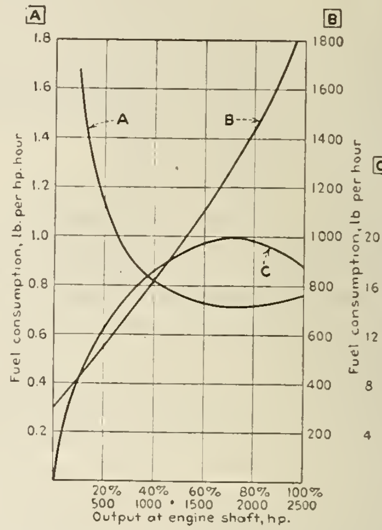


Fig. 12—Fuel consumption and thermal efficiency of 2500 hp. Gas-turbine Power Unit of Locomotive with approximately 1112 deg. F. gas temperature at turbine inlet.

trucks is articulated; that is, the tractive pull of the locomotives is transmitted through the cab underframe.

The 5000 hp. locomotive rests on four trucks, of which two have 4 wheels and the other two 6 wheels. The 6-wheel trucks and the motors installed in them are the same as those used in the 2500 hp. units. Only the springs will be different on account of the different axle load. Otherwise these trucks are interchangeable for the proposed locomotive types. The trucks are of the 4- and 6-wheel spring-bolster type having integral steel-casting frames. The axle boxes can be either of the antifriction or sleeve-bearing type. Two traction motors are mounted in each truck, the middle axle of the 6-wheel truck being an idler. Since the motors are of the forced-ventilation type, a flexible air connection is arranged between the truck and the cab underframe, on which the motor blowers are located.

Comparison of Weight and Length of Various Types of Locomotives

Table II gives the length of track occupied and the weight of various gas-turbine locomotives up to 10,000 hp.

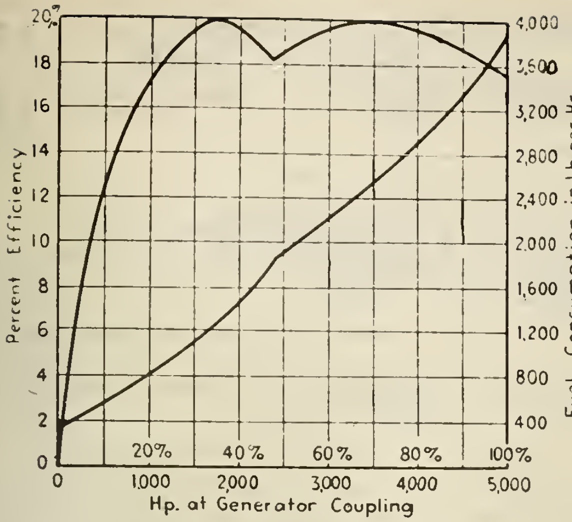


Fig. 13—Thermal efficiency and fuel consumption of 5000 hp. Gas-turbine Locomotive.

rating, built up by units of 2500 hp. and 5000 hp. rating.

When considering the fact that American railways are already operating a large number of steam locomotives of 6000 and 7000 hp., then it seems that gas-turbine locomotives of 10,000 hp. rating are not such fantastic units as one might think. The comparison of these different units shows that probably for a 10,000 hp. unit, a combination of two 5000 hp. units is preferable to a combination of four 2500 hp. units because the former unit is lighter, cheaper and also of smaller length.

A comparison between a 7500 hp. gas-turbine locomotive built up of three 2500 hp. units with a 5400 hp. Diesel-electric locomotive built up of four 1350 hp. units yields the following figures. The 7500 hp. gas-turbine locomotive weighs 382 tons whereas the 5400 hp. Diesel locomotive weighs 461.8 tons, i.e., the gas-turbine locomotive weighs only approximately 80 per cent of the Diesel locomotive but delivers 40 per cent more power. The Diesel locomotive has a slight advantage during starting because its tractive effort is about 110 tons whereas that of the gas-turbine is only 96 tons. This advantage, however, can only be utilized up to a speed of approximately 8.4 mph., while for all higher speeds the gas-turbine has a decided advantage due to the higher horsepower output.

TABLE II

Lengths and Weights of Combinations of Gas Turbine Locomotive Units

No. of Units Combined	Rating of each Unit hp.	Total Length ft.	Total Weight tons
1	2500	60	155
2	2500	111.5	305
3	2500	163	455
4	2500	214	605
1	5000	92	270
2	5000	184	540

Operating and Maintenance Costs

Brown Boveri has carried out extensive comparative studies of operating and maintenance costs for gas-turbine locomotive and Diesel-electric locomotives. The following performance data for the latter were taken from various recent papers in *Railway Age,* the *Railway Gazette*, etc., while, for the gas-turbine, the data have been closely estimated from available operating experience with the first gas-turbine locomotive and other gas-turbine power units. Many factors such as the following enter into the economics of locomotive operation: First cost, interest and depreciation of capital investment, maintenance of electrical, mechanical and thermal parts, fuel and lubricating oil costs and wages of crews.

FIRST COST. Estimates show that, in quantity production, it will be possible to build gas-turbine locomotives for a price about 80-85 per cent that of Diesel-electric locomotives of the same rating. This is justified if one realizes, as has been shown, that gas-turbine locomotives are considerably shorter and lighter than Diesel-electric locomotives built today, so that the mechanical parts will be cheaper; this applies particularly to locomotives of large output. The gas-turbine itself will be cheaper than Diesel engines of the same rating.

INTEREST AND DEPRECIATION OF CAPITAL. The rate of interest on the capital is assumed at 4 per cent for both types of locomotives. A life-time of 20 years for the gas-turbine and 15 years for the Diesel-electric locomotive are assumed, although our experience with rotating turbo-type machinery indicates that the life of the turbine locomotive, with its purely rotational movement of the prime mover, will very likely be much longer. As a matter of fact, both types as built today will very likely be out-dated long before the expiration of 20 years, due to improvements in design. The chances for such improvements are very pronounced for the gas-turbine locomotives, for instance where increasing temperatures of the gases result in higher efficiencies and more powerful locomotives for the same weights. These improvements are bound to come, when steels resisting higher operating temperatures are available.

MAINTENANCE OF EQUIPMENT. The maintenance data in Table III for the Diesel-electric locomotives were collected from various publications issued in the United States at different times. The figures in cents per mile (U.S. currency) for 2500 and 5000 hp. locomotives were based on these publications and for our estimates, in accordance with the horsepower ratings of the locomotives selected.

TABLE III

Maintenance Costs, cents per mile:

Locomotive hp.	2500		5000	
	Gas-turbine	Diesel	Gas-turbine	Diesel
Electrical equipment	2	2	3.3	3.3
Thermal equipment	3.21	5.6	6.0	11.1
Mechanical parts	3.4	3.4	5.45	5.45

The work which each locomotive, in our cost estimates, had to fulfil is about as follows:

a) For a 2500 hp. passenger locomotive, it is assumed that trains of 750 tons weight, the same for the Diesel and the gas-turbine locomotive, are operating over a certain profile of about 620 miles single length, making about

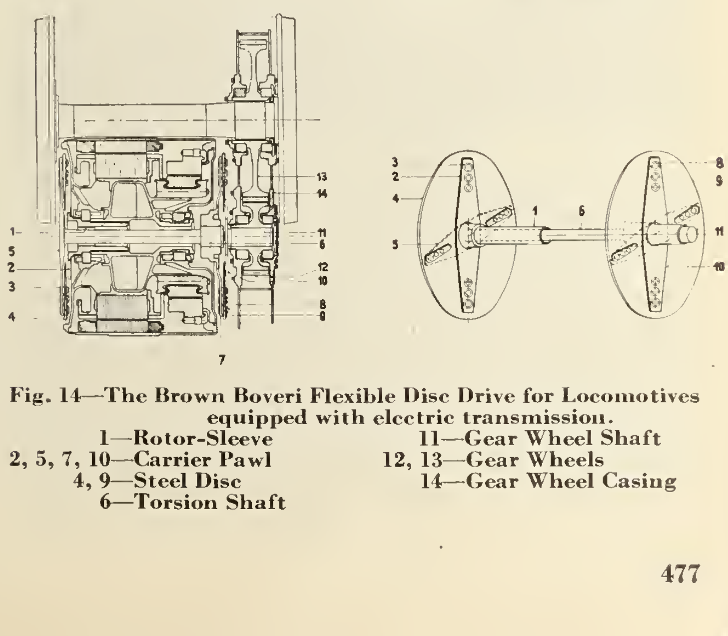


Fig. 14—The Brown Boveri Flexible Disc Drive for Locomotives equipped with electric transmission.

1—Rotor-Sleeve
2, 5, 7, 10—Carrier Pawl
4, 9—Steel Disc
6—Torsion Shaft
11—Gear Wheel Shaft
12, 13—Gear Wheels
14—Gear Wheel Casing

150 round-trips per year (time per round-trip about 24 hours) or about 187,000 miles per year.

b) For a 5000 hp. passenger locomotive, trains of 14 passenger cars are assumed, the total weight being 1470 tons. Each train operates over a certain profile of approximately 930 miles single length, each round-trip taking a time of about 36½ hours, making 120 round trips per year, and resulting in a total annual distance covered of about 239,000 miles. There is at present no maintenance data available on the thermal equipment of gas-turbine locomotives, however our extensive experience with thousands of steam turbines and many gas-turbines operating under somewhat different conditions, indicate that the above-given maintenance values are about what can be expected.

FUEL AND LUBRICATING OIL COSTS. For fuel costs, the average values of 4.5 cents per gallon (American) for Diesel oil and 2.7 cents per gallon for bunker oil were assumed. In order to obtain a fairly true picture of the fuel oil consumption for both types of locomotive, 15 per cent was added to the estimated quantity of fuel oil for the gas-turbine locomotive to allow for low speed orders, no-load periods before starting, running after the arrival of trains and unexpected stops during the run. For the Diesel-electric locomotives, a fuel oil consumption of 0.41 lb. per horsepower hour was assumed and 12 per cent of this figure for no-load periods. Diesel engine lubricating oil costs as published for the power range involved in our estimates amount to about 0.023 and 0.055 gallon (U.S.) per mile. The lubricating oil costs for the mechanical and electrical parts of Diesel-electric locomotives are of the order of 5 per cent of the fuel costs. The same cost is about to be accepted for the same equipment parts of the gas-turbine locomotives. The lubricating oil costs of the gas-turbine plant, as mentioned before, are practically negligible but are entered in our calculations as 0.5 per cent of the fuel oil costs.

ANNUAL SAVINGS. Based on these estimates, the total annual savings with a gas-turbine locomotive as compared with a Diesel-electric unit of the same power amount to:

a) approximately $10,000.00 per year for the 2500 hp. unit
b) approximately $20,000.00 per year for the 5000 hp. unit

These results are obtainable with gas-turbines of existing and tried designs working with an inlet gas temperature of about 1110 deg. F. Naturally the economic advantages of the gas-turbine locomotive will become even more attractive when the metallurgists can provide alloys for continuous operation with higher inlet temperatures to the gas-turbine. Such advances will have a very pronounced influence on the power developed by a given gas-turbine frame size, or in a given locomotive unit, or on the thermal efficiency of the power plant or both. The result will be lower first costs and fixed charges and, particularly, reduced fuel costs.

In connection with the above mentioned types of gas-turbine locomotives, it can be said that Brown Boveri has now under construction a new 4000 hp. gas-turbine power unit designed for use in locomotives. An efficiency of 22 per cent for this larger gas-turbine group is expected. The test results will be available later.

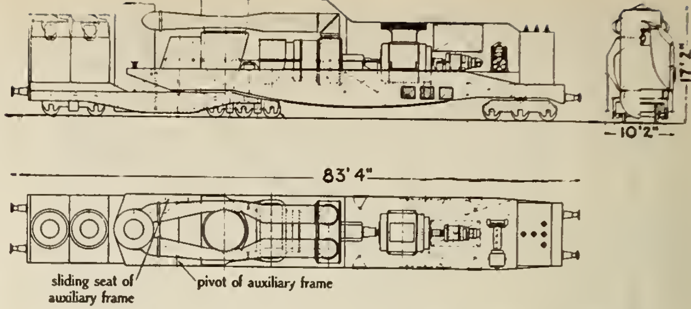


Fig. 15—Portable 4400 kw. Gas-turbine Power Plant.

Portable Gas-Turbine Power Plant

There exists another field of application of gas-turbines that might be very interesting to railroads. In Fig. 15 is illustrated the layout for a 4400 kw. portable power plant. Such a power plant can be very valuable during the development of new territories when electric power must be delivered within a short time or as standby plant. This power plant, which is mounted on three trucks, can be shifted to any side track. Within a very short time, it can deliver its full output. Because the prime mover is a gas-turbine, no water connections are necessary and fuel oil can be pumped into the reservoirs of the power plant from any standard tank car shifted to a track next to the gas-turbine plant. The only outside connection needed will be an electrical transmission line from the roof terminals to the tie-station. The total length of this installation is only 83 ft.

Future Prospects

It can be said that extensive tests are being carried out on a coal burning gas-turbine which, when it can be satisfactorily operated, will open a wide field especially in territories where coal is available at low cost.

Furthermore, it should be remembered that the trend is naturally towards higher temperatures as soon as suitable materials are available. This will make it possible to produce better, more powerful and more efficient machines. At some time, perhaps not too far distant, a continuous gas-inlet temperature of about 1380 deg. F. may be possible. The gas-turbine power plant on which these comments are based will then deliver 2500 hp. at 28 per cent thermal efficiency or 3800 hp. with 26.5 per cent thermal efficiency.

The gas-turbine power unit, recommended for the locomotives considered above, having outgrown the experimental stage, Brown Boveri therefore is in a position today to build locomotive power plants with firm guarantees on performance, output, and thermal efficiency.

From the above, and in conclusion, it can be stated that the gas-turbine locomotive shows sufficient merit today to warrant the serious consideration of forward-looking railroad engineers.

OPERATIONAL EXPERIENCE ON LORAN

A Navigational Aid Using Pulse Transmission

S. S. STEVENS

Director of Communications and Electronic Development, Trans-Canada Air Lines, Winnipeg, Man.

Introduction

The word Loran, which was derived from LOng RAnge Navigation, designates a navigation system developed during the war and whose principle of operation is the pulse transmission of signals.

There has been a great deal of discussion on long-distance radio navigational aids for flights, particularly over ocean areas such as the Atlantic, but the ideal system is still not at hand. However, to date, Loran has been the only system which has been extensively used, and operational results have been obtained over the past year from a commercial airline's viewpoint.

Trans-Canada Air Lines has used the Loran system of navigation for the past year and a half, mainly because it was the only system available that gave the desired results, and, in this period, has attempted to obtain data which might be of interest on both the Loran and Consol, or Sonne system as it is known. A review of the Consol or Sonne data was found to be inconclusive because, for the past year, the only Sonne stations in operation were the ones in Norway and Spain, and these were a considerable distance from the area over which we desired its use, and where they could be compared with Loran to establish some factual data. Because of this it was necessary to discount our Sonne observations and await the installation of Sonne stations so situated that they would be of practical value for flights over the North Atlantic.

This article is divided in two parts. The first contains a description of the Loran system in general and the second discusses Loran data as experienced by Trans-Canada Air Lines over a period of several months.

Principle of Operation

Hyperbolic navigation is achieved when synchronized signals, having a known velocity of propagation, are transmitted from at least three known points, and when the relative times of arrival of these signals are measured and interpreted by a navigator. The signals may be transmitted and received by any known means, but radio is at present the only mechanism which offers interesting accuracy at long ranges. A number of types of signals, ranging from continuous waves through modulated waves to pulses, may be used. In the more useful current applications, pulse transmission is preferred as ambiguity is minimized and the power supplied to the transmitters may be kept low. The apparent increase in the band width required for the system, because of the use of pulses, may be entirely illusory because by their use a number of methods of identifying signals become available. Thus a large number of pulse signals may be transmitted within a common radio frequency channel without excessive confusion, while continuous wave systems require the use of a separate radio frequency for each component in order to provide identification. At present the hyperbolic principle is used by only three operating systems. Of these three, the pulse method is exemplified by two, Gee and Loran, while the continuous wave technique is used in the Decca system.

Consider two fixed stations to transmit signals at the same instant. If a navigator receives these signals simultaneously, and if the velocity of propagation can be considered to be equal over the two paths, he knows that his position must be somewhere along the perpendicular bisector of the line connecting the transmitting stations. If one signal arrives before the other, a measurement of the time difference identifies some other line of position on which the navigator must be. These lines of position are approximately spherical hyperbolas but may usually be represented by plane hyperbolas drawn on a conformal conic projection if the distances involved are not too great; say, less than three or four hundred miles in the case of a system whose errors are expected to be several hundreds of yards.

In practice, in the pulse systems, the signals are not transmitted simultaneously but are separated by an arbitrary, constant, time difference. This is done partly to avoid uncertainty as to which signal is which, and partly so that the state of the receiving equipment may be altered as required to accommodate each signal individually. The signals are ordinarily repeated in an endless sequence so that the measurement to be made is actually one of relative phase rather than a time difference between single impulses, although the units generally used have the dimension of time.

The navigator in the aircraft obtains a fix by finding his lines of position relative to two or more pairs of stations. These readings may be made individually or simultaneously, or may be continuously indicated by semi-automatic equipment. In air navigation, a few of the available lines of position are usually precomputed and exhibited on special charts so that any line of position may be obtained by interpolation.

The number of distinguishable lines of position, in the pattern surrounding pair of stations, is equal to twice the time taken for a signal to travel from one ground station to the other divided by the smallest change in time difference which can be observed on the navigator's indicator. In Gee, there are typically a thousand resolvable lines for a single pair, while in Loran or Decca there may be as many as ten thousand. Since, at considerable distances from the ground stations, the lines of position are approximately radial with an origin at the centre of the base line, the positional accuracy of a hyperbolic system is about that which would be obtained with a direction finding system capable of resolving one fifth to one-fiftieth of a degree.

The labour involved in computing these lines of position is large, so large that several hundred thousand man-hours have already been spent in the construction of Loran charts and tables, but the results of the computations are permanently available as the lines are fixed with respect to the surface of the earth. Thus the time spent, per navigator, decreases with increasing use of the system and becomes small compared with the computing time required for celestial navigation; and the process of taking a fix is greatly speeded by the precomputation.

An important feature of hyperbolic navigation, as of some other radio aids, is that the act of navigation may be carried out in the future rather than in the past. A navigator may determine, from charts or otherwise, the indications which obtain at some distant point (such as his objective or one of a series of points on the route to his objective) and may preset his equipment to the constants applicable at that point. His aircraft may then be so steered as to follow a simple path until the predicted indications are obtained at the instant of arrival. Thus, at certain interesting times and places, the taking of a fix is made instantaneous instead of yielding the position occupied at some previous time.

The great advantage of hyperbolic navigation over radar beacon systems, which do or could offer equal or greater precision over the same ranges, lies in the fact that saturation of the ground facilities is impossible. The transmitters of a hyperbolic system are essentially a family of lighthouses whose keepers simply transmit intelligence according to prearranged standards. Thus there is no correlation between the activities of the navigators and those of the transmitter operators, and the behaviour of the system does not at all depend upon whether one or thousands of navigators are making use of the service it provides.

When Loran is used for navigation in advance or for obtaining occasional fixes to be used with dead reckoning methods, the most important feature of hyperbolic navigation is used to full advantage. Since the hyperbolic lines are fixed with respect to the earth, all courses derived from them are true courses and all speeds are grounds speeds. Thus the effects of drift are compensated automatically with the result that a pilot can navigate an aircraft with amazing ease and accuracy.

Standard Loran

Standard Loran such is is used over the North Atlantic is a hyperbolic system which was developed primarily for over-water navigation. It operates on one of several frequencies between 1700 and 2000 kilocycles and therefore enjoys propagation characteristics determined primarily by soil conductivity and ionospheric conditions. The transmitters currently in use radiate about 100 kilowatts and give a ground wave range over sea water of about 800 nautical miles in the daytime. The daytime range over land is seldom more than 250 miles even for high flying aircraft and is scarcely 100 miles at the surface of the earth. At night, the ground-wave range over sea water is reduced to about 600 miles by the increase in atmospheric noise, but sky-waves, which are almost completely absorbed by day, become effective and increase the reliable range to about 1400 miles. The transmission times of the sky-waves are somewhat variable, thus reducing the accuracy of the system, but the timing errors decrease with increasing distance and partially compensate for the increasing geometrical errors, so that navigation by sky-waves, appropriately enough, compares tolerably well with celestial navigation. Except in the case of over-land ground wave transmission, the signal strength, and therefore the usefulness of the system, does not vary at all with the altitude of the receiver. Even in the over-land case the signals increase rapidly with height so that there is little improvement to be had by going to altitudes greater than 300 ft.

Because of the medium frequency used, and the consequent necessity for conserving band width, the use of pulses whose length is of the order of fifty microseconds is unavoidable, and it is wise to operate as many stations as possible in a single radio frequency channel. The large pulse length makes necessary careful matching techniques in order to obtain reasonable precision. The method employed is to alter the gain of the receiver as required in order to produce pulses of equal amplitude on the oscilloscope no matter what distances or attenuating factors may be present in the two transmission paths. The pulses may then be accurately superimposed, provided that they are made sufficiently identical by all transmitters, and a measurement may be made with a precision of one per cent of the pulse length if the signal-to-noise ratio is sufficiently good.

If three Loran stations are used as a triplet, the average error at short distances is of the order of 300 yds. and increases smoothly throughout the ground-wave service area to a little more than one mile at 700. At night, sky waves may be used at distances between 300 and 1400 miles with average errors ranging from one and one-half to about eight miles. Occasionally, errors to 80 miles were noted, but these have always been traced to poor area coverage or maladjustment and operating of equipment.

The average errors of fix are frequently smaller than these estimates at long ranges, because pairs can often be found with crossing angles better than those obtainable from a triplet. Loran stations are often installed in a chain, along a coast line or between islands. The number may be anything greater than two, and each station may or may not operate as a member of two pairs with the stations on each side. In each pair, pulses are transmitted at a special recurrence rate, one of a family which have the ratios 400; 399; 398. Thus eight pairs may operate in a single radio frequency channel. The navigator's equipment can be adjusted to synchronism with any one of these rates; the pulses at the chosen rate then appear stationary so that their time difference can be measured, while the pulses from all other stations pass across the screen at speeds such that confusion is negligible. Stations intermediate between the ends of a chain ordinarily are " double "; that is, they act in all essentials as two independent stations at the same location, so that a chain consists of a number of separate pairs set accurately end to end.

The navigator can choose from among these the pairs he will use for determining a fix in the same way that he would choose stars for celestial navigation; that is, by taking those whose lines of position cross at the most favourable angle. In fact, he frequently uses three or four line fixes if he wishes to attain maximum precision, the reading of a single line of position at a time permitting great freedom of choice. This arrangement stems directly from the concept that Loran navigation is to be effective over a large area in comparison to that which could be served by a single pair or triplet. The system in the North Atlantic consists of a chain of four stations along the east coast of the United States, Nova Scotia and Newfoundland, a triplet between Newfoundland, Labrador and Greenland, and a triplet extending from Iceland through the

Loran equipment installed in T.C.A. planes operating on the trans-Atlantic route.

Faeroes to the Hebrides. These stations form a total of seven pairs, so that often a total of three, four or five lines of position are available to the navigator.

With Loran equipment, a fix is ordinarily taken in one to three minutes. Homing to a point can be accomplished by following one line of position until the correct compass heading has been determined and then switching to a second pair of stations to determine the progress along the first line.

The chief disadvantages of Loran are:

1. The impossibility of instantaneous fixing without dual installations.
2. The number of persons required to operate the ground installations.
3. The proper sites generally make it necessary to locate one or more of the ground stations in remote and uninhabited areas.
4. The frequency spectrum necessary.
5. The fact that the use of sky-wave transmission requires the application of corrections before the charts or tables can be entered.
6. The presence at night of long trains of pulses reflected from the ionosphere. In one of these trains only the first reflected impulse is useful for navigation, but from one to twenty useless pulses may follow it, thus greatly increasing the difficulty of identifying the correct one and interfering with the operation of other pairs in the same channel.
7. The fact that ionospheric transmission is not homogenous so that the shapes of the sky-wave pulses are often distorted, making them hard to match, while the time of transmission varies from hour to hour creating minor errors which cannot be eradicated.
8. The difference between the ground waves ranges over land and water.

The chief advantages of Loran are:

1. Accurate fixes can be obtained 700 to 1000 miles from the transmitting stations in daytime, and from 1400 to 1800 miles at night with a general accuracy better than that of celestial observations.
2. It is almost completely independent of weather. It works during the most adverse weather, in rough air, and under all conditions except that of severe precipitation static.
3. No transmissions are required from the aircraft.
4. Fixes can be obtained by a skilled operator in about one minute and no calculations are necessary.

Operational Data

Loran equipment, type AN/APN-4, as illustrated herewith, was installed on Lancaster aircraft operated on the Trans-Atlantic services by Trans-Canada Air Lines during August and September 1945.

Training of navigating officers in the use of this new facility was accomplished with the co-operation of the Royal Air Force Transport Command at Montreal, who made available an instructor and necessary training equipment. Assistance in this programme was also given by an instructor from the Communications Department of T.C.A.

All flight radio operators on the Trans-Atlantic service were given a somewhat briefer course of training in the theory and operation of Loran, the idea being that radio operators could assist the navigating officers in taking readings, and also lend a hand whenever any trouble was encountered with the adjustments or the equipment.

Two brief lectures in the theory of Loran were given to captains and interested first officers, for the purpose of making them acquainted with the possibilities of the new navigational aid.

Detailed notes on operation and adjustment of the equipment were prepared by the Communications Department of T.C.A., and distributed to all navigators and flight radio officers. A descriptive booklet on Loran prepared by the U.S. Coast Guard was also made available for study by all interested flight crew members.

Initial flight tests of aircraft equipped with Loran were accompanied by the Communications Department instructor, and the equipment was found to perform satisfactorily. The initial east and west crossings with Loran were also accompanied by the instructor, and results obtained were fully up to expectations.

In order to determine the reliability and accuracy of Loran as a navigational aid, a series of tests were commenced in mid-November, 1945, and continued until mid-March, a period of four months. A total of 74 reports have been received from the navigating officers covering the majority of crossings during this period.

Most of these crossings were effected between Prestwick, Scotland, and the following bases on this continent: Montreal, Que., Gander, Nfld., and Goose Bay, Labrador. Some crossings were made directly between the two terminal points, while others went by way of Reykjavik, Iceland; Lagens, Azores; and Bermuda Islands. The reports received contain data observed on both the eastbound and the westbound voyages. The following table gives a summary of the information gathered.

Total number of Loran reports received	74
Total number of Loran readings reported	980
Total number of Loran fixes obtained and reported in survey	417
Average Loran fix error from all reports (nautical miles)	10.2
Total number of flights reporting equipment troubles	11
Total number of flights reporting aurora or static seriously affecting Loran	23
Percentage of flights reporting aurora or static seriously affecting Loran	31.1%

Analysis of Reports Received

It is quite evident from the reports received that personalities enter into the results obtained. Some navigators make very extensive use of the facility, others merely use it occasionally. Some navigators obtain consistently good results with Loran, others only indifferent to poor results. It is also quite evident that many of the navigators place less faith in a Loran fix than they do on a D/R position, while others are entirely satisfied with the accuracy of Loran.

The period of this survey extended over a time when radio signals have been badly affected by aurora and sun spot activity. The period—winter—also covers a time when precipitation static resulting from cloud-flying has been at its worst. Given more favourable conditions, it would appear therefore that the accuracy and percentage of utilization of Loran would have been considerably better.

The percentage of flights reporting equipment troubles, while low, is still higher than could be desired. This is due partly, no doubt, as a result of unfamiliarity with the new installation. It is confidently expected that continued use and increasing familiarity with the equipment by servicing and operating personnel will soon reduce equipment malfunctioning to an almost negligible figure.

Of the total number of flights submitting reports, sixteen operated via the Azores. The portion of the route Azores-United Kingdom is notably poor for Loran, being in an area where Loran coverage is extremely weak.

Eleven flights operated via the Iceland-Greenland route, an area which is close to base line extensions and has near-parallel Loran lines.

Analysis of Large Fix Errors

An analysis has been made of all Loran fix errors reported in excess of twenty nautical miles, and some logical explanation has been sought for each recorded error. With 45 such errors reported out of a total of 417 Loran fixes obtained in the survey, this is a percentage of 10.8, which is, however, considerably reduced when allowances are made for the number of reported errors which were found to be incorrectly recorded. The figure 20 nautical miles was chosen arbitrarily, as being not too excessive an error for mid-ocean fixes, considering average working conditions on board the aircraft.

Flying almost entirely over water, it has been practically impossible for the flights to check Loran fixes with the terrain below except in a few isolated cases. In the few instances where visual checks were obtained the Loran fixes generally agreed fairly well with the actual position.

A good percentage of the Loran fixes were checked against Astro, and assuming reasonable accuracy of the latter, there can be no doubt as to the error of the Loran fix. However, many instances where Loran is compared with Astro, the comparison is, strictly speaking, not correct, as the Astro fix may have been an hour or more old, and the position estimated by the navigator on D/R.

On practically all occasions where Loran fixes are compared with strictly D/R positions, there is every reason to believe that the reported Loran error is not nearly so great as is indicated. In fact, in those cases where large errors—40-50 miles—are reported comparing Loran with D/R, it is quite likely that the Loran position is the more accurate of the two, particularly where the Loran fix was obtained in a good coverage area.

The conclusions to be drawn from these facts are that, of the 45 Loran fix errors reported in excess of 20 nautical miles probably not more than 25 were actual errors at all, while another 10 were actually errors resulting from miscounting or poor plotting, thus leaving only some 15 cases where Loran fixes likely erred to any great extent. This number, out of a reported total of 417 Loran fixes obtained during the survey, is a suitably low percentage. (Less than 4 per cent).

It is interesting to note that of the 45 large fix errors reported, 7 of them were daylight fixes obtained far beyond the normal day range of Loran coverage.

Conclusions

From an analysis of the foregoing reports, it would appear that Loran is giving generally satisfactory results, but, occasionally, large and sometimes unexplainable errors occur, greatly reducing the reliance which can be placed on Loran as a prime aid to navigation.

It is believed that as experience is gained, particularly in the use of sky waves, the overall accuracy of Loran fixes will increase somewhat. It would also appear that many of the larger errors now being reported would not be encountered, and the navigators would place greater faith in the results obtained by this system.

It is quite evident that greater care must be exercised by certain of the navigators in correctly matching pulses, and in ensuring correct counts. Several obvious cases of errors in plotting were also noted, which were incorrectly charged against Loran.

While it is recognized that it is not always possible to select the pair of stations which would give the best cut, it is apparent that in many cases fixes were based upon a more or less haphazard selection of stations. Greater care in selection of stations would, in many cases, result in higher accuracy of fixes. Greater use of a third pair of stations would also help towards this end.

A fair percentage of fixes reported with errors were obtained at extreme range, or in poor-cut areas for Loran. The fact that our flights must continually traverse such areas will tend to keep down the overall accuracy for Loran fixes. (It is presumed that navigating personnel are making due allowances for fixes obtained in such areas).

Difficulties arising from precipitation static and auroral effects were much greater than might be expected. While there is no perfect remedy for the latter, some experimentation by flight personnel with different antenna arrangements and lengths could very easily result in a reduction of precipitation static effects. A gradual increase in the availability of Loran under static conditions can also be expected as personnel gain more experience in reading signals through " grass ".

There is also every reason to believe that a marked decrease in static problems will result from the installation of wick-type static dischargers. During the period of this survey the aircraft were not equipped for static reduction, and hence were unduly handicapped by this trouble. The current programme for installation of static dischargers should materially improve the usefulness of Loran by making it available a greater percentage of time.

PRE-COMPRESSED CONCRETE DESIGN (*Continued from page 469*)

This reasoning is fully borne out by Mr. McNaughton's experiments when he states, referring to Graph II: " had the wire been pre-stretched to 130,000 lb. per sq. in. prior to loading to 114,000 lb. per sq. in., the departure from proportionality and the creep at this loading would have been negligible."

Although I have no wish to evade Dr. Pratley's question regarding a possible Canadian field for this material, I feel that it would be presumptuous on my part to be categorical on the subject; Dr. Pratley has already enumerated a number of articles which can be produced to advantage immediately. To this list may be added: water and fuel tanks and high pressure pipes which have been produced and are already in use in Canada and United States. I also feel that the application of this new technique in the construction of our short span highway and railway bridges would be of immediate benefit to all concerned. Although I must of necessity base my opinion on limited experience in the use of pre-compressed concrete, I suggest that the argument regarding cost of equipment and skilled labour is not entirely valid; the equipment used by European engineers for pre-compressing concrete is inexpensive and simple of operation; the normal skilled labour employed to produce reinforced concrete can be trained very quickly and simply to produce pre-compressed concrete. This, at least, was the experience of Royal Canadian Engineers.

One great advantage of pre-compressed concrete which may not be entirely appreciated is that it is " self-repairing." For example, in a pre-compressed concrete pipe filled with water, it is possible to raise the pressure of this water to a point above the designed capacity of the pipe until water escapes through minute cracks in the concrete caused by the abnormal pressure; upon reducing the pressure to normal, the cracks close and seal themselves automatically and the pipe is as good as new. Considering the damage done to our highways every year as a result of frost heaving and the cost of continued maintenance it involves, the economy which would derive from " self-repairing highways " is of such magnitude as to justify large scale experiments in this field immediately.

THE ARCHITECT, ENGINEER, AND LANDSCAPE ARCHITECT IN CITY AND REGIONAL PLANNING

RUSSELL VAN NEST BLACK
Planning Consultant, New Hope, Pa.

An address delivered before the New York Architectural League.

This is the renaissance of city and regional planning. Perhaps, though, " renaissance " isn't quite the word for never was there a time when so many people and cities evidenced as much interest in doing a real planning job as now. Why people and cities want to plan isn't so important as that, finally coming to want and demand planning, they be given bread and not stones; plans and not talk of plans. The opportunity that planners have dreamt of is here. Whether that opportunity goes up in a puff of smoke, depends much upon what the planners produce now. It depends upon what kind of plans they make.

The planning profession has been caught flat-footed. Never large and, as a whole, never overly competent, it is now quite unequal either in power or in numbers to do anywhere nearly all the planning that is now demanded in anything like the time that is required. Planning and planners are on the horns of a dilemma. Shall there be a few good plans or a lot of indifferent plans? Is it better to cover a little ground well or a lot of ground superficially?

In my opinion, superficiality is planning's worst enemy. Nothing in the past has held back planning so much as the fact that so many plans were mere surface scratchings. More of that kind of planning will do nothing to establish and perpetuate planning. Nothing will kill this new interest in planning so fast as a lot of empty and mistaken notions in the name of planning. We sometimes think that city administrators are a little dumb but they are not dumb enough to accept and keep on paying for a lot of false-front planning.

What then is the solution? The greatest threats to the survival of planning are insufficient manpower and insufficient brain power. Where are we to find the men and the brains to grasp firmly and to develop fully the present planning opportunity?

Planning — A Composite Profession

It is perhaps expected that I shall say, " from the men in this room—from the architects, the engineers, and the landscape architects, since I have been asked to speak for them." That may be but I think it depends upon *the* architect, *the* engineer, and *the* landscape architect—upon his background, training and experience and whether he has much knowledge and comprehension of this thing called planning, outside the small sector of it represented by his particular professional field. Architecture, engineering, and landscape architecture are *parts* of planning but no *one* is by any means the *whole* of planning. It follows that no engineer, architect or landscape architect is a planner per se, in the sense that we are here using the term " planner ", any more than a bricklayer is a builder.

By this time someone will have suspected that I disagree with the contention of some of my friends that planning is not a profession but, rather, a collaborative enterprise wherein the several professions join to produce plans. And the suspicion is well founded. I *am* convinced that planning comprises a true profession even though a composite one. For my own peace of mind I could not think otherwise. After more than twenty-five years spent almost exclusively in planning, I find so much still to be learned about it that I could no longer maintain the delusion of average intelligence if I were for one moment to admit that there isn't something special about the job.

Planning is a collaborative process in the sense of utilizing many kinds of skill and many kinds of knowledge. These various skills and kinds of knowledge may be brought to bear upon a particular problem by as many individuals. But points of view must be reconciled. The several individual contributions, technical and otherwise, must be synthesized into a single, organized and balanced concept. The process of synthesization is planning. The man who conducts or directs the process is a planner.

The " planner " on a particular project may be one man or a group of men. But for a group of men to achieve an organized concept of a city plan is as difficult as for a group of men to paint a picture. Not many cities and fewer city planning budgets are large enough to employ a balanced group of technical men. Usually, one man must assume all technical responsibility. To do so intelligently and successfully he must be more and less than an architect, an engineer, a landscape architect, a lawyer, a sociologist, and an economist. He must comprehend the fields of them all, must have considerable specific knowledge in each field, but need be master of none. The planner must be a jack of all trades and a master of his own business.

Until the word became threadbare, a lot of people liked to talk about " coordination ". Some of them seemed to have an idea that a street plan, a park plan, a public buildings plan, and a host of other plans and high-flown ideas could be thrown into a sort of mill called a coordinator, which, by some mysterious process, would produce a city plan. It would be less sanguine to expect to achieve an emulsion by the mere mixing of oil and water. A comprehensive plan is the outgrowth of a comprehensive concept that starts at the very begininng of the planning process and carries through to the effectuation of the plan.

This balanced concept of community needs and this synthesis of ideas is the only real contribution made as yet by this relatively new art and science called city planning. Given the opportunity, good engineers have always produced good transport and sewerage systems; good architects have produced fine civic centres; and good landscape architects have produced fine park systems. But rarely, have all these things been achieved and brought together in one integrated whole. Planning is the integrator. Far-sighted integration of urban development is the chief new thing that planning has to offer. It is, I maintain, a job in itself, sufficiently challenging to invite lifetimes of endeavor, sufficiently demanding to compromise a profession.

So, we have planning and planners on a pedestal. (I have heard it called an ivory tower). And the planners are not too happy about this lonely business of flag-pole sitting. A lot of people think that planners are not too bright. But they are bright enough to know that if they muff this opportunity, fail to do well the job now set before them, they can fold up their pedestal, their ivory tower, their flag-pole, or what-have-you and go home. They are bright enough to know that their greatest weakness is their small number and that the thing most needed to support their precarious position is strong reinforcement by more and better planners, by men of large technical capacity, judgment, and vision.

The Planner

Where are these reinforcements to come from and what have been the origins of this current crop of vainglorious towerites? Most of the older men came from architecture, engineering, and landscape architecture, with landscape architects predominating. A few have come from the field of economics, others from God knows where. Some, mostly the younger men, have had the benefit of specialized schooling but the great majority have learned their lessons on the job. Research in origins might be expected to produce some clue as to most likely sources of new recruits but seemingly does not. Early background training as between one profession and another appears to have had relatively little to do with the comparative success and the quality of production of individual planners. Even specialized schooling appears to have had less effect than might be expected. Graduates of planning schools are likely to get a fast start in the profession but unless they have those more-exacting qualities of a successful planner that cannot be taught in schools, these fast starters soon lose their advantage to men who do have these qualities. These qualities include a sponge-like capacity to soak up new knowledge, human sympathy and understanding, power of expression, and, most important of all, good judgment and a lot of hard practical common sense. Some of these qualities can be acquired in some degree, others can be improved and developed, but mostly they are things a man is born with. They are, therefore, outside the purposes of this discussion, which is more specifically concerned with the contributions that can now be made to planning by the professions of architecture, engineering and landscape architecture.

Although there are many elements in city planning other than the arrangement and design of physical objects, I am strongly of the opinion that a first requirement of a city planner is an appreciation of form and a knowledge of, and a capacity to design. Knowledge and ability in almost any kind of designing will help even if it is in things like building an efficient and beautiful machine. Naturally, the closer a man's design training and experience come to the work in hand, the better and quicker he will be at the job. The form of design coming closest to city planning requirements is probably that of landscape architecture in its larger aspects. Landscape architecture in its full meaning has to do with molding the land to multiple human use and purposes. It deals with large spatial relationships. It recognizes and deals with the third dimension and must comprehend and apply many of the more important engineering principles. It seeks to make all things beautiful. It must perforce make most of its products useful and practicable.

All this is directly applicable to city planning. If he has the other prerequisites for planning, it gives the landscape architect perhaps a little edge on other professionals in entering the planning field. However, having had *my* early training in landscape architecture, I am naturally somewhat prejudiced in the matter. I know quite well that engineers and architects claim equal, although perhaps different, advantages for their professions. Debate on the subject is likely to become quite acrimonious. I propose to avoid any such cat and dog fight tonight if possible. At any rate I shall not encourage it. Even the economists might join in, for there is considerable to be said for economics as an entry to planning.

The truth of the matter is that any well-grounded man from the professions of architecture, landscape architecture, or engineering has a good technical start in city planning and may make an important contribution. He is not, however, by the mere fact of being well versed and skilled in his profession, a city planner qualified to assume full responsibility for a comprehensive planning job. He has still to acquire the tools and the knowledge peculiar to the planning process. He must learn the mechanics of plan making and plan presentation. He must accustom himself to seeing the community, its life and its needs as a whole. He must learn to use statistics and to know which facts are important and which are not. He must learn a lot about municipal law, economics, and public finance. This is some of the special equipment a full-fledged planner should have, no matter what his professional origin. Some can be gotten in planning schools but most of it, normally, comes from long years of inquiring and acquisitive experience.

But there is great need and demand for planning now and no time for lengthy schooling or long-extended experience. Men most nearly equipped to plan must be worked into planning jobs. These men are most likely to be found among the architects, the engineers and the landscape architects. There is no question but that a man well founded in any of these professions can be immediately useful in a planning office under experienced direction. My concern is rather for getting more men equipped to assume responsible charge of planning operations. To do this satisfactorily, as I have already said, I believe that no matter how good a man is in his own profession, he must have considerable new knowledge. How is he to get it, in reasonable degree, in a short period of time?

He can get something by a lot of cramming in planning literature, but, most fruitful, it seems to me, would be intensive in-service schooling running for periods up to six weeks or more. There has been a lot of talk about setting up such schools but little has been done about it. There is no substitute for experience, and schools of themselves will produce no top-notch planners. But they should enable a person otherwise well equipped to find his way around in planning without too many missteps.

I have been instructed by program to say that a "technical talent formerly largely applied to project planning can be useful in overall planning". Of course it can be useful but I think it should be developed to the point where it can be more than merely useful. More needed than helpers are men who can take the initiative in planning to produce plans so good there can never again be question of overall planning as an essential function of government.

From Month to Month

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

THE ROYAL COMMISSION REPORTS

So far no one seems to have anything favourable to say about the report of the Royal Commission on Administrative Classifications in the Public Service, made public on the 15th of July. Newspapers, organizations and individuals all criticize it adversely, though not always for the same reasons. It would seem too that it would receive no better support from government officials when and if they care to make public their opinions.

The Institute's interest is related principally to the manner in which the recommendations would affect the professional worker. The Institute presented a brief to the Commission during its hearings, but there is no indication that the presentation offered any suggestions acceptable to the Commission. The three main recommendations were that the wages ceiling be raised to a specified figure, that the Civil Service Commission be enlarged to include a professional member, and that an interdepartment technical panel be established.

The report reveals that the ceiling recommended is far below that proposed by the Institute; there is no mention of a change in the number of commissioners, and the nearest thing to an interdepartment technical panel is the proposal to appoint a personnel officer in each department. These could become an interdepartmental panel, but certainly they would not be technical or professional—nor would they have the slightest competence to deal with the professional problems.

The report does not deal specifically with the situations in which the Institute is primarily interested. "We have not given particular consideration to the position of the junior ranks and of the scientific, technical and professional personnel ". There are general references to some need for treating the professional worker better, but nothing very helpful. Of more than passing interest is the following, " We recommend that the scales for the scientific, technical and professional classes in positions carrying a salary of $5,000.00 or more be the same as those proposed above for the administration grade, and we suggest that the existing salary situation respecting scientific, technical and professional personnel in positions carrying a salary below $5,000.00 be further reviewed.

The chief worry of the commissioners seems to have been the administrative worker. More attention is paid to the need of getting from the universities candidates whose general qualifications would indicate that they could become good administrators. There is no appreciation of the fact that an executive can be built from many classes, whereas an engineer or other professional worker must come from the group trained specifically for that work. If they are not attracted to the service, there is no other group that can do the work.

Structurally, the report leaves much to be desired. If an engineer made a similar report, it is not likely his client would think much of it. It criticizes and makes proposals without giving reasons. It is not enough to say " we recommend " without pointing out where and why the new arrangement would be better than the existing. This is not done. In other words, the report does not attempt to carry the reader with it. It is mostly statements without supporting evidence or argument, and, consequently, is not convincing.

Changes in C.S.C. Responsibilities

Perhaps the most far reaching proposal is that the Civil Service Commission should have its wings clipped, and that the pieces should be stuck on the wings of someone on the Treasury Board—yet to be appointed. Just how this would improve conditions is hard to discover—nor does the report attempt to explain. The proposal is—

" We recommend the continuance of the Civil Service Commission as an independent and separately constituted body. The Commission should be relieved, however, in the manner outlined below of certain of its present duties in order that it may be in a position to concentrate upon the highly important work of recruitment, which should be its primary function.

The duties of the Civil Service Commission should be as follows:

(a) The recruitment on a merit basis of personnel for all grades and classes.

(b) The review of recommendations by Deputy Ministers and Heads of Agencies for promotions of personnel in all grades other than the administrative, scientific, technical and professional grades.

(c) The transfer of personnel in all grades other than the administrative, scientific, technical and professional grades from departments where they are no longer needed to other departments where additional staff is required.

(d) General guidance to departments regarding programs of in-service training except in the case of the personnel covered by 4 (f) below."

And

4 (f) "We recommend the creation of a new Establishments and Personnel Division in the Treasury Board, under a Director General (or Deputy Minister) of Establishments and Personnel, who should have the rank of a senior Deputy Minister. The duties of the Director General should be as follows:—

(a) Responsibility to the Government, through the Treasury Board, for all matters concerning the organization and establishments (numbers and grades of positions required) of departments, and of the agencies listed in Appendix A.

(b) The submission, after consultation with the Advisory Committee referred to below, of recommendations to the Treasury Board regarding scales of pay and important regulations affecting the service as a whole.

(c) The review of recommendations by Deputy Ministers and Heads of Agencies (Appendix A) for promotions in the administrative and also in the scientific, technical and professional grades.

(d) Responsibility, after consultation with the Advisory Committee and, where necessary, with the approval of the Treasury Board, for the transfer between departments and agencies (Appendix A) of administrative and also of scientific, technical and professional personnel, to the full extent desirable for the proper training of such personnel and the best use of officials throughout the service.

(e) To be a member of, or to be represented on examination boards for the selection of applicants from outside the service for positions in the administrative, scientific, technical and professional grades.

(f) General responsibility for policy and guidance to departments regarding programmes of in-service training for the administrative, scientific, technical and professional grades.

(g) To act as chairman of the official side of the National Joint Council of the Public Service which is designed to provide an effective means of consultation with the staff.

(h) Responsibility for recommending policies concerning working conditions throughout the service including the improvement of morale and personnel welfare.

"Obviously the Director General will require an adequate staff of highly qualified assistants including such transfers from the Organization Branch of the Civil Service Commission as he may think desirable".

This appears to be a simple transfer of duties from the Civil Service Commission to the Treasury Board. What assurance is there that the work can be done any better by officers in a department already overburdened with its present duties than in the Civil Service Commission? In the opinion of many, the past performance of the Treasury Board does not justify any hope that an improvement would follow.

There are dangers to such a move. As the *Ottawa Journal* points out in commenting on the position of the Civil Service Association in voicing its opposition, "It is a position easily understood by all those who remember the bad old days when the doctrine prevailed 'to the victor belong the spoils', when merit was of little account in the Civil Service and politics and pull were everything." To put such power back into the hands of one department is indeed, as the Civil Service Association says "a decidedly retrograde step".

The only suggestion of a reason for this proposal is that, as the Civil Service Commission has to apply to the Governor-in-Council (which the report says means "approval by the Treasury Board") on matters of establishment, organization and money, it would be better to transfer these things entirely to the Board. "Financial control, without the direct and simultaneous duty to determine requirements and to provide the necessary means for effective operation, leads to delay, frustration and inefficiency". All departments of government, including special boards and agencies, have to apply to the government for their funds. Is this any reason why the work of such organizations should be taken over by the agency providing the funds? Would it be sensible to ask the Treasury Board to take over the work of the National Research Council just because the Council's requirements for funds are submitted to the Board? It doesn't seem so.

Misfits

It is interesting to read of the commissioners' concern over "misfits" and "redundant personnel". They point out correctly enough that for the former "there is a tendency to leave such officials in their posts and to prop them up in one way or another", and for the latter "there is always the danger that departmental organizations will be retained unaltered despite the fact that work has fallen off". "There is a tendency", and "there is the danger" are very mild observations to the mind of the "outsider" who is familiar with conditions in Ottawa.

Personnel Officers

The proposal that personnel officers be appointed to each department has some merit, but it would do nothing to solve the problems involved with professional workers. Surely 2,700 professional workers, whose engagement, promotion and continued service is so vitally important to many departments, are entitled to some personnel services from persons at their own level. The report offers nothing for this. The Institute believes that the intelligent handling of the professional worker is one of the greatest needs of the whole service.

The Old Story

Unfortunately, the report drags in the old fatuous argument that employment with the government has other compensations to offset a low salary. "Because of the special circumstances of public employment, the salaries in the case of the most senior ranks of the service have never been, and in our view need not be fully equivalent to the higher ranges in private employment. The senior civil servant has certain advantages which do not accrue to private individuals; he occupies a position of importance and usually of considerable interest; his appointment carries with it comparative security of tenure; upon retirement he becomes entitled to a relatively generous pension; provision is made for a pension for his widow; and above all, he has the satisfaction of rendering public service".

This is a hardy perennial that is produced on all occasions. The plain facts are that many employers today offer work that has more "importance, interest, security of tenure, and retirement income" than has the work of government. It is surprising to find a Royal Commission fooling itself with such hoary and disproved arguments. The laborer is still "worthy of his hire", and in cash.

New Ceilings for Deputy Ministers

There are recommendations for higher salaries for all deputy ministers. As this officer's salary provides the top for his department, it is important to get him high enough, but the report goes only part way, in that it suggests salaries in some instances as low as $10,000.00. Experience has shown already that highly competent professional assistance cannot be secured at remunerations below that level. Why not face that situation?

The Commission recommends salaries for deputies all the way from $17,500 to $10,000, without saying clearly which departments should get which. They recommend that the Deputy Minister of Finance, Dr. W. C. Clark, and the president of the National Research Council, Dr. C. J. Mackenzie, be given a special category carrying a salary of $17,500 "in recognition of highly meritorious services or of particularly onerous responsibilities". No one should quarrel with this recommendation.

The deputy-ministers in Agriculture, Justice and Trade and Commerce, are placed in the $15,000 class, but in Public Works, Transport, Veterans Affairs and National Revenue the proposal is for $12,000. What makes the deputy in Public Works worth $3,000 less than his opposite in Agriculture or in Mines and Resources, or in Revenue? Public Works is one of the really big spending departments. Surely the responsibilities and the need of outstanding qualities are at least as necessary here as elsewhere. To an outsider, it looks as though the wisest and fairest thing to do would be to pay all deputies the same, with some additional allowance for "highly meritorious services". Conversations with senior members of the Civil Service in Ottawa give strong support to this idea.

Senior Officers Far Down the Scale

The report recommends that, in a department where the deputy gets $15,000, there be one assistant at $10,000, and several at $8,000. Where the deputy gets $12,000, "we visualize one or more assistants at $8,000". For a deputy of the $10,000 size, "we think the next in rank should be paid $6,500 to $7,500".

To select a salary scale that gives the deputy fifty per cent more than his principal assistant, as in the first case, is unsound—particularly in government employment where the senior assistant may have to be a professional man and the deputy not—and also where the deputy may pass on to his assistant the principal burden of his office. A senior assistant worthy of the title should be able to reach a salary very close to that of his deputy. There are departments where competent men will not be secured or retained at lesser amounts.

In General

Perhaps one should not be too disturbed by the disparities of this report: if established custom prevails, it will not be implemented anyway. That seems to be one of the rules with regard to Royal Commissions. On the other hand, the proposals offer substantial improvements over existing conditions (except for the recommendation about curtailing the Civil Service Commission), and it would be better to have them adopted than to get nothing. Still, it is too bad that a more balanced report wasn't possible.

Is it too much to expect that the Government will take the report as a starting point and from it build up a really adequate policy of administration and remuneration? Without it the departments have little chance of attaining that degree of efficiency that is essential to economical operation.

REUNION IN PARIS

Last March, the president of the Institute was invited to attend a meeting of the Société des Ingénieurs Civils de France, in Paris, on June 21st and 22nd. The occasion was intended to mark the resuming of relations between the Société and the associations of engineers in other countries.

As President Hayes could not be present, Colonel D. C. Unwin Simson, M.E.I.C., military attaché at the Canadian embassy in Paris, was requested to represent the Institute and very ably filled the assignment, as will be seen from the following report.

Canadian Embassy

Paris, 12th July, 1946.

Acting on your cabled request I represented The Engineering Institute of Canada at the meeting of the Société des Ingénieurs Civils de France held on 21st June, 1946, at their H.Q., 19 rue Blanche, Paris.

The meeting was more a fraternal and social gathering than a technical one. Delegations were present from the U.S.A., Great Britain, Holland, Belgium, Rumania, Czecho-slovakia and Jugo-slavia. The United Kingdom delegation was by far the largest, representing different branches of the engineering profession.

The president and committee greeted us on arrival in the president's room and at 9.00 o'clock we entered the lecture hall with the president and mounted the stage. The hall was well filled with engineers and their families from all departments of France. The president introduced the different delegations to the audience and then drew attention to the fact that this was the first meeting in the hall since 1939.

Following the president's speech, replies were made by representatives of the foreign delegations. These mostly concentrated on welcoming the liberation of France, the overthrow of the Nazis, etc. When these were terminated the president proceeded to the presentation of prizes (Lauréats) awarded for the years 1940 to 1946 which had not been awarded during the occupation. Prizes were offered for the best papers written on engineering topics and adjudged by the committee of the Société as being most outstanding for the year in which they were submitted. Nearly all of them dealt with different phases of progress in the substitution of gasoline by new methods of internal combustion such as from compressed gas and gas generated from wood burning.

After the presentations were terminated a paper was read by Mr. Demaret, president of the Architects Associations of France and an honorary president of the Société des Ingénieurs Civils. In the paper he treated in turn of the war losses suffered in houses, bridges and all branches affecting the engineering profession in the different countries occupied during the war, evaluating the cost of the damage and the methods by which it was proposed to proceed with reconstruction. According to him Poland had suffered to the greatest extent.

The prime object of all studies in the reconstruction of big towns in France is the speeding up of transportation; for road transport by constructing by-pass roads around big towns and building overhead bridges to replace level crossings; for railways by reorganizing terminal stations in the cities and where possible building union stations. Before the war, trains on different railway lines entering the same town often had two separate stations and connections were made by a small local train. This procedure caused unnecessary inconvenience to travellers as well as considerable loss of time.

The meeting closed about 11.45 on Friday evening followed by a lunch at noon on Saturday, held at Claridges Hotel on the Champs-Elysées. After this, most of the delegates departed but for those that remained the president held an " at home " on Sunday afternoon.

I am endeavouring to obtain a copy of the paper read by Mr. Demaret and if successful will forward this to you as well as minutes of the meeting.

Colonel D. C. Unwin Simson, M.E.I.C.

BROAD THINKING ON COMMUNITY PLANNING

Like a breath of fresh air in an atmosphere not too sweet comes an address by Mr. Russell Van Nest Black, a recognized expert in the field of planning. It is a relief to see a frank open statement of the relationship between the groups concerned with an admission of their weaknesses both human and technical. Such fair mindedness, such honesty, such modesty should help a lot right now in Canada.

The address was delivered before a discussion group of the New York Architectural League, and is reproduced on page 483 of this issue with the kind permission of the author.

PRAISE FOR ENGINEERS

The Honorable E. C. Manning, Premier of Alberta, spoke to the Canadian Electrical Association at Banff in June, and concluded his address with some rather complimentary comments on engineers. With due modesty, the *Journal* presents herewith the paragraphs to which reference is made.

" In closing I would like to pay a tribute to those of you here who are members of the engineering profession. I do it in all sincerity because I believe that one of the causes of our great problems in the field of human relationships today is the fact that in political science, in the abstract sciences that have to do with human relationships, we have not made the progress that you gentlemen who are associated with the physical sciences, in the realms of engineering, have made in your profession.

" If we could apply to the abstract sciences, our political economy, and in our dealings with our fellowmen the same intelligence, the same ingenuity, the same perseverance that you men apply in your profession as engineers, we would get somewhere. You have gone so far ahead in your sphere of science, and political science is trailing so far behind, that today your achievements in the engineering world have placed in the hands of the human race powers of destruction so great that mankind, through his lack of development and progress in the abstract sciences, is unprepared to have in his possession."

INSTITUTE POLICY TOWARDS NEW COUNCIL OF ENGINEERS AND SCIENTISTS

The following report was recently presented to Council of the Institute by its Committee on Professional Interests. In view of the confusion existing in the minds of several persons on this subject, Council has directed that the report be published in the *Journal*. It is earnestly recommended that every member of the Institute study it carefully. —Ed.

A resolution from the Toronto Branch Executive regarding participation by The Engineering Institute of Canada in the C.C.P.E. & S. was discussed at considerable length at the March 23rd, 1946 meeting of council. It was referred to the Committee on Professional Interests for action.

The attention of the Toronto Branch Executive is respectfully drawn to the *Engineering Journal* for June 1945. On page 391 appears a report to the membership from the Committee on Professional Interests which includes a statement of the principal consideration which led the committee to its recommendation with regard to the new council. On page 400 appears the statement of principles and policy of the Institute on relations with sister societies, followed by the resolutions of council regarding participation in the C.C.P.E. & S.

Item E of the statement of policy (adopted May 19th, 1945) reads:

> " Council is prepared to consider as an experiment the formation of a committee representative of engineering bodies on which committee the members act only upon consent of the bodies they represent, and the chairman and the members change periodically, and the secretariat rotates annually among the headquarters of the constituent bodies ".

This is followed by the resolutions regarding participation in the C.C.P.E. & S., the first of which reads in part as follows:

> "As Clause E of the Committee's Statement of Principles and Policy proposed a Presidents' Conference Committee, and as this statement has received the unanimous approval of the individuals and organizations mentioned above, the committee recommends that Council consider the advisability of proposing such a committee to other interested and appropriate organizations ".

There was then discussion in favour of making arrangements for cooperation with other groups when there are special reasons for joint action.

> " Finally, on the motion of Mr. Eadie, seconded by Mr. Lalonde, it was agreed unanimously that a copy of these two resolutions be forwarded to the Canadian Council of Professional Engineers and Scientists, to the Dominion Council of Professional Engineers, to the provincial professional associations with which the Institute has cooperative agreements, and that the Institute's representatives at the forthcoming meeting of the committee of fourteen be authorized to use these resolutions as they see fit at that meeting, and, further, that the future steps to be taken in the matter be referred to the Committee on Professional Interests for study and recommendation ".

The following observations give additional weight to the Institute decision not to participate in an " omnibus " organization such as the C.C.P.E. & S.

(1) The state and multiplicity of professional organizations in Canada, with the exception of statutory bodies administering the licensing of engineeers, is now not very dissimilar from that in the United Kingdom thirty years ago. Attempts there to form a general council have not been successful. Our information is that support for such an organization is rapidly waning.

Experience in the United States is somewhat similar. Confusion there appears to be even greater than in Canada. Various attempts at the organization of all-embracing engineering bodies have been made. Those which have been brought into existence have enjoyed only brief periods of more or less general support. A satisfactory means of cooperation has been found, however, through what is called " The Joint Conference Committee " of purely engineering organizations.

(2) The president of the Institution of Electrical Engineers of Great Britain, Dr. P. Dunsheath, C.B.E., was the speaker at the Institute's Annual Dinner on February 8th, 1946. Early in his very fine and instructive address he mentioned that the presidents of the Institutions of Civil, Mechanical, and Electrical Engineers meet together from time to time and that through their discussions the policies and actions of these large autonomous bodies, with a combined membership of about 60,000, were influenced along the same or complementary lines when desirable. These informal meetings have been found to be the best way of meeting their cooperative requirements.

(3) In the international field, there is now an attempt to form an overriding body " The International Federation of Engineering and Scientific Societies ". This is receiving little encouragement and no support from stable professional bodies either in Europe, the United States, or Canada.

(4) As time goes on, there will be no doubt more and more specialized voluntary associations and an extension of statutory licensing in fields where the public is affected. Some individuals are already members of and contributors to four bodies, and this situation will become more aggravated as further specialization develops. The multiplication of contributions by the individual to an overriding body such as the C.C.P.E. & S. should be avoided unless such overriding body is absolutely essential.

The feeling is also developing that even nominal financial contributions by provincial licensing bodies, which are in effect indirect contributions by the individual, are " ultra vires ".

(5) The main functions which the C.C.P.E. & S. appear anxious to undertake seem to lie in two general classes.

1. Material welfare of the individual. The need for raising the remuneration of scientific workers of all kinds and for providing much greater compensation for our best research workers is emphasized. The hope is that the drain of technical personnel to the United States will be at least diminished.

An object of the C.C.P.E. & S. with an office in Ottawa is to act as " watchdog " regarding legislation, and there has even been talk of carrying on a " lobby ". It is hoped thereby that steps may be taken to mould proposed legislation to the interest of scientific workers.

2. Advisory. What amounts to a sufficiently powerful " pressure group " is apparently envisaged, so that governments may be forced to mould their research policies and coordinate all branches of science to place this country in the lead in all scientific developments.

How far progress may be accelerated by any organization towards the above and other projects under consideration is debatable. It is the opinion of this committee that just as much and probably more progress can be made on all practicable subjects by a President's Conference Committee without a new secretariat and therefore at vastly less cost.

(6) The Institute participated in the Committee of Fourteen. It is now cooperating with and is represented on the Canadian Chamber of Commerce, the National Construction Council, and other technical and non-technical bodies.

It is ready and willing to participate in a joint committee with other organizations on matters of common concern subject to the following: The Committee will not act as a mouthpiece. It will have no permanent secretariat. Each organization should bear the expense of its own representatives. The Committee will be used only to discover how the policies of the participating autonomous organizations may be coordinated. Each organization will normally speak for itself, although at times joint action for a specific project, as in the case of the Committee of Fourteen, would be in order.

It is considered that the effect is much greater when a number of known and respected autonomous organizations of large corporate membership exhibit the same policy, than when all are spoken for by a council having no corporate membership.

The council of The Engineering Institute of Canada will support a Presidents' Conference Committee of engineering bodies. It has in the past participated in such conference committees as well as in others including non-engineering bodies. There is nothing to hinder participation in a committee as covered in Item E and including other bodies for purposes of mutual benefit.

For the advisory functions which the C.C.P.E. & S. appear anxious to undertake, it should be noted that the National Research Council already has an advisory committee. It is understood that this committee represents a complete cross section of scientific activity.

We are informed also that the National Research Council has had a coordinating committee for twenty-five years for the purpose of integrating the activities of all research agencies and assisting them in their projects and programmes. There has been close association with universities, industry and governments. This coordinating committee is now tied in with the Research Division (of which Dr. C. J. Mackenzie is Director-General) of the Department of Reconstruction.

If something more is desired and appears practicable, then it is suggested that the Presidents' Conference Committee might see fit to discuss a definite proposal and subsequently be the means of coordinating representation to the Government on the form and substance of the scientific advisory set-up desired.

It is understood that there is a Parliamentary and Scientific Committee functioning in London with some success, and that a similar committee at Ottawa proposed by the Canadian Association of Scientific Workers is in progress of formation. It would seem that such a Committee, with the Government committees now established, would perform without cost to the profession the advisory functions which the C.C.P.E. & S. propose to undertake.

Conclusions

(1) The C.C.P.E. & S. is composed of representatives of many organizations covering a very wide field of professional endeavour. The interests of some will be contrary to the interests of others. If a clash of interests develops, either no action can be taken or one or more organizations must withdraw. The recent hearing of Bill 200, proposed by the Corporation of Professional Engineers of Quebec to the Quebec Legislature is an example. Opposition was offered by representatives of several provincial bodies whose national organizations are represented in the C.C.P.E. & S.

A Presidents' Conference Committee can expand or contract to include all those but only those interested in a specific subject. It seems that this provides the only effective vehicle for cooperation between organizations.

(2) Any overriding body composed of representatives of other organizations, but without corporate membership of its own, can only speak with authority after formal approval by the executives of the participating organizations. Otherwise it must encroach upon the autonomy of the participating organizations.

(3) Duplication of many activities of others have already been undertaken by the C.C.P.E. & S., and apparently many others are considered. Only a limited number of people are willing and able to do such society work. When there is duplication of effort by overriding organizations, additional strain is placed on many already overworked individuals. Their interests are divided and their capacity for effective accomplishment impaired.

(4) The cost of maintaining an organization such as the C.C.P.E. & S. in Ottawa will be an additional indirect burden on the individual members of each organization. It is neither practical nor desirable to secure large sums from sources outside the professions and such contributions would be very embarrassing to any organization seeking or receiving them.

(5) Experience in the United Kingdom and in the United States shows the inadvisability of "omnibus" organizations. The Committee on Professional Interests believes that a Presidents' Conference Committee is the best, if not the only, practical method of attaining the ends desired and that such a committee—

1. should not act as a mouthpiece.
2. should have no permanent secretariat.
3. should be used only to discover how policies regarding problems of common concern can be coordinated and therefore dealt with individually by those organizations participating in the discussions.

The Committee has again gone deeply into the matter and is still of the opinion that the "Statement of Principles and Policy of the Institute on Relations with Sister Societies" is sound, and that, in the best interests of the profession, the Institute is fully justified in refraining from participation in the C.C.P.E. & S. It is always ready and willing, however, to consider in detail the views of any members, group of members, or branch, so that it may be currently in a position to make the soundest possible recommendation to Council.

President of the Institute J. B. Hayes listens to description of exhibit at 1946 Semi-Annual Meeting of the American Society of Mechanical Engineers in Detroit. Left to right: J. W. Armour, chairman of the general committee for the meeting, D. Robert Yarnall, president, A.S.M.E., J. W. Parker, past-president, A.S.M.E., and J. B. Hayes, president, E.I.C.

MARITIME PROFESSIONAL MEETING

Final Programme

Wednesday, September 4th

3.00 p.m.—Regional Meeting of Council.

10.00 p.m.—Starter-offer—Members who will have arrived are invited to the Maritime Professional Engineers' Club Room. Music and refreshments will be provided.

Thursday, September 5th

8.00 a.m.—Early Birds Breakfast—Special entertainment will be provided.

8.30 a.m.—Registration.

10.00 a.m.—Professional Session.

Chairman, C. D. Martin, chairman of the Halifax Branch of the Institute.

Engineering Education, by H. W. McKiel, Dean of the Faculty of Applied Science, Mount Allison University, Sackville, N.B.

Chairman, T. H. Dickson, Member of the Executive of the Moncton Branch of the Institute.

Oil Exploration in the Maritime Provinces, by D. J. MacNeil, Professor of Geology, St. Francis-Xavier University, and Consulting Engineer, Antigonish, N.S.

1.00 p.m.—Luncheon—Addresses of Welcome by J. B. Hayes, O.B.E., president of the Institute, and His Worship the Mayor of Digby.

2.45 p.m.—Recreation—Golf, tennis, bathing. Prizes will be awarded the winners of the many games and contests planned by the Committee.

6.30 p.m.—Cocktail Party.

7.45 p.m.—Dinner.

10.00 p.m.—Grand Opening Ball. (Dress optional).

Friday, September 6th

10.00 a.m.—Professional Session.

Chairman, L. O. Cass, chairman of the Saint John Branch of the Institute.

Industrial Electronics, by T. J. Halme, Engineering Service Department, Canadian General Electric Co., Toronto, Ont.

Chairman, J. A. MacDonald, chairman of the Cape Breton Branch of the Institute.

The Utilization of Sydney Slags, by Norman A. Parlee, Director of Research and Development, Dominion Steel and Coal Corporation, Sydney, N.S.

1.00 p.m.—Luncheon—Address.

2.45 p.m.—Recreation—see Thursday.

6.30 p.m.—Cocktail Interlude.

7.45 p.m.—Engineers' Banquet De Luxe—Special speaker: Thomas H. Raddall, Canadian Author, Liverpool, N.S., on *Nova Scotia Humor*.

Special entertainment will be provided in the main dining room after the dinner.

Saturday, September 7th

"As You Like It".

For the ladies, a special programme is being arranged and will include teas, scenic tours, bridge, golfing and tennis.

Special Railway Rates

Special return tickets, at the cost of single fare plus one-third, are available under the Identification Certificate Plan of the Canadian Passenger Association, to members attending the meeting, and their families.

Special Identification Certificates, which must be presented to the local agent when buying tickets, can be secured from Institute Headquarters, 2050 Mansfield Street, or from P. A. Lovett, P.O. Box 263, Halifax, N.S.

Dress

Dress is optional at all functions.

Hotel Reservations

Reservations for hotel accommodation should be made with P. A. Lovett, P.O. Box 263, or 14 Prince St., Halifax.

Time

The times shown on the programme are Atlantic Standard.

USE OF SCIENTIFIC FILMS

The following paragraphs have been prepared by a group interested in promoting a wider use of films as an aid to science and to industry. For some time the Engineering Institute has been interested in such activities, and doubtless will find the new association of considerable aid. At the same time, it can be of assistance in establishing this association and expanding its usefulness. (Ed.)

Up to the present, no organized group has existed in Canada to stimulate the wider use of scientific films in industry, research and education. As compared with other countries, Canada has made little use of the motion picture as an industrial tool, or as an aid to science teaching in schools, or as a stimulus to discussion on such subjects as public health or the need of a national programme of scientific development. Accordingly, a small group interested in science and film have formed themselves into an Interim Committee to set up a Canadian Scientific Film Association (CSFA). The proposed Association corresponds to the Scientific Film Association founded in Britain four years ago, which is now providing extensive services to industrial firms and professional bodies, and counts among its members The Royal Society of Medicine, the London County Council, the Department of Scientific and Industrial Research, Imperial Chemical Industries and the Shell Oil Company.

The aims of the Canadian Scientific Film Association, as embodied in its draft constitution, are as follows:

(1) To promote and co-ordinate the use of the scientific film in Canada in order to achieve the widest possible understanding of scientific method and outlook.

(2) To study the needs of Canadian educators for scientific films; and to further the production of films needed to fill special Canadian educational requirements, or to make known the work of Canadian scientists.

(3) To review and appraise scientific films from all countries, and to establish an information service to make these findings known to all interested organizations in Canada.

(4) To appoint trained advisers, where so requested, to ensure the authenticity and accuracy of scientific films produced in Canada.

(5) To recommend the production of English and French language versions of outstanding scientific films originally produced in other languages.

(6) To make scientific films available throughout the country by employing the community film libraries associated with the National Film Society.

(7) To establish a central preview service of scientific films, so that prints of new productions may be seen by interested organizations; and to form a permanent library of films of outstanding scientific interest which will be available to members.

(8) To publish specialized catalogues of scientific films; and to issue a journal and other publications which will advance the use of the scientific film and will spread information about new film technology to research workers and to the professions.

(9) To encourage the wider appreciation by the public of science and its place in society by setting up local Scientific Film Societies and regional councils.

(10) To co-operate with UNESCO and with scientific film associations in other countries so as to further the international exchange of scientific information.

The membership of the Association will be drawn from national organizations of science and film; professional scientific and medical associations; universities and other educational groups; industrial concerns; Scientific Film Societies and private individuals.

The following letter from a member of the Engineering Institute will be read with interest by members everywhere. The letter is particularly pointed in Quebec because of the encouragement it gives to broad thinking and continued negotiations between the two groups.

There is nothing to be gained by further public utterances on the futile attempts made in the past to negotiate these differences, but the lesson to be learned from the experience in Pennsylvania should not be lost in Quebec.

PENNSYLVANIA SOCIETY OF PROFESSIONAL ENGINEERS
OFFICE OF THE HISTORIAN
524 COURT ST., READING, PA.

June 20th, 1946.

Mr. L. Austin Wright
Gen'l Secretary Eng. Inst. of Canada
2050 Mansfield St.
Montreal 2, Canada

Dear Mr. Wright:—

Your account of unfriendly "Legislation in Quebec" on the part of some of the Architects and their friends, on p. 314 of the May Journal, prompts me to enclose herewith a copy of the "Code of Ethics governing the Mutual Relationship between Architects and Engineers" entered into in May 1942 between the Pennsylvania Society of Professional Engineers (P.S.P.E.) and the Pennsylvania Association of Architects (P.A.A.),—which may suggest to responsible representatives of the two professions in Canada some way out of the unnecessary and undignified, if not ridiculous *impasse* they have come to in Quebec. I also enclose a copy of the "Architects' Law" as finally amended in 1939, by the State Legislature, which our P.S.P.E. *helped* the P.A.A. to get through the Legislature, thus healing a breach which for a while looked threatening.

Our P.S.P.E. was chartered in 1934, and has grown slowly but steadily. The sole qualification for membership is a license to practice engineering in Pennsylvania, granted by the State Board of Registration for Professional Engineers to persons who can show that they are qualified by education and experience in any branch of engineering, and are of good character and repute. Membership in our Society is not automatically consequent upon registration, as it is in the Canadian Provinces; — wherein the Canadians are, professionally, perhaps a step ahead of the registered engineers in the U.S. However, our State Societies, now numbering 25 or so, are constantly growing. The P.S.P.E. has now over 1200 members.

In May, 1935, the P.S.P.E. was barely a year old, but got very active when a bill was introduced in the Legislature by a few Architects that would have prohibited professional engineers from designing or supervising any building structures whatever, — even industrial buildings and power plants which are strictly engineering jobs. The P.S.P.E. sent out about 3200 postal-card requests to all the registered engineers in the State, to ask their legislative representatives to oppose this bill, and the prompt responses resulted in the killing of the bill in committee.

By the time the next biennial session of the State Legislature assembled in 1937, some members of both P.S.P.E. and P.A.A. got together in a spirit of cooperation and agreed to help sponsor a bill in the State Senate that would prohibit permits to be issued for governmental structures unless plans and specifications for same were signed by either a Registered Architect or a Registered Engineer. This bill failed of passage, but the incident marked the beginning of an era of better feeling between the professions.

At the next legislative session, in 1939, *P.S.P.E. actually helped the P.A.A.* to draft needed amendments to the Architects' Law of 1919, and get it passed through the Legislature. The amended law of 1939 made the Architect's legal status more definite than before, and further clarified the relations between Architects and Engineers where their functions might overlap. (See paragraph at bottom of p. 9, and top of p. 10, of the enclosed copy of the Architects' Law). Shortly thereafter, each Society formed its own committee of six members, to meet jointly with the committee of the other Society, for the purpose of establishing a *Joint Code of Ethics* to govern their mutual relationships. It took a couple of years, with quite a number of joint sessions, to devise the Code, but the result was good enough to be approved by the Boards and finally by the general membership of both Societies, in May, 1942.

You will notice that the Code does not attempt to specify the particular types of buildings to which Architects and Engineers are expected to restrict themselves respectively. Its appeal is primarily to cooperative reasonableness. A good friend of mine who was a member of the Engineers' 6-man committee for the whole period, told me that all hands were most cooperative and reasonable throughout; but he went on to remark that a single unreasonable person might have spoilt it all.

As the enclosed Code copy is a photostat "negative", it will be easy to get as many "positives" photostated from it, as you wish, in case you decide to distribute any of them amongst the Provincial Associations or Corporations of Registered Engineers, or of Registered Architects and their corresponding bodies, if you think any of them would be willing to accept enlightenment on how interprofessional quarrelling has been stopped in Pennsylvania, — for since its adoption, nothing has occurred to mar the harmony of the two professions in this State.

The New York State Society of Professional Engineers which is older than ours, dating from 1926-7, had a similar battle with the Architects that lasted from 1929 to 1932, when it was finally settled. Part of it was waged over the "Multiple Housing Law" of 1929, which excluded professional engineers as well as anyone else not a licensed architect, from designing apartments, hotels and covered by the Act. The full story of how all differences were finally adjusted can be found in the History of the N.Y. State Society, in the Society's 1941 Year Book, for years 1929 to 1932 inclusive. You may have this book in your Library, — if not, you ought to have it for the sake of this History by Arthur V. Sheridan, who has been President of the N.Y. State and the National Societies of Professional Engineers.

I was employed professionally in Canada for over 8 years, — 1918 to 1926, and enjoyed the experiences I had in Winnipeg and Vancouver, where my work lay. The engineers I knew in Western Canada were all reasonable men, and I hope that the architects in Quebec may prove equally so, if they have a chance to see how easily such disagreements have been settled south of the Border.

If what I am sending you, including this letter, can be helpful if passed around on both sides of the controversy, please use all of it in any way you see fit.

Very truly yours,

(Signed) W. NELSON SMITH, Life Member E.I.C.
Historian, Penna. Society of Prof. Engrs.

CODE OF ETHICS GOVERNING RELATIONSHIPS BETWEEN ARCHITECTS AND ENGINEERS IN PENNSYLVANIA

Reprinted from the February issue 1946 of the *Pennsylvania Professional Engineer*

1. Preamble:

The practice of Architecture and Engineering in the Commonwealth of Pennsylvania shall be conducted in a dignified and ethical manner. The following code of ethics has ,therefore, been adopted by the Pennsylvania Society of Professional Engineers and the Pennsylvania Association of Architects as a statement of conduct which is an ethical guide under ordinary conditions for business relations with the public and among members of both professions. All Architects and Engineers have an obligation to observe it as such.

2. Definitions:

(a) Primarily, the practice of Architecture and of Engineering shall be defined as set forth in the respective Licensing Laws of those professions and as issued by the Commonwealth of Pennsylvania.

(b) Each profession recognizes the other as an honored and learned profession of equal merit whose close cooperation is essential at all times for the benefit of the public welfare.

3. Field of the Architects:

(a) An Architect may ethically accept commissions for projects involving both architectural and engineering work, provided the primary problems of the project are in a field in which he has actively practiced.

(b) For structures supervised by Architects, which require engineering aid or assistance, Architects will employ Registered Professional Engineers to do such engineering and will pay a mutually agreed upon fee.

4. Field of the Engineers:

(a) An Engineer may ethically accept commissions for projects involving both architectural and engineering work, provided the primary problems of the project are in a field in which he has actively practiced.

(b) For structures supervised by Engineers and which require any architectural aid or assistance, the Engineer will employ a Registered Architect and will pay a mutually agreed upon fee.

5. Use of Seal:

The seal of the Registered Professional Engineer or Registered Architect to whom the commission is awarded shall be affixed to all drawings. In addition to his seal, the names and registration numbers of those Registered Professional Engineers and Registered Architects under whose direction any separate fields of work have been executed, shall appear in a special space on each drawing in connection with the title block.

6. Mutual Relationships:

(a) Architects and Engineers will cooperate to uphold the dignity and progress of each other's professions by exchanging general information and experience, and will foster instructions of students in their respective professions in every practicable way.

(b) In any case of dispute over questions of relationship between Architects and Engineers which cannot be resolved by discussion and which threatens the amicable relationship of the professions generally, or of individual members, the matter shall be referred to a Board of Arbitrators composed of one member of the Pennsylvania Association of Architects and one member of the Pennsylvania Society of Professional Engineers, who shall select a third disinterested party to sit with them and pass on the matter at issue and who shall have power by majority decision to determine it finally.

7. Public Responsibility:

(a) Architects and Engineers will interest themselves in public welfare on behalf of which they shall at all times apply their special knowledge, skill and training within the scope of their commissioned work.

(b) The professions oppose the practice of furnishing to the public free engineering and architectural services from manufacturers or their representatives on designing and planning work which comes within the fields of the Registered Professional Engineer and Registered Architect. But this shall not be construed as to prevent either profession from calling upon manufacturers of special equipment to furnish details of their product and the advantages of its application in specific cases.

8. Individual Obligations:

A. Each Architect and Engineer will familiarize himself with the Registration Laws of both professions and will not knowingly violate such laws.

B. Each Architect and Engineer pledges himself to respect the honest business interests of every colleague and accordingly:

(a) Will not injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of another Architect or Engineer.

(b) Will not attempt to supplant another Architect or Engineer after definite steps have been taken towards his employment.

(c) Will not compete with another Architect or Engineer for employment on the basis of professional charges, by reducing his usual charges to underbid the other, after having been informed of the charges named by the other.

(d) No Architect or Engineer will review the work of another Architect or Engineer for the same client, except with the knowledge or consent of such Architect or Engineer, or unless the connection of such Architect or Engineer with the work has been terminated and he is fully compensated for the work already performed.

(e) Will not advertise in self-laudatory language or in any other manner derogatory of impartial truth, or of the dignity of the profession.

(f) Will not take advantage of a salaried position to compete unfairly with other Architects or Engineers.

PAPERS ON RADIOLOCATION

A Radiolocation Convention was held in London, England, last March, under the auspices of the Institution of Electrical Engineers and, as a result, a great deal of important information has become available for publication. The Institution has published the papers in a special number of Part III of its *Journal* with a series of eight supplements, all of which are being made available to members of the Institute.

Members who already subscribe to Part III of the *Journal* of the Institution of Electrical Engineers at half the normal rate will be able to obtain the Special Number without additional charge and may purchase the Supplements at a special price of 2s. 6d. per Supplement.

Others will be required to pay £1 for the Special Number and 5s. for each Supplement.

Members who wish to receive copies are requested to place their order with the Institute Librarian at 2050 Mansfield Street, Montreal, enclosing a remittance to cover the cost.

A list of the contents of the publications follows:

Part IIIA, No. 1—All Survey Papers and Lectures delivered at the Convention and abstracts of supporting papers.

The following are the Supplements which contain the supporting papers, and any discussions on the survey papers, within the headings indicated.

Part IIIA, No. 2 — Naval Gunnery Radar.
Radar Navigation.
Precision Radar.

Part IIIA, No. 3 — Propagation.
Aerials — I: Metre-wave.
Part IIIA, No. 4 — Aerials — II: Centimetre-wave.
Wave Guides.
Part IIIA, No. 5 — Cathode-ray Tubes.
Valves.
Part IIIA, No. 6 — Transmitters and Receivers.
Part IIIA, No. 7 — Circuit Techniques for Radiolocation.
Part IIIA, No. 8 — Radio Measurements and Test Gear — I: General.
Part IIIA, No. 9 — Radio Measurements and Test Gear — II: Centimetre-wave.

ADDRESSES WANTED

As it is planned to publish a membership list shortly, Headquarters would be glad to receive as quickly as possible, information regarding the addresses of the following Students, some of whom have been overseas. A list of the Members and Juniors for whom we have no addresses appeared in the July issue.

STUDENTS REPORTED OVERSEAS

Adams, John Lindley
Cheeseman, Edgar W.
Bruce, Gordon Wyndham
Fleming, John Patten
Mackenzie, Robert Kenneth
Mercer, George
Murphy, Daniel Francis
Murphy, Herbert John
Newman, Harvey Elliott
Snyder, Robt. Bertram
Taylor, Bruce S.
Welch, John Kenneth

OTHER STUDENTS

Bandiera, Leo Joseph
Bernardi, Aldo
Blaine, Donald Smith
Burrows, James Louis
Calder, John
Cameron, Curtis B.
Cann, John Alastair Ross
Carmichael, Douglas Alfred
Carter, Charles Douglas
Carter, Charles Junior
Chappell, Douglas Stewart
Chenevisse, Emile
Clark, Chester Graham
Clark, Frederick Hubert
Collingwood, John C.
Cook, James E.
Coppick, Sydney
Crowther, Edward James
Curtis, George Louis
Dickie, Harold Guthrie
Dolan, M. A.
Dunphy, Kenneth Rae
Dudych, Daniel
Fielding, Geo. Parker
Forbes, Cyril Robert
Galbraith, John D.
Garland, Hedley Robert
Godbout, Adolphe G.
Gordon, John Edward
Gregory, Arthur Herbert
Herbert, Albert Cecil
Horton, Graydon Thring
Howe, Lloyd G.
Hubley, John Stuart
Kennedy, Thos. Vernon
King, John Shirley Lowe
Kummen, Harold Thorvald
Kuzyk, Wm. John
Leavens, John Wright
Lowe, Howard Thomas
Leeper, Robert Patrick
Lichty, Lyall J.
MacDonald, Ignatius Lloyd
MacFadyen, Allan Burt
Macfarlane, Robt. Murray
MacInnes, Thomas Robert
Mackey, Keith Barker
Magee, E. D. B.
Maguire, Robert Adam
Martin, John Henry
Mason, H. L. K.
Maughan, Ronald George
McCallum, Francis
McKie, Wm. M.
McLaughlin, Robert Hugh Benson
Miller, Justin Ormond
Mowbray, John Frederick
Muirhead, Charles Randolph
Munro, Donald David
Oxley, Loren A.
Palmer, Kenneth Winfield
Peacock, Robert Fred
Pouliot, Jean
Prokopy, Peter J.
Reikie, W. Thorpe T.
Rhodes, Edward LeRoy
Robinson, A. H.
Scott, Ainsworth David H.
Sokoloski, Steve
Stewart, Walter D.
Tamblyn, Robert Teudar
Telford, Robt. Brown
Ternan, Jas. B.
Thompstone, Robt. Edward
Thomson, Thos. Moncrieff
Venables, Wm. Norman
Wales, Donn
Walker, Roger Hugh
Ward, John William
Welch, Kenneth
White, Hubert Edward
Wills, Nicholas James
Wilson, Hugh Wm.
Wilson, John Edwin
Yamanaka, Richard Hiroji

AFFILIATE: Goldenstein, Abraham

LIST OF MEMBERS

The compilation of the membership list is now under way, and it is expected that publication will be made before the end of the year. Many members have returned the post-card containing the information necessary, but 40% have not yet completed the form.

The form is reproduced herewith for their benefit as well as for those whose position or address has changed since they returned the card. Right now, before it is forgotten, the form should be completed and forwarded to Headquarters.

An accurate and complete list requires full cooperation —and requires it now.

Steel Construction
Federal, Provincial and Municipal Departments
Construction
Consulting Firms
Teaching
Undergraduates
General Manufacturing and Industrial
Communications
Transportation
Power
Pulp and Paper
Mining

....
Last name — Initials or Christian names as you desire them in the list
....
Position or nature of duties
....
Name of firm or employer
....
Business address — Street — City — Province
....
Home address — *(Underline the one to be used for Institute mail)*

INFORMATION FOR OFFICE RECORDS ONLY

....
Degrees — University — Year of Graduation
....
War service (Give dates, rank and decorations)
....
In which branch of engineering: (a) did you graduate? (b) Would you now classify yourself?
....
In which of the classifications on the list at the left are you interested?
....
If a registered professional engineer, state in which province.

Personals

It will be a matter of interest to all members of the Institute to see the list of their fellow members who share in the recent King's Honour Lists. There are seventy-one persons included in the published lists which we believe are complete.

It is a particular pleasure to find there the name of the president of the Institute, J. B. Hayes.

The Institute joins with the other citizens of Canada in congratulating the following members for the honour which they have so well deserved.

KING'S BIRTHDAY HONOURS LIST

ORDER OF COMPANION OF HONOUR

General the Hon. A. G. L. McNaughton, C.B., C.M.G., D.S.O.

APPOINTMENT TO IMPERIAL PRIVY COUNCIL

Right Honourable C. D. Howe

COMMANDERS OF THE MILITARY DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (C.B.E.)

Brigadier Earl Ritchie Suttie, R.C.A., D.S.O., Montreal, Que.
Air Commodore Walter Alyn Orr, R.C.A.F., O.B.E., M.I.D., Ottawa, Ont.

OFFICERS OF THE MILITARY DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (O.B.E.)

Engineer Captain Angus Downes Mathwin Curry, R.C.N., Jollimore P.O., Halifax Co., N.S.
Captain (E) Arthur Cecil Montague Davy, R.C.N., Esquimalt, B.C.
Captain (L) Ernest Geoffrey Cullwick,, R.C.N., (R), Ottawa Ont.
Colonel William Little Laurie, R.C.C.S., Kingston, Ont.
Colonel Norman Clarence Sherman, R.C.E.M.E., Kingston, Ont.
Colonel John Tuzo Wilson, R.C.E., Toronto, Ont.
Lieutenant-Colonel George Hylton Spencer, R.C.E., Toronto, Ont.
Group Captain Denton Massey, R.C.A.F., Toronto, Ont.

DOMINION DAY HONOURS LIST

COMPANIONS OF THE MOST DISTINGUISHED ORDER OF ST. MICHAEL AND ST. GEORGE (C.M.G.)

Lieutenant-Commander Charles Peter Edwards, O.B.E., Ottawa, Ont.
Dr. Augustin Frigon, Montreal, Que.
Emmett Patrick Murphy, Ottawa, Ont.
Joseph Emile St. Laurent, Ottawa, Ont.

HONOURARY COMPANION OF THE MOST DISTINGUISHED ORDER OF ST. MICHAEL AND ST. GEORGE

William L. Batt, Philadelphia, Pa.

COMMANDERS OF THE CIVIL DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (C.B.E.)

Henry Blane Bowen, Montreal, Que.
Edward Launcelot Cousins, Toronto, Ont.
Frederick Coburn Jewett, Ottawa, Ont.
William A. Newman, M.B.E., Montreal, Que.
John Hamilton Parkin, Ottawa, Ont.
Walter Albert Rush, Ottawa, Ont.
James Morey Wardle, Rockcliffe, Ont.
John Armistead Wilson, Ottawa, Ont.

OFFICERS OF THE CIVIL DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (O.B.E.)

Frederick Alport, Ottawa, Ont.
Hope V. Anderson, Ottawa, Ont.
Henry M. Armstrong, Fredericton, N.B.
Bristow Guy Ballard, Ottawa, Ont.
David Boyd, Toronto, Ont.
Donald Roy Cameron, Ottawa, Ont.
Albert Deschamps, Montreal, Que.
C. Leonard Dewar, Montreal, Que.
William Flockhard Drysdale, Montreal, Que.
J. Bertram Hayes, Halifax, N.S.
Llewellyn Corbett Jacobs, Montreal, Que.
Robert Edwards Jamieson, Montreal, Que.
Percy John Jennings, Banff, Alta.
Frederick Binns Kilbourn, Montreal, Que.
Ernest Lavigne, Quebec, Que.
Wilfrid S. Lawson, Ottawa, Ont.
Thomas Rodgie McLagan, Montreal, Que.
Frank Leslie Mitchell, Montreal, Que.
James Geoffrey Notman, Montreal, Que.
Russell Kenneth Odell, Ottawa, Ont.
Ernest Clint Perley, Ottawa, Ont.
Frederick Hatheway Peters, Ottawa, Ont.
Dr. Ronald C. Rose, Ottawa, Ont.
Lesslie Rielle Thomson, M.B.E., Ottawa, Ont.
Richard Laurence Weldon, Montreal, Que.

News of the Personal Activities of members of the Institute

COMPANIONS OF THE IMPERIAL SERVICE ORDER (I.S.O.)

Edward B. Jost, Ottawa, Ont.
Ivan E. Vallee, Quebec, Que.
Ernest Owen Way, Ottawa, Ont.

MEMBERS OF THE CIVIL DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (M.B.E.)

William Henry Stephenson Bird, Winnipeg, Man.
Ernest W. Bowness, Calgary, Alta.
John Ellis Breeze, Ottawa, Ont.
Frederick Thomas Brown, Montreal, Que.
Alexander Stuart Donald, Fredericton, N.B.
Michael Dwyer, Moncton, N.B.
Alexander Gray, Saint John, N.B.
Richard Duncan Hiscocks, Toronto, Ont.
Frederick S. Jones, Montreal, Que.
Albert Lawrence Killaly, Peterborough, Ont.
Charles King Le Capelain, Ottawa, Ont.
Frederick Charles Mechin, Toronto, Ont.
Horace Owen Merriman, Ottawa, Ont.
John Bernard Phillips, Montreal, Que.
Alexander Watson, Montreal, Que.
Russell Yuill, Saint John, N.B.

MEDAL (CIVIL) OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE (B.E.M.)

Arthur Magennis Hudson, Montreal, Que.
Norman Douglas Wilson, Toronto, Ont.

C. H. Boisvert, M.E.I.C., chief engineer of the Public Service Board of the Province of Quebec, is the newly elected chairman of the Quebec Branch of the Institute. Born at Montreal, he graduated from Ecole Polytechnique, Montreal, in 1925 with a B.A. Sc.

He followed the Shawinigan Water and Power Company student test course that year, going to the Quebec Public Service Commission in 1926 as an engineer. He became acting chief engineer of the Commission in 1931.

E. V. Gilbert, M.E.I.C., formerly assistant engineer in the Winnipeg office of the Department of Public Works of Canada, was appointed, last January, as senior assistant engineer. He is a graduate in civil engineering from McGill University, Montreal, and joined the Department in the Ottawa district office in 1938 after five years on engineering projects in the province of Quebec. He became assistant engineer at Winnipeg in 1939, going the next year to St. John's, Nfld., and later loaned to the British Admiralty Technical Mission as engineer of docks and dredging. In 1942 he was assigned to the works and buildings branch of the Canadian Naval Service and in 1943 was made district engineer for Newfoundland, where he remained until his appointment later in that year as chairman of the Board of Development at Ottawa. Mr. Gilbert returned to his duties in the Department at Winnipeg in January 1944.

W. H. M. Laughlin, M.E.I.C., who has been connected, since his graduation from the University of Toronto in 1927, with the Ontario division of Dominion Bridge Company Limited, latterly as chief engineer, has joined the Toronto consulting engineering firm of Proctor and Redfern. The firm will be known as Proctor, Redfern and Laughlin. Mr. Laughlin was chairman of the Toronto Branch of the Institute in 1943 and has represented that Branch on the Council since 1945.

Dr. J. J. Green, M.E.I.C., has been awarded a life honorary membership in the American Association of Airport Executives. His name appeared on the list of annual awards for 1945 made at the convention in May 1946 in recognition of outstanding contributions to the Association, its members and the civil airports they represent.

N. T. McKee, M.E.I.C., research engineer and vice-president of the Superheater Company, New York City, received the honorary degree of doctor of science in engineering at the commencement exercises of the University of Kentucky in June. He holds the B.M.E. and M.E. degrees from that university, and has served as vice-president of the Superheater Company, director of the Air Preheater Corp., director of the Superheater Co. Ltd. of Canada. From 1920 to 1922 he was director of Marine and Locomotive Superheater Ltd., in London, England.

Lyle G. Trorey, M.E.I.C., is chairman and chief engineer of the newly established firm, Aerographic Surveys Limited, Weybridge, Surrey, England. The firm will undertake aerial mapping commitments anywhere in the world, specializing in the preparation of topographic maps for engineering, forestry, geological and similar purposes, and supplying consulting services in these and related fields. Mr. Trorey is also senior partner of Trorey and Hunter, consulting civil and air survey engineers, Stratford, Ont., which firm is the Canadian agent for Aerographic.

F. O. Mills, M.E.I.C., mechanical engineer in the Department of Public Works district engineer's office at New Westminster, B.C., retired in April, 1946, after thirty-four years service with the Department. He went to New Westminster in 1925 as assistant engineer, after several years service in the Vancouver office.

E. E. Orlando, M.E.I.C., was appointed manager, central station sales, of the Canadian Westinghouse Company Limited in July. He will be located at the Hamilton headquarters building. A graduate of the Nova Scotia Technical College, he followed the Westinghouse student course and in 1928 commenced his duties in the engineering department. Appointed sales engineer in Montreal in 1934, he was promoted in 1944 to manager, apparatus division in that office, from which position he goes to his new assignment.

G. A. Vandervoort, M.E.I.C., who has been technical adviser with the British Columbia Power Commission, Victoria, B.C., since November, 1945, was recently appointed chief engineer for the Commission. He joined the Commission in 1945 after twenty-two years with the New Brunswick Electric Power Commission, finally as chief engineer.

A. Watson, M.E.I.C., formerly acting marine superintendent in the Department of Transport at Ottawa, has been appointed marine superintendent. He has been with the Department since 1931, and was previously connected with Canadian Vickers, Montreal, as chief engineer of the marine department.

S. B. Wass, M.E.I.C., has retired from the service of the Canadian National Railways and is residing at Uxbridge, Ont. He had been with Canadian National since 1918 where he served as division engineer at Moncton, N.B., and as terminal engineer for western lines at Fort William, Ont. As terminal engineer he was transferred to Montreal in 1927 and to Toronto in the same capacity in 1933. He was later divisional engineer at St. Thomas, Ont., and returned to the Toronto office in 1943.

W. L. Thompson, M.E.I.C., who recently returned to Canada after five years service overseas with the Canadian Army, has rejoined the Bailey Meter Company in the position of manager of the Toronto Office, which he held prior to enlistment. He saw service with the R.C.E.M.E. in England, France, and Belgium, in command of No. 1 Advance Base Workshop.

Group Captain C. A. Davidson, M.E.I.C., has received the appointment of director of construction engineering for the R.C.A.F., and will be stationed at Ottawa. He served with the Royal Canadian Engineers in World War I, and was commissioner of highways in Alberta for thirteen years. In the R.C.A.F. he had been stationed at Vancouver, Calgary and Winnipeg, and was latterly chief construction engineering officer for Maintenance Command at Uplands Air Station, Ontario.

H. B. Dickens, M.E.I.C., has resigned as supervising structural engineer for the Department of Public Works of Canada at Ottawa and opened a consulting office in that city, where he will specialize in modern reinforced concrete design. He was for a time reinforced concrete engineer for the City of Hamilton. He also had charge of the London office of the Dominion Structural Steel Company in 1929-30, and has been engaged in engineering in England, Wales, Turkey and Africa. He returned to Canada in 1940 as senior engineer for the United Kingdom Technical Mission and was advisor on design and construction for General Engineering Company at Toronto. He entered the Department in 1942.

Guy A. Lindsay, M.E.I.C., is employed as design engineer with the industrial electronics division of the Westinghouse Electric Company at Baltimore, Md. He was previously engineer in charge of the general engineering branch of the Department of Transport, located in Ottawa, Ont., and in 1940 was active on a committee appointed to represent Canada in the investigations for the early development of power resources in the international section of the St. Lawrence River.

A. O. Wolff, M.E.I.C., who has been district engineer for Canadian Pacific Railway at Saint John, N.B., since 1939, is now in the Toronto office of the company as assistant engineer, maintenance of way. He was chairman of the London Branch of the Institute in 1937 when stationed there as division engineer, and was councillor representing the Saint John Branch in 1942 and chairman of that Branch in 1943.

D. O. Turnbull, M.E.I.C., has been in private practice as a consulting engineer in Saint John, N.B., since January, 1945, specializing in the design and supervision of municipal and industrial engineering works. He had been with the R.C.A.F. since 1940 latterly as a squadron leader, stationed at Ottawa and Rothesay, N.B.

H. L. Shepherd, M.E.I.C., recently of the R.C.N.V.R., is now connected with the University of Toronto. He is assistant professor of general studies and assistant to the director of studies in the Faculty of Applied Science and Engineering at Ajax, Ont.

Paul Guénette, M.E.I.C., has entered the employ of the ammunition division of the Canadian Industries Limited at Brownsburg, Que., as an engineer in the methods department. He had been connected with the Dominion Rubber Company Limited in Montreal since 1944 as process development engineer, following service with the Regent Knitting Mills Co. Ltd., St. Jérôme, Que., as head of the planning department.

G. J. T. Gunn, M.E.I.C., is on the staff of R. A. Hanright, consulting engineer of Toronto, Ont., engaged at present as electrical engineer on the extension of the Bowater's Newfoundland Pulp and Paper Mills at Cornerbrook, Nfld. He was previously with the Robert A. Rankin Company at Montreal.

Jas. W. Houlden, M.E.I.C., has been transferred by Canadian Industries Limited to the Winnipeg office where he will handle western sales for the "Dominion" Ammunition of the company. He was formerly at the Montreal office as special assistant to the sales manager, having been transferred in 1945 from Brownsburg, Que., where he was ballistic engineer.

R. J. Mattson, M.E.I.C., has accepted the position of project officer with the Central Technical Power Board of the Department of Works, Mines and Power, of the Government of India at Simla. He was associated with the Canadian and General Finance Company at Toronto early this year, after five years service with the Aluminum Company of Canada Limited in Montreal.

J. B. Nelson, M.E.I.C., recently associated with E. Leonard & Sons Limited of London, Ont., is now with H. G. Acres, consulting engineers, Niagara Falls, Ont.

B. P. Rapley, M.E.I.C., is resident engineer for the Imperial Oil Company Limited in connection with the extension and modernization programme now being inaugurated at their Montreal East Refinery. He had been in Talara, Peru, since 1937, as chief engineer with the International Petroleum Company.

A. Raymond, M.E.I.C., is vice-president and general manager for the International Braid Company of Canada Limited at Ste. Rose de Laval, Que. He was previously with the Dominion Rubber Company as industrial engineer at the head office in Montreal. During the war, he was superintendent of Dominion Rubber small arms ammunition plant at Cap de la Madeleine, Que.

P. R. Sandwell, M.E.I.C., recently resigned his position as assistant chief engineer of the Ontario Paper Company Limited at Thorold, Ont., and has accepted an appointment as chief engineer with the Powell River Company Limited at Vancouver, B.C.

R. W. Wellwood, M.E.I.C., has accepted a position as wood technologist with the Department of Forestry of the University of British Columbia, Vancouver, B.C. He was previously employed in the same capacity by the Commonwealth Plywood Company Limited at Ste. Therese, Que.

T. W. Wilson, M.E.I.C., who received his discharge from the R.C.E. in March, is now employed by Canadian Bitumuls Co. Ltd., Leaside, Ont.

L. S. McGregor, M.E.I.C., has received the appointment of mechanical engineer, central region, with Canadian National Railways, and is located in Toronto. He had been appointed mechanical inspector in Montreal for Canadian National on his recent return from service overseas with the R.C.E.M.E.

H. F. Finnemore, M.E.I.C., was elected chairman of the Town of Mount Royal Protestant School Board at the first meeting of the board for the 1946-1947 school year.

R. C. Flitton, M.E.I.C., is retiring as chairman of the Town of Mount Royal Protestant School Board. He has been re-elected to the commission for a three-year term.

J. J. H. Miller, M.E.I.C., was named to the Town of Mount Royal Protestant School Board, at the first meeting of the current school year.

C. A. Boulton, M.E.I.C., is now in Regina, Sask., as district manager for the prairie provinces for Housing Enterprises of Canada Limited. He had recently been located in Halifax with the E. G. M. Cape Company Ltd.

E. E. Gregg, M.E.I.C., has recently ceased to practice as a consulting forester in Vancouver, B.C., and has joined the Western Plywood Company Limited of that city. His position is assistant general manager.

George Ford, M.E.I.C., has been admitted to the degree of Master of Science by the University of Alberta, where he has been sessional demonstrator in the department of civil engineering.

Maurice Laquerre, M.E.I.C., has associated himself with Lavoie and Delisle, consulting engineers at Chicoutimi, Que. He has been with the Aluminum Company at Arvida, Que., since 1942.

Donald Rhodes, M.E.I.C., who has been, since June 1946, district plant superintendent of the Bell Telephone Company's provincial district, has been transferred to a similar position in charge of the east district, Montreal.

G. C. Turner, M.E.I.C., is with the Curtiss-Wright Corporation at Columbus, Ohio, in the engineering department of the airplane division. He is working on stress analysis.

Elio D'Appolonia, M.E.I.C., was recently granted the degree of Master of Science by the University of Alberta, Edmonton. He is in the civil engineering department as an instructor.

R. N. McManus, M.E.I.C., was admitted to the degree of Master of Science by the University of Alberta, where he is a lecturer in civil engineering.

T. Hogg, M.E.I.C., has accepted an appointment with the B.C. Power Commission and is located at Victoria, B.C., having terminated his duties as administrator officer to the special commissioner for defence projects in northwest Canada.

H. R. M. Acheson, M.E.I.C., is now plant engineer with the Gaspesia Sulphite Company Limited at Chandler, Que. He was formerly supply engineer for the Canadian International Paper Company at Timiskaming, Que.

J. C. Dale, M.E.I.C., who served overseas with the R.C.A., has returned to his former position with Canadian Utilities Ltd. in Calgary, Alberta.

R. E. Daly, M.E.I.C., who served with the R.C.E.M.E., has returned to his former employment in Detroit, Mich.

Keith Dixon, M.E.I.C., who served in the artillery in both wars, attaining the rank of lieutenant colonel, has returned to his position with the Department of Transport at Prince Rupert, B.C.

A. B. Dove, M.E.I.C., has returned from overseas with the rank of lieutenant colonel in the R.C.E. and rejoined the Steel Co. of Canada Ltd., in Montreal.

E. J. Durnin, M.E.I.C., who served overseas with the R.C.E. for over four years, has returned to his former position with the Saskatchewan Power Commission at Regina.

J. B. Eldridge, M.E.I.C., who was overseas for four years with the R.C.E., has returned to the English Electric Co. of Canada Ltd., at St. Catharines, Ont.

R. A. Lombard, M.E.I.C., who was overseas for four years with the R.C.E., has accepted a position with the Boiler Inspection and Insurance Company of Canada in Montreal.

M. J. Lupton, M.E.I.C., who served overseas for several years with the R.C.E. on special technical work, is now with the Dominion Bridge Co. Ltd., at Winnipeg, Man.

L. D. McGee, M.E.I.C., who gained the rank of lieutenant colonel with the R.C.E.M.E. overseas, has accepted a position with the Industrial Development Bank, Montreal.

D. L. McGillivray, M.E.I.C., has retired from the R.C.N.V.R., and returned to his former position with Imperial Oil Ltd. at Sarnia, Ont.

H. R. McQueen, M.E.I.C., veteran of World Wars I and II, serving in the latter in the R.C.E.M.E., is now located and practicing in San Diego, California.

J. H. Mellor, M.E.I.C., who served overseas in the R.C.E.M.E., has returned to his former employers, Canadian Copper Refineries Ltd., Montreal, as chief engineer.

Guy McRae Minard, M.E.I.C., who served with the R.C.A.F. in Canada and overseas, is now assistant to the managing director, Spruce Falls Power and Paper Co. Ltd., Kapuskasing, Ont.

B. R. Spencer, M.E.I.C., who has been in the R.C.N. since 1924, is remaining in the post-war navy.

Harry Taylor, M.E.I.C., who served overseas in the R.C.E.M.E., has returned to his former position with the Canadian National Railways at Winnipeg, Man.

G. W. Thompson, M.E.I.C., who is a major in the R.C.E.M.E., is remaining in the post-war army.

F. L. Thompson, M.E.I.C., who was with the navy, has now returned to his former employers, Imperial Oil Ltd., and is stationed in Toronto.

K. H. Tremain, M.E.I.C., who rose to the rank of colonel in the R.C.A., is now manager of Mount Royal Importers Inc., in New York.

W. A. MacCallum, M.E.I.C., who was in the R.C.E.M.E., is now at the Fisheries Experimental Station at Halifax, N.S.

W. M. Berry, JR.E.I.C., Winnipeg, Man., a B.Sc. in civil engineering from the University of Manitoba in 1944, won the University Travelling Fellowship for $400.00.

T. A. J. Leach, JR.E.I.C. who served overseas in the R.C.E. as a survey officer is now at Saskatoon with the Department of Highways of Saskatchewan.

H. A. Leonard, JR.E.I.C., who served in the R.C.N. during the war, has decided to remain there and has been sent to England.

G. G. Leroux, JR.E.I.C., who served overseas in the R.C.A.F., is now with the Foundation Co. of Canada in Montreal.

G. Osberg, JR.E.I.C., has retired from the R.C.N.V.R. and accepted a position with the Bell Telephone Co. of Canada in Ottawa.

William Schofield, JR.E.I.C., has been released from the R.C.A.F. and returned to his former position with Alliance Paper Mills Ltd., at Merriton, Ont.

J. M. Scott, JR.E.I.C., who served overseas for over five years in the R.C.E., has accepted a position with the National Harbours Board at Montreal.

Reginald F. Shapcotte, JR.E.I.C., who served overseas with the R.C.E. on building construction, is now employed with the Department of Public Works, at Ottawa, Ont.

Richard Scott, JR.E.I.C., has temporarily relinquished his position as lecturer in electrical engineering at the University of Toronto and is at the Massachussets Institute of Technology, Cambridge, as instructor in electrical engineering while doing graduate work. He expects to remain about two years.

R. O. Lockwood, JR.E.I.C., has taken his discharge from the Canadian Army and has accepted a position as lubrication engineer with McColl-Frontenac Oil Company Limited at Calgary, Alta.

J. L. Simpson, JR.E.I.C., is manager of the new Manitoba branch of Insulating Industries Limited of Vancouver. He went to Winnipeg in May to build the company's plant there.

R. E. Davey, JR.E.I.C., is in the employ of Canada Oils Company Limited, Montreal He had recently been with the Rapid Transit Department of the Toronto Transportation Commission and from 1942 to 1945 he was engineer in charge of works and buildings for the Naval Service of the Department of National Defence, Shelburne, N.S.

J. N. McCarey, JR.E.I.C., has returned to the employ of Stephens-Adamson Manufacturing Co. of Canada Ltd., at Belleville, Ont., after being connected for some time with the Canadian International Paper Company at Hawkesbury, Ont.

J. E. Quist, JR.E.I.C., has severed connections with German and Milne, naval architects of Montreal, and has entered the service of Canadian Comstock Limited, Montreal, where he will be employed in electrical draughting. He was discharged from the R.C.N.V.R., in 1945 with the rank of lieutenant (elect).

P. W. Woodfield, JR.E.I.C., is now employed by A. V. Roe (Canada) Limited at Malton, Ont., as test engineer in the mechanical test section of the gas turbine division. He had been with Turbo Research Limited at Winnipeg since his discharge in 1945 from the R.C.A.F.

G. M. Webster, JR.E.I.C., is in Yellowknife, N.W.T., as resident engineer for the Doris Yellowknife Gold Mines Ltd. He is also doing consulting work in the area for the Tatham Company Limited. He was previously employed in the Nylon Division of Canadian Industries Limited in Kingston, Ont., as production supervisor and as assistant project engineer on the nylon plant expansion.

René Dansereau, JR.E.I.C., who served overseas with the R.C.A.F., is now re-established in Montreal.

G. P. Dewar, JR.E.I.C., who served overseas with the R.C.E. for four years, has accepted a position with Imperial Oil Co. Ltd., in Montreal.

J. R. Desmarais, JR.E.I.C., who was with the R.C.A.F. overseas, has accepted a position with the City of Montreal.

L. R. Douglas, JR.E.I.C., who was over four years overseas with the R.C.C.S., has returned to the Canadian General Electric Co. Ltd., Toronto, Ont.

L. F. Eull, JR.E.I.C., who served in the R.C.N., has returned to his former position with the P.F.R.A. at Regina.

C. B. Livingston, JR.E.I.C., who served overseas in the R.C.N.V.R., has accepted a position with the Canadian General Electric Co. Ltd., in Toronto, Ont.

J. G. M. Loomis, JR.E.I.C., was overseas with the R.C.A.F., has accepted employment with the Construction Equipment Co. in Montreal.

James G. MacLeod, JR.E.I.C., who served in the R.C.N.V.R., has accepted a position with the Canadian Refractories at Kilmar, P.Q.

D. P. MacVannel, JR.E.I.C., who served overseas in the Navy, is now with Otis Fensom Elevator Co. Ltd., at Hamilton, Ont.

G. F. McAulay, JR.E.I.C., who was with the R.C.A.F., has returned to his position with the City of Edmonton.

C. B. McMillan, Jr.E.I.C., who served in the R.C.A.F., has now returned to his former employment with the Canadian National Railways.

W. A. Marshall, Jr.E.I.C., who served in the R.C.E.M.E., has returned to the Dominion Structural Steel Co. Ltd., in Montreal.

D. R. Stanley, Jr.E.I.C., who served in the R.C.A.F., is now the Provincial Sanitary Engineer, Department of Health, Edmonton, Alberta.

J. P. Stanley, Jr.E.I.C., who was overseas with the R.C.A.F., has returned to his former position with Stevenson and Kellogg at Montreal.

W. R. Staples, Jr.E.I.C., who served in the R.C.N.V.R., is back on the staff of the University of Saskatchewan.

Charles G. Taylor, Jr.E.I.C., who served overseas in the R.C.E., is now with Beatty and Beatty in Pembroke, Ont.

R. H. Tivy, Jr.E.I.C., has been demobilized from the R.C.N.V.R. and has accepted a position with the Manitoba Power Commission in Winnipeg.

Graham R. Treggett, Jr.E.I.C., who was overseas with the R.C.A.F., has returned to his former position with the Coca Cola Co. of Canada Ltd in Montreal.

Leslie C. Turner, Jr.E.I.C., who served overseas with the R.C.N. Air Branch, has accepted a position with Molsons' Brewery in Montreal.

M. MacR. Uloth, Jr.E.I.C., who was in the Navy, has returned to his former post with the Canadian General Electric Co. Ltd., in Peterborough, Ont.

C. H. Vatcher, Jr.E.I.C., who served in the Navy, has now returned to his former employers, Canadian National Carbon Co. Ltd., in Vancouver, B.C.

D. L. Ryan, S.E.I.C., who served for a short period in the R.C.E., has taken a position with the Dominion Bridge Co., Lachine, Que.

Bernard K. Ryan, S.E.I.C., who served with the R.C.N.V.R., is now with the Canadian Tube and Steel Co. Ltd., in Montreal.

W. R. Sadler, S.E.I.C., who served overseas in the 1st Canadian Mechanical Equipt. Co. R.C.E., has accepted a position with the Alberta Transit-Mix Concrete Co. in Calgary.

Ralph Thomas Sansom, S.E.I.C., who was overseas for four years in the Sask. L.I. (M.G.), is now with Canadian National Railways at Moncton, N.B.

J. A. Savory, S.E.I.C., has been discharged from the navy and accepted a position with the Hydro Electric Power Commission of Ontario.

Léo Scharry, S.E.I.C., who served in the R.C.E.M.E., has recently graduated from Ecole Polytechnique of Montreal.

Stewart M. Schofield, S.E.I.C., who was overseas with 16th Fed. Co. R.C.E. is now with the B.C. Dept. of Public Works at Port Coquitlam, B.C.

W. B. Scott, S.E.I.C., who served in the R.C.E., is now with the Quebec North Shore Paper Co. Ltd., Baie Comeau, Que.

H. E. Seely, S.E.I.C., has been discharged from the army and is continuing his studies at the University of New Brunswick, Fredericton.

R. C. Sentance, S.E.I.C., who served overseas in the R.C.E.M.E., has accepted a position with B. Greening Wire Co. Ltd., Hamilton, Ont.

G. D. Zimmerman, S.E.I.C., will manage the newly established Montreal office of the Fischer and Porter Company of Hatboro, Penn. He is a graduate of the University of Toronto in chemical engineering, and was instrument engineer with the Canadian Synthetic Rubber Company Limited prior to his present appointment.

H. R. Wright, S.E.I.C., is employed as an electrical engineer by the Shawinigan Water and Power Company at Quebec.

Blake B. Denyes, S.E.I.C., is plant mechanical engineer for the Monarch Battery Mfg. Company Ltd., Kingston, Ont. He was formerly at Queen's University, Kingston, as demonstrator in the mechanical engineering department.

W. D. Martin, S.E.I.C., is with the Tomlinson Construction Company in Saskatoon, Sask. He had been with the Department of Mines and Resources at Banff, Alta., as assistant engineer.

L. Vergin, S.E.I.C., has completed the General Electric test course at Peterborough, Ont., and is employed as an electrical engineer by the Aluminum Company of Canada in Kingston, Ont.

J. M. Bennett, S.E.I.C., is in the employ of Canadian Blower and Forge Co. Ltd., at Kitchener, Ont.

K. L. Broe, S.E.I.C., is taking the Canadian General Electric Company's test course in Peterboro, Ont.

M. S. Greene, S.E.I.C., is employed by the Dominion Bridge Company Limited, Lachine, Que., as assistant to the sales development manager. For the past two years he was junior engineer with Engineering Service Company, Halifax, N.S.

L. E. Henne, S.E.I.C., is with the Northern Electric Company, telephone division, in Montreal as telephone equipment engineer.

R. A. Hemstock, S.E.I.C., is at Norman Wells, N.W.T., where he is employed as chief engineer for the Imperial Oil Company.

T. G. Higgins, S.E.I.C., has accepted a position with Canadair Limited in Montreal.

R. J. Kennedy, S.E.I.C., was discharged in March from the R.C.E., and has been lecturing in the civil engineering department of Queen's University, Kingston, Ont.

G. R. Lotts, S.E.I.C., has secured employment as plant engineer with the H. J. Heinz Company of Canada Ltd., at Leamington, Ont.

D. L. Mackinnon, S.E.I.C., has been appointed manager of the building department of the Foundation Company of Ontario Limited with hearquarters in Toronto, Ont. He was with the Foundation Company of Canada Limited prior to serving with the R.C.A.F.

A. N. Oldfield, S.E.I.C., is in Montreal in the employ of the Northern Electric Company, electronics division.

W. A. Potruff, S.E.I.C., joined the Hydro Electric Power Commission of Ontario on his discharge from the army in May. He is located at Toronto as a junior engineer.

H. L. Saunders, S.E.I.C., is in Guelph, Ont., where he is employed by the W. C. Wood Company, as production engineer.

T. E. Sullivan, S.E.I.C., is with the Bell Telephone Company in Montreal, being employed as engineering assistant in the plant department.

Jack H. Ward, S.E.I.C., has secured a position with the H. J. McFarland Construction Company of Picton, Ont. At present he is field superintendent over two paving undertakings in the vicinity.

Gordon T. Davis, S.E.I.C., who was in the R.C.N.V.R., is now employed with Canadian General Electric Co. Ltd. at Peterborough, Ont.

Jean Dessaules, S.E.I.C., who served overseas with the R.C.A.F., has returned to his former position with Shawinigan Water and Power Co. at Trois-Rivières, P.Q.

H. H. Dixon, S.E.I.C., who served in the R.C.A.F., is now employed in Santa Monica, California.

Ralph J. Doehler, S.E.I.C., who served overseas with the R.C.A.F., has accepted a position with the Montreal Welding Company.

A. T. Dougall, S.E.I.C., who served in the R.C.N., afloat for over four years, is now with the Standard Chemical Co. in Toronto, Ont.

Bernard H. Downman, S.E.I.C., who was in the R.C.N.V.R., is now with Fonboro Co. Ltd., in Montreal, Que.

J. M. Elliott, S.E.I.C., has returned from overseas service with the R.C.E.M.E., and is now with John Bertram and Sons Co. Ltd., Dundas, Ont.

W. R. Elsey, S.E.I.C., has retired from the R.C.E.M.E., and is now with Canadian General Electric Co. Ltd., in Winnipeg, Man.

Robert E. Evans, S.E.I.C., who served in the R.C.N., is now with Stadler Hurter Co. Ltd., Montreal, Que.

Douglas K. Macdougall, S.E.I.C., who served in the army, has now accepted employment with the New Brunswick Department of Public Works.

U. F. McCulloch, S.E.I.C., who was overseas with the R.C.A., has accepted a position with the Foundation Co. of Canada, Montreal, Que.

A. D. McKeller, S.E.I.C., has been discharged from the R.C.N.V.R., and has accepted a position with the Dominion Engineering Co. at Lachine, Que.

C. D. McKinney, S.E.I.C., who served in the navy, is now with the Shawinigan Water and Power Co., Montreal.

R. J. B. McNally, S.E.I.C., has been released from the R.C.E.M.E. to take up a position with the Canadian Synthetic Rubber Co., at Sarnia, Ont.

J. D. McPherson, S.E.I.C., who served overseas in the R.C.N.V.R., has joined the Foundation Co. of Canada in Montreal, Que.

R. B. McRae, S.E.I.C., who was with the R.C.E., has returned to his former position with Julius Kayser and Co. Ltd., Sherbrooke, P.Q.

Zavie Miller, S.E.I.C., has been demobilized from the R.C.E.M.E. and has accepted a position with the Northern Electric Co. Ltd. in Montreal.

K. R. Stehling, S.E.I.C., who served with the army overseas in the Canadian Repat. Depot, has returned to complete his studies at the University of Toronto, Ont.

M. I. Steiman, S.E.I.C., who served overseas in the R.C.E., has accepted a position with the Dominion Department of Public Works, Winnipeg, Man.

Martin, Swarek, S.E.I.C., who was with the R.C.C.S. overseas, is now with the City Hydro Commission, Winnipeg, Man.

Henry Todd, S.E.I.C., who served overseas with the R.C.E., has accepted employment with the Canadian Ohio Brass Co. at Niagara Falls, Ont.

W. R. Topham, S.E.I.C., who was in the R.C.A.F., has returned to his former position with Canadian Industries Ltd., in McMasterville, Que.

Obituaries

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

Cecil Ewart, M.E.I.C., died on February 14th, 1946, at Victoria, B.C., at the age of seventy-four.

Born at Dinan, France, on January 27th, 1872, Mr. Ewart was educated at Victoria College, Jersey, Channel Islands, and came to Canada in 1896, where he was first engaged as chainman and later as instrumentman on the Kaslo and Slocan Railway.

From 1902 to 1904 he was resident engineer for the Great Northern Railway at Vancouver and from 1904 to 1909 in a similar capacity for the Grand Trunk Pacific in Alberta, during the period of construction through the Yellowhead Pass. In 1911 he was moved to Winnipeg where he became divisional engineer for Canadian National Railways.

Returning to British Columbia in 1914, he served as locating engineer during the following two years both with the Pacific Great Eastern Railway and with the Edmonton, Dunvegan and British Columbia Railway in northern Alberta.

He went overseas in 1916 with the 8th Battalion, Canadian Railway Troops, B.E.F., and served in France, winning the D.S.O. and returning to Canada in June 1919 with the rank of major.

Returning to the service of the Canadian National Railways, he was engaged successively as resident engineer at Fort William, Ont., as divisional engineer at Saskatoon, later (in 1928) being recalled to Winnipeg where he served for some years as industrial commissioner for the western region, C.N.R.

Throughout the last few years prior to his retirement in 1939, Mr. Ewart's health made it difficult for him to continue his duties and his many old friends in Winnipeg will recall with admiration his remarkable devotion to duty, his determination and cheerfulness in the face of ill health. At his retirement he moved to California, settling in 1941 in Victoria, B.C.

Mr. Ewart joined the Institute as an Associate Member in May 1907, becoming a Member in April 1911. In March 1938 he became a Life Member.

John E. Griffith, M.E.I.C., former deputy minister of railways for the British Columbia government, passed away at his home in Victoria on July 20th, 1946.

He came to Canada in 1881 from Port Dinorwick, Wales, where he was born in 1861 and articled in contracting engineering. In Winnipeg, Man., he was employed by the Canadian Pacific Railway as a draughtsman and as assistant to the chief engineer from 1881 to 1884. After spending a year in England he returned to the Canadian Pacific in 1886 as assistant engineer, becoming resident engineer on the Selkirk section the next year. Travelling to South America, he spent several years operating the Transandian Railway in Argentina.

He returned to Canada in 1909, entering the British Columbia Department of Public Works as assistant engineer, and was appointed in 1918 to the post of deputy minister of public works. The government of the province transferred him in 1925 to the position of chief engineer and deputy minister of railways.

Mr. Griffith became a Member of the Institute in 1912, and was elected to Life Membership in March 1945.

Walter James Armstrong, M.E.I.C., consulting engineer of Montreal and Toronto, died on July 10th, 1946, in Montreal after a brief illness.

Born at Fair Hill, Md., in 1885, he graduated as a mechanical engineer from Cornell University in 1909. He commenced his engineering career that year in New York City with Westinghouse, Church, Kerr and Company, becoming successively assistant engineer, assistant chief engineer in connection with hotels, stations and railroad shops, and finally engineer in charge of design and purchase of materials for heating, ventilation, plumbing and refrigeration for the Canadian Pacific Railway Station at Vancouver, B.C.

He entered the engineering department of Ross & Macdonald, Montreal architects, in 1913 as assistant chief engineer, later to be engineer in charge of the department. Here he was concerned with design and supervision of mechanical features for the construction of such projects as the Fort Garry Hotel in Winnipeg, Man., and The Macdonald, at Edmonton, Alta. He was in charge of preliminary plans, specifications and estimates for mechanical and electrical features for the Regina Hotel, the Halifax Ocean Terminals, the Toronto Union Station and the Mount Royal Hotel, Montreal, among the works of major interest. In 1931 he established a private consulting practice in Montreal with branch office in Toronto. He directed such projects as the Dominion Square building, and the Canadian Marconi Company plant in Montreal, the Royal York Hotel and the Bank of Montreal building in Toronto and Trinity College of the University of Toronto, the Bank of Nova Scotia at Saint John, N.B., and the T. Eaton Company stores in Montreal, Toronto, Calgary, Saskatoon and St. Catharines, Ont.

Mr. Armstrong joined the Institute as an Associate Member in 1916, becoming a Member in 1921.

Thurstan William Fairhurst, M.E.I.C., sales director of Ruston and Hornsby Limited, Lincoln, England, died suddenly on June 15th 1946, in Milwaukee, Wis. He had been making a tour of Canada and North America on behalf of his company.

He was born in 1889 at Chorlton-cum-Hardy, Cheshire, and, in 1904, started his apprenticeship in mechanical engineering at Manchester with Crossley Brothers, studying at the College of Technology, where he received a certificate in 1910. At the outbreak of World War I he joined the Royal Engineers in the ranks, was commissioned in the field, twice mentioned in dispatches and made responsible for the construction and operation of the desert pipe line from the Suez Canal to Palestine. He was demobilized in 1919 as a commander of two field companies. That year he joined the Vancouver Machinery Depot, Vancouver, B.C., as managing engineer of their sales department. He transferred in 1923 to the Marion Steam Shovel Company, Marion, Ohio, as managing engineer for the sales department, being engaged until 1927 in the establishment of the company's world sales organization and associated British manufacture of their products. He was then appointed overseas manager of the Nordberg Manufacturing Company, Milwaukee, Wis., and from 1933 to 1936 served as general sales manager for Crompton Parkinson Limited, Chelmsford, England.

He left the electrical industry in 1936 and returned to mechanical engineering, associated as sales director with Ruston and Hornsby Limited, Lincoln, England, and later became a director of the associated company, Davey Paxman and Company Limited, of Colchester, England.

Mr. Fairhurst became a Member of the Institute in 1940.

Alexander Thomson, M.E.I.C., Lethbridge civil engineer, passed away on July 15th 1946.

He was born in Edinburgh, Scotland, in 1891, educated at Leith Technical School, and spent four years apprenticeship in the city engineer's office at Perth, Scotland, becoming assistant engineer in 1912. He came to Canada in 1914, entering the Dominion Western Railway in Calgary, and transferring the same year to the Canadian Pacific Railway Department of Natural Resources, where he was a draughtsman in connection with irrigation and Dominion land survey work. With the Calgary South Western Railway in 1916 and 1917 he was draughtsman and transitman and transferred to the Canadian Pacific at Winnipeg in 1917 as a draughtsman. Later he joined the Dominion Parks Department as transitman on road location and construction and in 1919 and 1920 was draughtsman in connection with the topographical surveys for the Department of the Interior at Calgary, then given charge of plans for construction in the Lethbridge Northern Irrigation District and spending several years as hydrometric engineer for that department. For the past thirteen years he has been a member of the civic engineering staff at Lethbridge.

Joining the Institute as a Junior in 1922, he transferred to Associate Member in 1925 and became a Member in 1940.

ERRATUM

We sincerely regret the error whereby the name of the late **Joseph E. Hinchliffe,** M.E.I.C. appeared incorrectly spelled in this section of the July issue of The Journal,

News of the Branches

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

NIAGARA PENINSULA BRANCH

P. A. Pasquet, jr. e.i.c. - *Secretary-Treasurer*
J. L. McDougall, m.e.i.c. - *Branch News Editor*

The Niagara Branch held its annual special dinner meeting on May 28th at the Queen Victoria Park Restaurant, Niagara Falls, Ont., with J. H. Ings presiding.

After refreshments and an enjoyable dinner, thanks due to the efforts of the personnel of the Niagara Parks Commission, the results of the incoming executive ballot were announced by P. E. Buss. W. D. Brownlee was elected chairman for the ensuing year.

Retiring chairman J. H. Ings voiced his appreciation. to the members of his executive for their assistance during his tenure of office. On behalf of the Branch members, Mr. Ings was presented with the gold membership pin of the Institute by W. R. Manock.

For this meeting the guest speaker was Colonel Herbert D. Vogel of the U.S. Army Corps of Engineers, who was introduced by C. G. Cline. The latter outlined briefly Colonel Vogel's career to date.

Colonel Vogel gave a very interesting talk, tracing the early history of the U.S. Corps of Engineers dating from George Washington, and mentioning such names as Colonel Richard Gridley, Colonel Rufus Putnam, Tronson du Coudray, Major du Portail, Captain L'Enfant, Roche-fontaine, Ville-franche.

A break in the history of the Corps occurred when in 1794 the designation was Corps of Artillerists and Engineers, whose duties dealt mainly with fortifications and assault. In 1802 the Corps of Engineers was established at the United States Military Academy. This latter corps, during the period of building in the United States, also undertook the building of roads, canals, lighthouses, and railroads. Among the notable works performed by the Corps were the Library of Congress, the Lincoln Memorial, Lee Bridge, the Washington Monument, and the Panama Canal. In December, 1941, all military construction work was placed in the hands of the Corps of Engineers.

Acommpanying Colonel Vogel were two of his associates, Colonel J. E. Deignan, and Major R. Kline, who were responsible to Colonel Vogel as base commander under General McArthur.

Both Colonel Deignan and Major Kline gave brief descriptions of their own first hand experiences through the fight in New Guinea and Philippine campaigns and of the landings on Iwo Jima; of the difficulties in building and maintaining communication lines; of roads and harbours constructed in spite of heavy rains and tropical heat, the latter causing much trouble in operation of mechanized equipment due to vapour locks in gasoline lines.

At the close of the talk a wide variety of questions was put to the speakers, whose information was most interesting.

H. W. LeBel thanked the speakers.

At the Niagara Falls meeting—left to right: C. G. Cline, W. R. Manock, P. A. Pasquet, Col. H. D. Vogel, W. D. Brownlee, J. H. Iings, Col. J. E. Deignan, P. E. Buss, Major R. Kline

QUEBEC BRANCH

Roger Desjardins, m.e.i.c. - *Secretary-Treasurer*

Le 29 avril, la section de Québec avait le plaisir d'entendre son vice-président, Monsieur C.-H. Boisvert, prononcer une conférence sur le sujet "Transport hier, aujourd'hui, demain". Voici un résumé du travail de Monsieur Boisvert.

Le seul moyen de transport au Canada, au début de la colonie, était la voie fluviale. Puis des agglomérations s'étant établies à l'intérieur, des routes furent construites pour les relier au St-Laurent et alimenter la voie fluviale.

Au début du 19ème siècle: développement de la route et transport de voyageurs par le chemin de la poste avec la diligence. Puis, ère du chemin de fer vers le milieu du siècle dernier et disparition de la diligence. La route sert de nouveau pour alimenter le chemin de fer, cette fois, plutôt que la voie fluviale. Puis vint le véhicule automobile, stimulant de la construction des routes durant les 35 dernières années.

Le premier autobus fut construit en 1829, en Angleterre, par Walter Hancock, et fonctionnait à la vapeur. Le développement de l'autobus prit naissance avec le perfectionnement du moteur à essence. G. Daimler fit breveter le moteur à essence en 1884 et vendit ses droits français et belges et son brevet en 1889 à Packard et Levasseur qui fabriquèrent leur premier moteur à essence en 1891.

En Amérique, le premier autobus régulier fit son apparition en 1907, sur la 5ème Avenue, à New-York. Jusqu'en 1920, il y eut très peu d'autobus.

Les automobiles enregistrés dans Québec, en 1910, étaient au nombre de 786; en 1920 — 41,562; en 1930 — 178,548; en 1940 — 225,152; en 1944 — 224,822. Ceci illustre le déplacement du chemin de fer par le véhicule automobile. Le développement des routes se fait à la même cadence. L'inauguration de la politique des bonnes routes se fit en 1912, dans Québec.

L'autobus est venu satisfaire cette partie de la population qui ne pouvait utiliser l'automobile privé. Il a favorisé le développement des banlieues des grandes villes.

Pauvres services d'autobus au début. Les services s'organisèrent vers 1920 et prirent essor avec la règlementation provinciale en 1926 par la Commission des Services Publics et des autres qui lui ont succédé. Actuellement, c'est la Régie Provinciale des Transports et Communications qui a juridiction complète sur les taux, horaires, services, permis, véhicules, assurances, etc. La consolidation des services et l'élimination de la concurrence ont apporté une amélioration considérable dans les services et a stabilisé l'industrie.

Les taux pour autobus dans la province de Québec varient de 2½ à 4 cents, par passager mille, et la moyenne est de 2.6 cents. Les taux sont réduits généralement de 40% environ, pour livrets de 10 ou 12 passages valides pour 7 à 10 jours.

L'autobus moderne est construit sur un châssis spécial, très fort, bas, avec moteur puissant et flexible et freins à air comprimé; ceci est très important car le véhicule pèse de 8,000 à 20,000 livres.

Le moteur à gazoline a un sérieux concurrent dans le moteur Diesel pour autobus et moteur électrique pour électrobus, qui est un tramway sans pneus.

L'autobus préféré pour service urbain est le 27 passagers et pour le service interurbain le 37 passagers. Pour l'autobus urbain, il n'y a pas de nécessité pour le grand confort, il doit être léger, court et facile de manœuvre à travers la circulation. Il doit avoir de l'espace pour les passagers debout. Pour l'autobus interurbain, le confort est primordial, chaque voyageur doit avoir son siège, il ne traverse pas de circulation intense et est beaucoup plus encombrant.

Dans la province de Québec, environ 25 millions de dollars sont investis dans les systèmes d'autobus, garage, termini et équipement. Les revenus annuels seraient d'environs 20 millions de dollars et le nombre de passagers de 140 millions environ, par année. En 1944, il y avait 1,469 autobus dans la province, en 1935, il n'y en avait que 505, donc une augmentation de 200% en regard de l'augmentation des autres véhicules qui n'a été que de 50%.

La capacité de l'autobus en 1925 était de 21 passagers; en 1927, 33 passagers; en 1935, 37 passagers. Le confort des autobus 1945-1946 est presqu'égal à celui des véhicules de promenade; certains coûtent près de $25,000.

A cause de la guerre et de la production restreinte, 400 autobus devraient être remplacés immédiatement dans la province de Québec, car ils sont devenus désuets et usés.

Les exploitants devront moderniser leurs véhicules et améliorer leurs services, s'ils désirent conserver une forte partie de la clientèle qu'ils se sont faite durant la guerre. Pour ce qui concerne les autobus de l'avenir, il est à prévoir qu'ils auront, pour les services interurbains, 8½ pieds de largeur généralement et 40 pieds de longueur, avec chambre de toilette dans les plus luxueux. Il est à prévoir que le système de propulsion sera, un jour, par turbo-générateur et l'énergie électrique produite sera transmise aux moteurs électriques sur les essieux. Vitesse prévue jusqu'à 100 milles à l'heure, sur routes modernes, avec pneus à l'épreuve des crevaisons. Freinage à l'électricité et conduite électrique ou hydraulique.

Les autobus seront climatisés et l'intérieur sera sous pression pour empêcher la poussière de pénétrer.

Les autobus de demain seront munis d'un haut-parleur pour le conducteur, d'un système radio-recepteur pour la distraction des voyageurs et de système de communication entre autobus et station de contrôle (à l'essai aux Etats-Unis).

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Le 29 mai 1946, la section de Québec avait l'insigne honneur de recevoir comme conférencier le Professeur G. Magnel, du département de Génie Civil de l'Université de Gand, Belgique. Le professeur Magnel traita du béton armé ordinaire et du béton pré-contraint.

Le professeur Magnel remercia tout d'abord la nation canadienne pour son magnifique effort de guerre et fit ressortir la grande contribution des Canadiens à la libération de la Belgique.

Le professeur Magnel expliqua, en premier lieu, la théorie du béton armé et exposa les désavantages de son utilisation dans sa forme actuelle. Le professeur illustra son exposé d'exemples concrets.

Par la suite, le professeur démontra les grands avantages de l'emploi du béton pré-contraint: économie dans le béton, élimination de l'armature, résistance supérieure, disparition des fissures, etc. L'armature dans les structures est remplacée par l'emploi de câbles d'acier auxquels on fait subir une élongation initiale en rapport avec les charges à supporter. Pour bien faire ressortir ses avancés, le professeur Magnel donna plusieurs exemples typiques où il démontra clairement les caractéristiques du béton pré-contraint quant à l'augmentation de la résistance avec des sections moins grandes que pour le béton armé ordinaire et l'élimination de l'armature. On y constate, en effet, une forte réduction de la section, une augmentation très substantielle de la résistance, et la disparition des efforts nuisibles causant les fissures.

Par des projections fixes, accompagnées d'explications appropriées, le professeur Magnel dévoila à l'assistance le résultat de ses nombreuses et fructueuses expériences sur le béton pré-contraint. De nombreux graphiques éclairèrent les auditeurs sur les caractéristiques de cette méthode nouvelle.

Le professeur Magnel fit dérouler par la suite un film bien au point illustrant le processus de différents essais dans ses laboratoires de l'Université de Gand, sur des poutres de béton ordinaire et de béton pré-contraint, en indiquant les charges maxima de rupture, de même que le travail de la poutre avec élimination graduelle de la charge. Ce film démontra de plus, clairement, les caractéristiques des poutres composées de blocs de béton de dimensions uniformes et pré-contraintes suivant le principe pour la poutre en béton monolithe.

Le professeur Magnel dévoila aussi que l'armée canadienne fut la première au monde à utiliser le béton pré-contraint. Un film nous démontra comment furent utilisées par l'armée canadienne deux poutres pré-contraintes composées de blocs de béton, pour construire une passerelle sur une partie du canal Terneuzen pour y faire passer les quatre lignes de la pipe-line qui apportait l'essence d'Ostende à Gand. Les travaux étaient exécutés par le corps de génie de l'armée canadienne au cours de ses opérations militaires, à Gand, en septembre 1944, sous la direction du Major Gaétan Côté, M.E.I.C., ingénieur civil de Sherbrooke et diplômé de l'école Polytechnique de Montréal, le professeur Magnel agissant comme consultant et aviseur.

Lors du passage des troupes canadiennes, l'éminent universitaire belge accueillit presque tous les jours des militaires canadiens à sa Faculté et à son laboratoire. Quelque 125 Canadiens ont fait des études à son laboratoire, travaillant comme les étudiants belges à fabriquer des poutres de béton pré-contraint. Le brigadier Georges Francoeur, M.E.I.C., ancien commandant de brigade dans le secteur de Gand, qui assistait à la conférence du professeur Magnel, a signalé l'amitié que celui-ci témoigna à nos militaires.

La Branche de Québec présente ses sincères remerciements au secrétariat-général de l'Institut qui lui a fourni l'avantage d'entendre cet éminent conférencier. La Branche souhaite un prochain retour du professeur Magnel.

Library Notes

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

BOOK REVIEW

ENGINEERING FOR DAMS

W. P. Creager, J. D. Justin and J. Hinds. New York, John Wiley & Sons; London, Chapman & Hall; 1945. 3 vols., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $15.00.

Reviewed by M. V. Sauer, M.E.I.C.*

This three-volume work by the well known authorities Creager, Justin & Hinds covers the design and construction of dams of all types to meet every condition of topography and of service. Each of the authors is a prominent practicing engineer of wide experience and they have embodied in this work a comprehensive study of the subject of dams in all its phases. Several well-known engineers have contributed chapters on special features of the subject.

Volume 1 covers investigation of dam sites, type of structure, foundation conditions, erosion below spillways, model studies, flood conditions and spillway capacities and design.

Volume 2 discusses the design of concrete dams of the gravity, arched and buttressed types.

Volume 3 covers the design of earth dams, including foundation conditions, soil tests and their utilization. There are other chapters in this volume on rock fill, steel and timber dams, as well as on head water control and various accessories.

A full exposition of the uses of the "flow net" and of the seepage line in the design of earth dams is given, and the value and location of core walls is analysed. Two instructive tables are included in the work, one showing the record floods and run off per square mile of many rivers throughout the United States, ranging from a drainage area of over 1,000,000 square miles, to small streams, and the other a tabulation of dam failures and their causes. There are bibliographies throughout the work.

Theoretical treatment of dam design is fully covered without losing sight of the practical side. The work is a valuable text for students as well as meeting the needs of engineers.

**Hydraulic Engineer & General Supt., Generating Stations, Electrical Dept., Quebec Hydro Electric Commission, Montreal.*

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Airport Planning:
Charles Froesch and Walther Prokosch. N.Y., Wiley; London, Chapman & Hall, c1946. 250 pp., illus., cloth.

Engineering Mechanics; 2d ed:
Seibert Fairman and Chester S. Cutshall. N.Y., Wiley; London, Chapman & Hall, c1946. 267 pp., illus., cloth.

Les Essais des Transformateurs Industriels Chez le Constructeur et Chez l'Exploitant; Suivi de La Marche En Parallèle des Transformateurs:
M. Lapine. Paris, Dunod, 1946. 139 pp., illus., paper.

Lincoln's Incentive System, 1st ed:
James F. Lincoln. N.Y., London, McGraw-Hill, 1946. 192 pp., illus., cloth.

Planning the Small Factory:
A. H. Huckle. London, Mitre Pr., (1946). 13 pp., illus., cloth.

Radio Amateur's Handbook; 23rd ed:
American Radio Relay League, Inc. West Hartford, Conn., American Radio Relay League, c1946. 468 pp., illus., paper.

Trains, Track and Travel; 7th ed:
R. W. Van Metre. N.Y., Simmons-Boardman, c1946. 423 pp. illus., cloth.

X-Rays in Practice; 1st ed:
N.Y., London, McGraw-Hill, 1946. 615 pp., illus., cloth.

TECHNICAL BULLETINS, REPORTS, ETC.

American Society for Testing Materials. Preprints-1946:
Annual Report of the Executive Committee, 1946.

...*(1)—Report of Committee A-1 on Steel.- (2)—Report of Committee A-3 on Cast Iron.- (3)—Report of Committee A-5 on Corrosion of Iron and Steel.- (4)—Report of Committee A-6 on Magnetic Properties.- (5)—Report of Committee A-10 on Iron-Chromium, Ron-Chromium Nickel and Related Alloys.- (7)—Report of Committee B-2 on Non-Ferrous Metals and Alloys.- (10)—Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought.- (12)—Report of Committee B-7 on Light Metals and Alloys, Cast and Wrought.- (18)—Notch Sensitivity in Static and Impact Loading of Some Magnesium-Base and Aluminum-Base Alloys, by J. P. Doan and J. C. McDonald.- (21)—Creep Tests on Some Extruded Lead and Lead-Alloy Sleeves and Tapes, by G. R. Gohn, S. M. Arnold, and G. M. Bouton.- (23)—Method for Predicting Failure of Metals, by P. E. Cavanagh.- (36)—Fatigue Properties of Beryllium-Copper Strip and Their Relation to Other Physical Properties, G. R. Gohn and S. M. Arnold.- (38)—Fatigue Tests of Rail Steel Under Compressive Stress, by R. S. Jensen and H. F. Moore.- (41)—Life Testing of Plain Bearings for Automotive Engines, by E. T. Johnson.- (42)—Fatigue Testing Machines for Ball and Roller Bearings, by Thomas Barish.- (45)—Metallographic Observations of Ball Bearing Fatigue Phenomena, by A. B. Jones.- (46)—Fatigue Resting of Roller Bearings, by H. R. Gibbons.- (48)—Corrosion-Resistant Steel for Architectural and Structural Applications, by H. A. Grove.- (53)—Results of 15 Year's Exposure Tests on Corrosion-Resistant Steels, by I. V. Williams and K. G, Compton.- (55a)—Tensile and Creep Strengths of Some Magnesium-Base Alloys at Elevated Temperature, by A. A. Moore and J. C. McDonald.- (57)—Report of Committee C-5 on Fire Tests of Materials and Construction.- (60)—Report of Committee C-9 on Concrete and Concrete Aggregates.- (62)—Report of Committee C-14 on Glass and Glass Products.- (63)—Report of Committee C-15 on Manufactured Masonry Units.- (64a)—Report of Committee C-18 on Natural Building Stones.- (65)—Concrete Flooring with Asphalt Admixture, by F. O. Anderegg.- (72)—Report of Committee D-1 on Paint, Varnish, Lacquer, and Related Products.- (74)—Report of Committee D-3 on Gascous Fuels.- (80)—Report of Committee D-9 on Electrical Insulating Materials.- (82)—Report of Committee D-11 on Rubber and Rubber-Like Materials.- (83)—Report of Committee D-12 on Soaps and Other Detergents.- (84)—Report of Committee D-13 on Textile Materials.- (85)—Report of Committee D-14 on Adhesives.- (86)—Report of Committee D-16 on Industrial Aromatic Hydrocarbons.- (87)—Report of Committee D-17 on Naval Stores.- (91)—Report of Committee E-1 on Methods of Testing.- (94)—Report of Committee E-4 on Metallography.- (99)—Ten Years' Outdoor Exposure of Filled Asphalt Coatings on Saturated Felts, by G. L. Oliensis.- (101)—Tension and Torsion Creep Properties of Cloth Laminates, by Joseph Marin.- (103)—Effect of Temperature and Humidity of Mechanical Properties of Molded Cellulose Acetate Plastics, by W. E. Welch, R. F. Hayes, T. S. Carswell, and H. K. Nason.- (106)—Water Determination in New and Used Insulating Oils by Doble Method, by Frank C. Doble.- (114)—Introduction to Symposium on Oil Procurement Practices, by R. A. Boyd.- (115)—Purchasing of Petroleum Oils by the General Electric Co., by Christian Dantsizen.- (117)—Airline Oil Procurement Practices, by J. T. Hendren. (114, 115 and 117 bound together).*

American Standards Association:

American Standard Practice for the Inspection of Elevators; Inspectors' Manual; 2d ed. (ASA-A17.2-1945).

American Welding Society:

Recommended Practices for Automotive Flash-Butt Welding (Tentative). (D8. 1-46T).

Association of Professional Engineers of the Province of Manitoba:

Twenty-fifth Anniversary Year Book, 1945.

British Standards Institution:

Ferrous Traps for Baths, BS 1291:1946.
...'Ready-To-Fit' Thermal Insulating Materials for Hot and Cold Water Supply and Central Heating Installations for Small Dwellings, BS 1304:1946.

Codes of Practice Committee:

...CP(B) 550—Domestic Hot Water Supply by Gas (Schools).
...CP(B) 551—Brickwork.
...CP(B) 552—Electric Lifts for Passengers, Goods and Service.

Electric Supply Authority Engineers' Association New Zealand:

Transactions of the Sixteenth Annual Conference, 1945.

Highway Research Board. Current Road Problems:

No. 13—Use of Air-Entraining Concrete in Pavements and Bridges.

Institution of Mechanical Engineers. Advance Papers:

Discharge Tests on an Archimedean Screw, by A. C. Donaldson.

Institution of Structural Engineers:

Reinforced Concrete for Buildings and Structures; Report on Formulae for Computation of Stresses, 1946.

Ingeniors Vetenskaps Akademien. Handlingar:

Nr 185—Lens Distortions in Photogrammetry, by Percy Tham.
...Nr 186—Undersokning av Zeoliter, av Lennart Simonsson.

Kungl. Tekniska Hogskolans. Handlingar:

Nr 2, 1946—Nagra Undersokningar Rorande Skivor Och Hoga Balkar av Armerad Betong, av Henrik Nylander och Hans Holst.

Philips Technical Review:

Volume 8, nos. 1—3, January-March, 1946.

Quebec (Prov.) Dept. of Mines. Bureau of Geological Surveys:

Preliminary Report on Taibi Lake Area, Abitibi East County, by Rene Beland. (P.R. No. 192).

Svenska Forskningsinstitutet for Cement och Betong vid Kungl. Tekniska Hogskolan i Stockholn:

Meddelanden N; r 6, 1946—Stampelbelastade, cirkulara plattor pa elastiskt underlag, by Sven G. Bergstom. (Circular Plates with Concentrated Load on an Elastic Foundation).

PAMPHLETS, ETC.

Chemical Education from the Viewpoint of a Petroleum Refiner:

Floyd C. Lantz. Chemical Institute of Canada, 1946.

Conditions of Labour Peace:

Leo Wolman. American Iron and Steel Institute, 1946.

New and Accelerated Methods Applied to Engineering Procedures:

Louis H. Berger. Boston, C. L. Berger and Sons, 1946.

Research and the Oil Business:

Henry H. Hewetson. Canadian Manufacturers' Association, 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.

BRITISH STANDARD SPECIFICATION FOR FERROUS TRAPS FOR BATHS. B. S. 1291: 1946.

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

This specification is complementary to B. S. 1189—Cast Iron Baths for Domestic Purposes and provides cast iron traps for use with standard baths. The traps are of the "p" type and may be of ordinary or malleable cast iron. The non-ferrous fittings are identical to those covered by B. S. 1184. The external finish may be fine cast, galvanised or glass enamelled. There are two depths of seal, viz:—1½ in., and 3 in. Workmanship, dimensions, inspection and overflow openings are dealt with and illustrations show a cross section through the trap and overflow connection, together with details of the non-ferrous fittings taken from B. S. 1184.

HOW TO FIND A SHORT; and Other Automobile Wiring Troubles:

Jack Steele. N.Y., Norman W. Henley, 1946. 209 pp., illus., 7½ x 5¼ in., cloth, $2.00.

This book was written, not only for the technician, but for the car owner, and for this reason is both simple and direct. It includes wiring diagrams of practically all makes of late model cars with trouble-shooting chart, and contains answers to all light and wiring troubles common to the modern automobile. It shows how to trace down shorts; install heaters, fog lights, signal lights, etc; and explains, in simple language, windshield wipers, hydro-electric window raisers, power top controls, etc.

STORY OF THE HELICOPTER:

Devon Francis. N.Y., Coward-McCann; Toronto, Longmans, Green, c1946. 182 pp., illus., 8¼ x 5¾ in., cloth, $3.75.

In narrative and essay form this book tells in lay language of the helipcopter's possibilities, of hundreds of years of try-and-fail experiments in rotary wing flight, and of the engineering ingredients that finally made up-and-down flight feasible. The attitude of the author is that only a few persons out of the many have flown because flying has been too hard to learn and too expensive for what the layman could get out of it, and also because personal flying, as opposed to flying in commercial transport planes, has been too dangerous. If, ultimately, millions of persons are going to pilot flying machines, they must have a type of vehicle that does not require forward velocity for suspension by the air, and they must have a machine which is easily managed and safe. The author believes the helicopter is that machine.

WORLD OF NUMBERS:

Herbert McKay. Cambridge, University Pr.; N.Y. Toronto, Macmillan, 1946. 198 pp., illus., 7¾ x 5½ in., cloth, $2.75.

This book is written with the intention of illustrating how the average person, with a school-leaving knowledge of mathematics, may work things out and fit them into a reasoned mathematical picture of the conditions in which we live. Nearly all intelligent people take an interest in the universe, stars, moon, planets; their distances and movements, their constitution and conditions. It is obvious that our knowledge of things outside the earth and of the earth itself are almost entirely mathematical, or based on mathematics, hence this book illustrates the importance of this science.

The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet all of these books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.

BASIC DESIGN OF SHIPS

By G. C. Manning. D. Van Nostrand Co., New York, 1945. 212 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $3.75.

Emphasizing basic principles, the author presents his material under the following chapter headings: preliminary estimate of displacement; preliminary estimate of principal dimensions and coefficients; preliminary delineation of lines; preliminary general arrangement plans; weight and strength calculations; hull systems and fittings. The opening chapter covers the historical background and contains a statement of the scope of ship design.

DEVELOPMENT OF MATHEMATICS

By E. T. Bell. McGraw-Hill Book Co., New York and London, 1945. 637 pp., 9 x 5¾ in., cloth, $5.00.

Although this book covers the evolution of mathematics from about 4000 B.C. to the present day, it is not strictly a history. The author's intent is rather to indicate main trends over this period, presenting them only through typical major episodes in each. Chief principles, methods and theories are considered in both pure and applied mathematics. The author clearly shows by the judicious use of technicalities how seemingly unimportant phases have been developed into tremendously useful lines of endeavor. The book should prove an inspiration and a guide to the young mathematician in taking a larger view of his field.

DICTIONARY OF METALLOGRAPHY

By R. T. Rolfe. Chapman & Hall, Ltd., London, W.C.2, 1945. 243 pp., tables, 8¾ x 5½ in., cloth, 15s.

This dictionary covers definitions of the terms relating to the constitutions and structures of metals and alloys, and the relation of these to their physical properties. Particular attention has been given to atomic structure, constitution, micrography, macrography, processes to which metals and alloys are subjected in manufacture, heat treatments, and tests of finished products. Considering the amount and the nature of the information given, the book virtually constitutes a condensed encyclopedic treatment of the field of physical metallurgy.

DESIGN of REINFORCED CONCRETE STRUCTURES; 2d ed.

D. Peabody. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 532 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $5.50.

Although this book is concerned, primarily, with the design of buildings, these fundamentals of structural design in reinforced concrete are applicable as well to other classes of structures. The several phases of structural theory are accompanied by illustrative problems which collectively form the essentials for the design of a complete building. This new edition includes "plastic theory", prestressed concrete, rigid frame design, and special conditions of beams and continuous frames. Matters of construction details and manipulation have not been considered within the scope of the book.

ELEMENTARY MECHANICS OF FLUIDS

By H. Rouse, John Wiley & Sons, New York; Chapman & Hall, London, 1946. 376 pp., illus., diagrs., charts, tables, 9¼ x 5¾ in., cloth, $4.00.

The author considers the mechanics of fluids to be as fundamental a treatment of fluid behavior as the mechanics of solids is of the behavior of rigid and elastic bodies, and develops flow principles from the basic equations of mechanics in a logical, systematic order. He describes the practical application of these principles to problems encountered in various phases of engineering endeavor, with many illustrative examples. The numerous problems are designed to further the student's own power of analysis.

GLYCERIN, Its Industrial and Commercial Applications

By G. Leffingwell and M. Lesser, with foreword by W. J. Murphy. Chemical Publishing Co., Brooklyn, N.Y., 1945. 259 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $5.00.

This book is a comprehensive survey of the large number of industrial products which contain glycerin in smaller or larger percentages. Each chapter covers the use of glycerin in a particular branch of industry and contains a discussion of the properties of glycerin which render it useful for that industry. Numerous formulae for various preparations and an extensive bibliography are included.

HEATING, VENTILATING, AIR CONDITIONING GUIDE, 1946, Technical Data Section, Manufacturers' Catalog Data Section, Roll of Membership and Complete Indexes. Vol. 24.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. 1279 pp., plus 94 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 conditioning systems. The technical section has been thoroughly revised, and much new material has been added, including a chapter on fluid flow. 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.

MACHINE-TOOL WORK, Fundamental Principles

By W. P. Turner and H. F. Owen, 2 ed. McGraw-Hill Book Co., New York and London, 1945. 364 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.00.

The purpose of this text is to offer a systematic course of instruction in the fundamental principles of machine-tool work, not to produce first-class mechanics, but to provide a background for further study of industrial processes and practices. Although the fundamentals common to all are stressed, the various types of machine tools are dealt with separately. New chapters on shop safety and broaching have been added in this new edition, and the material on measurement, previously scattered through the book, has been collected in a single chapter.

MÉTROLOGIE GÉNÉRALE (Grandeurs et Unités).

M. Denis-Papin and J. Vallot. Dunod, Paris, 1946. 428 pp., plates L-XLVI, tables, diagrs., charts, 6 x 4 in., fabrikoid, 240 frs.

This comprehensive manual covers the field of measurement from a broad point of view. Early chapters are devoted to a discussion of measurement in general, the international system of weights and measures, and the symbols and equations of fundamental systems of measurement. Methods of measurement and units are described for the fields of geometry, geography, mechanics, angular measure, stresses, electricity and magnetism, heat and radiant energy, optics and time as well as for simple everyday use. Special industries, ancient and foreign units are covered. A detailed subject index provides a key to the wealth of information. A second volume will deal with measuring instruments and their use.

OFFICE LIBRARY of an INDUSTRIAL RELATIONS EXECUTIVE, 1946.

Prepared by H. Baker. 5th ed. (Bibliographical Series No. 77) Princeton University, Industrial Relations Section, Princeton, New Jersey, March, 1946. 36 pp., 9 x 6 in., paper, $0.50.

A considerable list of recommended books and pamphlets for the industrial relations executive is presented under the following general headings: general works; specific personnel problems and programs; trade unions and collective bargaining; labor legislation and administration; social insurance. A section of additional sources of information lists periodicals, research organizations, commercial and government informational services.
Eng. Journal—7180—Gal. 4—Gus

OUR OIL RESOURCES:

Edited by L. M. Fanning. McGraw-Hill Book Co., New York and London, 1945. 331 pp., illus., charts, tables, maps, 8½ x 5¼ in., cloth, $4.00.

Eighteen authorities within the field have contributed chapters to this symposium. It constitutes an exhaustive study of our oil resources in terms of geographical knowledge as well as of human resources—engineering and scientific learning, and private initiative and incentive. Topics covered include technological development in exploration, production and refining, the estimation of oil and gas reserves, conservation, oil from coal and shale, and the subject of American oil companies in foreign oil operations.

PETROLEUM PRODUCTION, Vol. 1, Mechanics of Production; Oil, Condensate, Natural Gas;

By P. J. Jones. Reinhold Publishing Corp., New York, 1946. 228 pp., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.50.

Within the field of petroleum production this book limits itself to the consideration of a system of mechanics of producing oil and condensate prior to the breakthrough of displacing fluids into producing wells. Available information on the volumetric and phase behavior of fluids in reservoirs is presented in terms of barrels of oil and condensate and standard cubic feet of gas. Production is considered from uniform pay intervals corrected for the effect of permeability and volume ratios and interconnection.

PLANNING the SMALL FACTORY.

A. H. Huckle. (The) Mitre Press, London, 1946. 133 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, 15s.

This practical work presents a detailed description of the various elements which must be considered in a small concern of an engineering nature. Tables, charts, diagrams and working drawings are freely used to consolidate or illustrate the important subject matters. Management and costs are considered as well as design and production methods. A factory producing small machine and equipment parts with a personnel of 500 is the example under consideration in the book.

PRINCIPLES of PHYSICS, Vol. 2. Electricity and Magnetism. (Sears Physics Series).

F. W. Sears. Addison-Wesley Press, Cambridge 42, Mass., 1946. 434 pp., plus tables and Index, illus., diagrs., charts, tables, 9 x 6 in., cloth, $5.00.

A textbook of college grade, this volume deals with the elements of electricity and magnetism on the basis of a thorough preliminary

(Continued on page 504)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

August 15th, 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 October 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

BEST—GORDON LIVINGSTONE, of 588 Driveway, Ottawa, Ont. Born at Deal, Eng., Aug. 19th, 1909. Educ.: Diploma, R.M.C., 1931; 1937-38, Engr. Officer, R.A.F., 1938-40, Staff Officer, Directorate Repair and Mtce., Air Ministry, London, Eng., 1940-42, Chief Tech. Officer, Service Flying Training School, 1942-43, Sr. Aero. Engr. Officer, H.Q. No. 4, Training Command, Calgary, Alta., 1944, Deputy Chief Engr. Officer, H.Q., Allied Exp. Air Force, Eng., 1945 to date, Chief Engr. Officer (Aero. Engr.), H.Q. No. 45 (Transport) Group, R.A.F., Dorval, Que.

References: L. F. Grant, O. T. Macklen, C. A. Cook, R. G. Johnstone, A. Ferrier, E. W. Stedman.

BISHOP—JOSEPH WILLIAM, of Ottawa, Ont. Born at Grand Forks, B.C., Aug. 17, 1907. Educ.: B.A.Sc., B.C., 1929; R.P.E., Ontario; 1929-30, test dept., Canadian General Electric; with Allis-Chalmers Co., Ltd., as follows: 1930, hydraulic dept., 1930-34, sales engr.; 1934-39, mgr., air-conditioning divn., Canadian General Electric, Toronto; 1942 to date, R.C.E.M.E., with the rank of Colonel, Director of Mech. Engineering, Dept. of National Defence, Ottawa.

References: L. A. Wright, L. Trudel, N. C. Sherman, G. W. Beecroft, H. G. Thompson.

BLACK—SHAUN DUFF, of St. Catharines, Ont. Born at Fredericton, N.B., May 18th, 1921. Educ.: B.Sc. (Aero. Engrg.), Tri-State Coll., Indiana, 1941; 1936-37-38 (summers), opperated paving machine and other constrn. equipt., Canada Construction Co.; engrg. and dfting., Cub Aircraft Corp., Hamilton, Ont., "Theory of Flight and Navigation" Instructor and then Asst. to Chief Ground Instructor; 1942-43, Stanley Flying & Training School, R.C.A.F., Commonwealth Training School, Stanley, N.S.; 1943-45 (18 mos.), R.C.A.F. Aircrew, went through training, then graduated as Navigator; 1945 (3 mos.), engrg. and dfting., Noury Aircraft Ltd., Hamilton, Ont.; with English Electric Co. of Canada, Ltd., St. Catharines, Ont., as follows: 1945-46 (18 mos.), student engr., machine shop and elect. mtce., and at present, sales engr., application engrg., apparatus sales dept.

References: A. J. Bennet, G. Grant, C. B. Croasdale, G. Morrison, W. J. Lawson, J. B. Eldridge.

COVEY—DOUGLAS ELLIOT, of Three Rivers, Que. Born at Saskatoon, Sask., July 11, 1916. Educ.: B.Sc. (Chem. Engrg), .Sask., 1937; 1937-41, asst. mech. engr. on modernization of complete paper mill, then mech. engr., Wayagamack Divn., Consolidated Paper Corp Ltd.; 1942-45, R.C.E.M.E.; 1946 to date, asst. mech. engr. i/c dfting. office at paper mill, Wayagamack Divn., Consolidated Paper Corp Ltd., Three Rivers, Que.

References: H. G. Timmis, E. R. McMullen, E. Butler, F. W. Bradshaw, H. O. Keay.

DRUMMOND—GEORGE D., 576 Lansdowne Ave., Westmount. Born at Montreal, Jan. 29, 1886. Educ.: B.Sc. (Mining), McGill, 1907; 1907-12, mgr., blast furnaces, foundry, quarries, Midland Terminal R.R. & Docks, erection No. 2 blast furnace, Midland, instln. accessory equipt., asst. to genl. mgr., plants, Canada Iron Corp., Montreal; with Zenith Coal & Steel Products Ltd., (now Drummond & Co., Ltd.), as follows: 1913, founded company, 1914-17, director and eventually pres. and genl. mgr., Zenith Machine Co., Ltd., shell mfrs., 1914-15, handled for Drummond McCall Co., Ltd., sales of all Algoma Steel for war purposes, and sales Wm. Tod & Co., Youngstown, Ohio, of shell forgings, etc., to Canadian and Russian govts. respectively; 1939-40, prepared recommendation covering increase national iron and steel prod. to Canadian Govt., 1940-41, steel consultant to Dept. Munitions & Supply, 1941-42, general assignments, same Dept.; during period, 1940-41, collaborated with Dr. C. A. Robb as power consultant, Dept. Munitions & Supply; and at present, president, Drummond & Co., Ltd., Montreal.

References: J. R. Donald, W. F. Drysdale, F. J. Friedman, C. A. Robb, H. D. Cameron, L. A. Wright.

HALL—CHARLES DEVEREUX, of Montreal, Que. Born at Wirral, Chester, Eng., Aug. 17, 1909. Educ.: 1921-23, Sir Herbert Strutts Coll., Belper, Eng.; 1924 (3 mos.), J. S. Farr Ltd., elect. engrs.; 1924-25, asst. to chief electr., D. P. Battery Co., Bakewell, Eng.; 1925-29, repair and mfr. elect. equipt., Fred Thomson Co., Montreal; 1929-32, i/c power plant and assoc. equipt., asst. to chief radio attendant, Canadian National Telegraphs, Montreal; 1932-36, Hall & Johnson, Verdun, Que., elect. contracting; with Bepco Canada Ltd., as follows: 1936-37, asst. mgr., service dept., 1937 to date, mgr., service, repair and mfg. depts., incl. operation of machine shop, welding and steel fab. shop, mfg. of switchboards, cubicals, etc. (Asks for admission as Affiliate.)

References: W. L. Yack, J. Winder, R. A. Yapp, K. O. Whyte, C. Thomson, W. G. H. Cam.

HARROP—ALAN CAMERON, of Montreal, Que. Born at Niagara Falls, Ont., March 3, 1904. Educ.: B.A.Sc., Toronto, 1925; with Imperial Oil Limited, as follows: 1925-27, chemist, Calgary (International Petroleum, Peru, S.A.); 1927-30, chief chemist, 1931-35, refinery dept., 1936-39, supt., Regina, 1940-44, supt., Calgary, 1944-45, supt., Sarnia, 1946 to date, genl. supt., Montreal East refinery.

References: C. E. Carson, G. L. Macpherson, C. S. Scrymgeour, F. C. Mechin, C. P. Warkentin.

LAKE—GEORGE WILLIAM CHARLES, 30 Brant St., Orillia, Ont. Born at Toronto, Jan. 2, 1917. Educ.: Graduate, R.M.C., 1938; 1938-46, Royal Canadian Ordnance Corps (1940-45, Overseas).

References: H. H. Lawson, P. C. King, L. F. Grant, H. W. Love, W. N. Bostock, G. G. M. Carr-Harris, N. C. Sherman, K. B. Andre.

MacMILLAN—DONALD, of Kingston, Ont. Born at Guelph, Ont., May 16, 1915. Educ.: Graduate, R.M.C., 1937; B.Sc. (Civil), Queen's, 1938; with R.C.E., as follows: 1939-41, Camp Engr., Petawawa; 1941, proceeded overseas with 4th Bn., returned to Canada Nov., 1942, as instructor at Chilliwack, B.C.; returned overseas Sept., 1943, commanded 23 Cdn. Fd. Coy., 8 mos. in England, 4 mos. as Tech. Staff Officer; commanded pioneer unit in Holland and Germany, 9 mos.; at present, Camp Engr., R.C.E., Barriefield Military Camp, Ont.

References: L. F. Grant, H. H. Lawson, K. H. McKibbin, N. J. W. Smith, A. W. Love, A. J. Kerry.

ROSS—JOHN WILLIAM, of Toronto, Ont. Born at Owen Sound, Ont., June 11, 1919. Educ.: B.A.Sc., Toronto, 1941; R.P.E., Ontario; 1938-40 (summers), McNamara Constrn. Co.; Steel Co. of Canada, Burlington Works; H.E.P.C. of Ontario, Thunder Bay System; 1941-44, asst. i/c mtce. and constrn. in all phases of plant operations during period, with full responsibility for preliminary design, purchase, instaln., etc., of bldg. and machine facilities as well as plant service facilities, Canadian Industries Ltd., Dominion Ammunition Divn., Brownsburg, Que.; 1944 to date, development engr., with full responsibility as regards design, development, instln. and field work of special machines and processes using all types comp. gas, Dominion Oxygen Co., Toronto.

References: D. S. Lloyd, W. A. Duncan.

TALBOT—LOUIS RENE, of Quebec City. Born at Quebec City, Nov. 29, 1913. Educ.: Graduate, R.M.C., 1935; B.Sc. (Civil), Queen's, 1936; 1936 to date, president, genl. mgr., sales engr. and consultant, Rene Talbot Limited, equipment distributors, Quebec City.

References: P. A. Dupuis, P. Vincent, A. Longpre, M. Roy, L. McLaren.

WEBSTER—THOMAS BENJAMIN, 212 Bedford St., Cornwall, Ont. Born at Brockville, Ont., April 8, 1922. Educ.: B.Sc. (Mech.), Queen's, 1944; 1941-46 (summers), engrg. dept., Howard Smith Paper Mills Ltd.; 1944-45, R.C.N., Engineer Officer, Lieut. (E); 1945 to date, engrg. dept., Howard Smith Paper Mills Ltd., Cornwall, Ont.

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

YATES—BERT T., 5 Yates Ave., Cornwall, Ont. Born at Cornwall, Ont., 1892. Educ.: B.Sc. (Civil), Queen's, 1917; Member, Chemical Institute of Canada; 1917-18, tech. asst., chem. engr., i/c tech. work in connection with constrn., instaln. and operation of explosives plant, Trenton plant, British Chemicals Ltd.; 1918-20, asst. constrn. engr., i/c constrn., instaln. and operation of plant, TNT plant, Nobel, Canadian Explosives Ltd.; 1921-22, in partnership with W. L. MacKenzie, consultg. engrg.; 1923 to date, pres. and mgr., H. Yates & Co., Ltd., Cornwall, refrigerators, oil-burning equipt., etc.

References: D. Ross-Ross, H. E. Meadd.

FOR TRANSFER FROM JUNIOR

BIESENTHAL—CLARENCE GORDON, 217 Holland Ave., Ottawa, Ont. Born at Pembroke, Ont., June 5, 1909. Educ.: B.Sc. (Mech.), Queen's, 1936; R.P.E. Ontario; 1936-40, design dftsman., Spruce Falls Pulp & Paper Co., Kapuskasing, Ont.; 1940-41, design dftsman., Canadian International Paper Co., Gatineau Mills, Que.; 1941-45, with J. R. Booth Ltd., Ottawa, as follows: 1941 (6 mos.), design dftsman., 1941-42, i/c sawmill design and constrn., 1942-43, asst. mech. supt., 1943-45, mech. supt.; with Alex. Fleck Limited, as follows: 1945 to date, i/c plant mech. mtce. and constrn., and at present, chief engr. (Jr. 1938.)

References: C. W. Boast, H. D. Hyman, F. S. MacDonald, T. Foulkes, A. N. Ball, D. S. Ellis.

FRASER—FREDERICK WALTER, of Calgary, Alta. Born at Calgary, Alta., Aug. 27, 1915. Educ.: B.Sc. (Civil), Sask., 1941; 1941-42, design, estimating, detailing, Sault Structural Steel Co., Ltd.; 1942-46, Lieut., R.C.E.; at present, constrn. foreman, McColl-Frontenac Oil Co., Ltd., Calgary, Alta. (Jr. 1942.)

References: J. S. Neil, C. Neufeld, E. H. Davis, C. R. Forsberg, I. M. Fraser.

NEAR—FRANK MANNING, 35 Secord Ave., Toronto 13, Ont., Born at St. Catharines, Ont., July 14, 1919. Educ.: B.A.Sc., Toronto, 1943; R.P.E., Ontario; 1943-44, R.C.E.; 1944 (2 mos.), sr. inspectr., City of Toronto; 1944 (3 mos.), asst. township engr., North York Township; at present, jr. engr., H.E.P.C. of Ontario, hydraulic dept., Toronto, Ont. (Jr. 1944.)

References: W. P. Near, A. E. Berry, O. Holden, E. G. Tallman, F. Grosvenor, N. S. Haines.

SHAW—FREDERICK W. B., of Hawkesbury, Ont. Born at Montreal, Que., May 22, 1911. Educ.: B.Eng., McGill, 1934; R.P.E. Ontario; with Steel Co. of Canada Ltd., as follows: 1935-39, engrg. dept., Montreal, 1939-41, elect. engr., asst. to mech. engr., engaged in elect. and mech. constrn. and mtce. in steel mill, Montreal; 1941-43, elect. engr., elect. and mech. constrn. and mtce. pulp mill, Canadian International Paper Co., Hawkesbury, Ont.; 1943-46, Lieut., R.C.E.M.E.; at present, elect. engr., elect. and mech. constrn. and mtce. and administration in pulp mill, Canadian International Paper Co., Hawkesbury, Ont. (Jr. 1937.)

References: C. V. Christie, J. C. Antliff, E. C. Kirkpatrick, P. E. Poitras, LeS. Brodie, S. Wang, H. J. Whiting, H. Anvik.

WALLIS—W. HERBERT C., 4278 Sherbrooke St. W., Montreal, Que. Born at Montreal, July 13, 1914. Educ.: B.Sc. (Civil), N.B., 1936; 1936-40, Donald Inspection Co., Ltd., test lab. work and local asphalt, concrete, reinforc. and structl. steel inspecn. sulphite inspecn. at Bromptonville, La Tuque, selling services, i/c of concrete placement and design of mixes for Douglas Hall, Yamaska River Bridge, C.N.R. Central Terminal, etc., etc.; 1940-41, Engr. (Staff Officer), Divn. No. 3, Training Command. H.Q. Mtl.; 1944-46, Test Pilot and Eng. Test Pilot, R.C.A.F.; at present, project engr., i/c of all Netherlands C47A-DC3 Conversions, also Intermediate Conversions for Linea Aeropostal Venezolana, Canadair, Cartierville, Que. (Jr. 1942.)

References: B. W. King, D. O. Stapleton, P. F. Sise, E. O. Turner, A. S. Dawes, J. R. Donald.

WARD—KENNETH ROY, 81 King St., Kingston, Ont. Born at Kingston, Ont., Nov. 1, 1918. Educ.: Graduate, R.M.C. (diploma in mech. engrg.), 1939; with R.C.E.M.E., as follows: 1939-41, General Workshop Practice, 1941, Instructor, Ordnance Mech. Engineers' Course, Kingston, 1941-42, Sr. Instructor, Armament School, 1942-43, Chief Instructor, 1943-44, Officer I/C R.C.O.C., Goose Bay, Labrador, 1944 to date, Major, Staff Officer in Directorate Mech. Engrg., N.D.H.Q., Kingston, Ont. (Jr. 1944.)

References: R. L. Franklin, E. Mayhew, K. H. McKibbin, N. C. Sherman, L. F. Grant, A. O. Monk, P. C. King, G. G. M. Carr-Harris.

FOR TRANSFER FROM STUDENT

SADLER—ROBERT F., 1245 St. Mark St., Montreal, Que. Born at Chatham, N.B., Aug. 13, 1915. Educ.: B.Sc. (Civil), N.B., 1936; 1936-39, instru'man., Dept. of Highways, N.B.; 1939-40, Sec. Troop and finally Battery Cmdr., 1 Cdn. Regt., R.C.A., 1 Cdn. Army; 1946 to date, asst. engr., Canadian National Railways, mtce. of way, St. Lawrence Divn. engrs., Montreal, Que. (St. 1935.)

References: E. O. Turner, G. Grant, W. J. Lawson, J. J. O'Sullivan, W. D. Kirk, A. F. Baird, D. Ross.

LIBRARY NOTES *(Continued from page 502)*

background of mathematics and general physics. Separate chapters are devoted to ferromagnetism, chemical and thermal RMF's, and the basic principles of electronics. Vol. I of the same series covers mechanics, heat and sound, while Vol. III deals with optics.

PULSED LINEAR NETWORKS:

By E. Frank, McGraw-Hill Book Co., New York and London, 1945. 267 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $3.00.

An introduction to electrical transients which puts particular emphasis upon the analysis and operation of linear networks across which rectangular voltage pulses are impressed. Mathematical analysis is confined entirely to differential equations, and the results are correlated closely with the physical phenomena they describe. Fundamentals of curcuit operation are stressed and explained in detail.

RADAR, What Radar is and How it Works

By O. E. Dunlap, Jr. Harper & Brothers, New York and London, 1946. 208 pp., illus., diagrs., 8¼ x 5¼ in., cloth, $2.50.

Written for the layman, this book traces the history of radar from the early reflected wave experiments of Hertz and Marconi, and presents a simple explanation of its basic features. The range and likely worth of various peacetime applications are considered, and a glossary and bibliography are appended.

RADIO AMATEUR'S HANDBOOK.

American Radio Relay League, West Hartford 7, Conn. 23rd ed., 1946. 468 pp., plus Catalog Section, 208 pp., illus., diagrs., charts, tables, 9½ x 6½ in., paper, $1.00 in U.S.A.; $1.50 abroad.

The first ten chapters of this comprehensive work constitute a textbook on principles, theory and design considerations. The second group of nine chapters presents examples of practical equipment with essential structural data and instructions for adjustment and use. This section has been considerably revised, particularly the chapters on very-high-frequency equipment. The final section contains the invaluable classified vacuum tube tables and other data, and a brief treatment of radio operating.

RAILROAD AVENUE, Great Stories and Legends of American Railroading:

By F. H. Hubbard. McGraw-Hill Book Co., Whittlesey House Division, New York and London, 1945. 374 pp., illus., maps, 9 x 6 in., cloth, $3.75.

The author of this new book on railroading and railroaders has collected his material with an eye for the entertaining. Among the stories and legends are authoritative versions of old favorites, as well as a variety of lesser-known and obscure items from the full history of the period. Songs and poems from and about railroad life are reproduced, and there is a vocabulary of "railroad lingo". The book is well illustrated by contemporary portraits, drawings and photographs.

RELAY ENGINEERING

By C. A. Packard. Struthers-Dunn, Philadelphia, Pa., 1945. 640 pp., illus., diagrs., charts, tables, 7 x 4½ in., fabrikoid, $3.00.

Following an introductory and historical opening chapter are some fifty pages devoted to definitions of terms and illustrations with code designations of some 100 magnetic structures manufactured by the Company issuing the manual. Succeeding chapters deal with description of relays and auxiliary equipment, applications and circuits, the selection of relays for specific tasks, installation and service work, and standards. A bibliography and an appendix of technical data are provided.

REPAIR-SHOP DIAGRAMS AND CONNECTING TABLES FOR LAP-WOUND INDUCTION MOTORS

By D. H. Braymer and A. C. Roe. 2 ed. McGraw-Hill Book Co., New York and London, 1946. 387 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $5.00.

This practical, step-by-step guide for repair man and armature winders covers the laying out of coils for induction motor windings, and the connecting of the end of the groups of these coils in proper sequence of phase and pole groups. The information is also useful for reconnecting to satisfy changes in voltage or changes for operation with different phases, frequencies, or speeds. Each diagram is a practical shop drawing marked for the actual use of the winder when making the connections indicated.

SHEET PILING, COFFERDAMS and CAISSONS.

D. H. Lee. Concrete Publications Ltd., London, 1945. 191 pp., illus. diagrs., charts, tables, 9¾ x 6½ in., cloth, 10s.

The first two chapters of this book on deep foundation work cover sheet piling and the earth pressures involved. The design and construction of cofferdams are given in Part III, with the next three Parts devoted to the theory and practical application of cylinders and both open and pneumatic caissons. A brief note on box caissons as breakwaters is included. Construction details are effectively diagrammed, and examples have been selected to emphasize reasons for choosing certain types or methods.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS:

Proceedings, Vol. 3, No. 1, edited by C. Lipson and W. H. Murray; published and distributed by Addison-Wesley Press, Kendall Square, Cambridge, Mass., 1945. 154 pp., illus., diagrs., charts, tables, 11¼ x 8½ in., cloth, $5.00.

Twelve articles are included in the current volume, dealing with strain gages, residual stresses, stress models, analysis of shafting and of rivet shear tests, stress analysis with brittle coatings, and stresses in aircraft components. The contents pages of the previous volumes are included at the back. The illustrations in all the volumes are a particularly good feature of the publication.

SURFACE ACTIVE AGENTS, Theoretical Aspects and Applications

By C. B. F. Young and K. W. Coons. Chemical Publishing Co., Brooklyn, N.Y., 1945. 381 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $6.00.

Part I deals with the theoretical aspects of surface tension, methods for the determination of surface tension, and the structure of wetting agents, inclusing a comprehensive 35-page list of wetting and other surface active agents. Part II presents useful information concerning the origin and effect of surface tension phenomena and their use in the following practical fields: emulsions, plating, cosmetics, leather, flotation, inks, textiles, cutting oils, foods, adhesives, lubrication, soldering, brazing and welding.

(Continued on page 508)

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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 ENGINEERS OR CHEMISTS, preferably bilingual, for various paper plants in Quebec. Salary from $200 according to experience. Apply to File No. 3555-V.

CHEMICAL ENGINEER required by an industrial organization with headquarters in Montreal as assistant to chief chemist and control supervisor in a pulp and paper plant. Initiative to deal with unexpected problems essential. Salary from $250 according to experience. Apply to File No. 3555-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, recent graduate up, required by a petroleum refining company in Montreal for process and design work. Salary about $200. Apply to File No. 3575-V.

CHEMICAL ENGINEER, recent graduate, required for sales work by a company in the Montreal area. Salary according to qualifications. Apply to File No. 3587-V.

CHEMICAL ENGINEERS, age 22-35, recent graduates up, are required by a Montreal firm for development work, maintenance, design and construction in explosives field. Sales and technical service representation to paper and textile industries. Salaries according to qualifications. Apply to File No. 3588-V.

CIVIL

CIVIL ENGINEER to be superintendent of construction with a contractor in Montreal. Salary according to qualifications. Apply to File No. 3558-V.

CIVIL ENGINEER, recent graduate up, to be assistant to town engineer of a town in the Montreal area. Permanent position. Salary from $175 up. Apply to File No. 3569-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 considerable building experience, as construction superintendent with a firm of building contractors in Central Ontario. Salary open. Apply to File No. 3582-V.

CIVIL ENGINEER required as town manager, preferably experienced, for a company town in Quebec. Must be bilingual. Accommodation is available. Salary about $350. Apply to File No. 3583-V.

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

CIVIL ENGINEER with 3 or more years' experience on design of industrial buildings, equipment, supports and foundation work, is required by a Montreal firm for structural design work in steel, timber and reinforced concrete. Salary $200 up. Apply to File No. 3588-V.

ELECTRICAL

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 required as superintendent for the power plant, distribution lines, etc., in Ontario town, age over 35. Salary open. Apply to File No. 3556-V.

ELECTRICAL ENGINEER with power plant experience, must be bilingual, to take complete charge of power plants and distribution system for a N.B. town. Salary according to experience. Apply to File No. 3561-V.

ELECTRICAL ENGINEER for a junior position in the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-V.

MECHANICAL

MECHANICAL ENGINEER with at least five years' industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary $275-$325. Apply to File No. 3553-V.

MECHANICAL ENGINEER with considerable experience in heating and ventilation, etc., required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3565-V.

MECHANICAL ENGINEERS with experience in heating and ventilating or the pulp and paper industry or with general mechanical layout and design work are required by a firm of consulting engineers in Montreal. Salary from $250-$350 according to experience. Apply to File No. 3568-V.

MECHANICAL ENGINEER, recent graduate, for junior position in the design department of a firm in Central Ontario making special heavy duty mobile equipment. Apply to File No. 3572-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 some electrical experience for the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-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 ENGINEERING DRAUGHTSMAN, fully experienced in kraft and sulphite mills processes and modern design, required by a pulp and paper firm on the West Coast. Salary open. Apply to File No. 3586-V.

METALLURGICAL

METALLURGIST, age 25-30, veteran, experience in Metallurgical Laboratory or Mine Assay office and Mining Mill practice decided advantage, required by a Montreal firm to be trained for Sales Representative. Salary depending on experience. Apply to File No. 3588-V.

MISCELLANEOUS

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.

CIVIL OR MECHANICAL ENGINEERS, preferably with pulp and paper experience, required for engineering and operating staff of a large Ontario corporation. Salary according to qualifications. Apply to File No. 3554-V.

CHEMICAL OR MECHANICAL ENGINEERS, age about 30, with at least five years' experience in the paper industry, required by an Ontario Company to train for executive positions. Salary open. Apply to File No. 3554-V.

STRUCTURAL ENGINEER with general building experience, aged 30 to 40 years, for estimating and design in office of general contractor, Vancouver. Permanent position for right man. Apply to File No. 3559-V.

CIVIL AND MECHANICAL ENGINEER, capable of detail work on compressor stations, piping layouts, surveying, etc., wanted by a gas producing and distributing utility in Southwestern Ontario. Preference to Service personnel. Good future for right man. Apply to File No. 3562-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.

CIVIL OR MECHANICAL ENGINEER with construction experience required by an Ontario firm manufacturing and installing building specialties for industrial plants. Salary open. Apply to File No. 3567-V.

SALES ENGINEER with experience to organize the sales and service or marine engines in the Prov. of Quebec. Must be bilingual. Headquarters Montreal. Salary $250 to start. Apply to File No. 3576-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.

ELECTRICAL OR MECHANICAL ENGINEERS, recent graduates, required for design work in the hydraulic side by a manufacturer in the Montreal area. Apply to File No. 3579-V.

MECHANICAL OR CIVIL ENGINEER, recent graduate, required by a power engineering Compnay. in the Montreal area. Salary according to qualifications. Apply to File No. 3587-V.

MECHANICAL AND ELECTRICAL DRAUGHTSMEN required by a Montreal firm. Must have working knowledge of equipment layout, architectural, piping and design. Salary from $200 up. Apply to File No. 3588-V.

MECHANICAL AND ELECTRICAL ENGINEERS, from recent graduates up, are required for mechanical and electrical maintenance, also design phases of project engineering work, by a Montreal firm. Salaries according to qualifications. Apply to File No. 3588-V.

GRADUATE ENGINEERS required as Development Engineer and Assistant to Sales Manager by a Montreal firm. Industrial, also sales and administrative experience necessary. Salary $200 up according to experience. Apply to File No. 3588-V.

INDUSTRIAL ENGINEER, 5 years' experience industrial manufacturing or process work, required by a Montreal firm for study and co-ordination of plant work. Salary $295 up according to qualifications. Apply to File No. 3588-V.

CHIEF DRAUGHTSMAN, under 35, 5-12 years' experience in drawing office, including year or more as squad boss, required by a Montreal firm. Salary $225 up. Apply to File No. 3588-V.

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

CHEMICAL

CHEMICAL ENGINEER with some pulp and paper experience required for the technical department of a paper mill in Lake St. John area. Apply to File No. 3470-V.

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. Salary open. Apply to File No. 3549-V.

CIVIL

TWO CIVIL ENGINEERS are required to act as senior and junior structural designer respectively with a steel company in southern Ontario. Salary open. Apply to Box No. 3389-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to Box No. 3394-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in the Montreal area. Apply to File No. 3446-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 with executive experience for position of Town Manager in progressive New Brunswick town. Good salary to right man. Apply in writing giving full details qualifications and experience. Apply to File No. 3481-V.

CIVIL ENGINEER DRAUGHTSMAN, age 25-35, for consulting engineer's office near Toronto. Applicant should have some knowledge of municipal sewerage and waterworks problems. Apply to File No. 3489-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 ENGINEER with considerable experience is required by a Montreal firm for work in construction of radio stations. Salary from $225. Apply File No. 3506-V.

CIVIL ENGINEER, recent graduate, required by a firm of consulting engineers in Montreal, to assist Engineer in charge of field work in Ont. Salary $175 up. Apply File No. 3518-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 with experience as structural designers and draughtsmen are required by an engineering firm in Montreal. Salary from $300—$400 according to experience. Apply File No. 3520-V.

CIVIL ENGINEER to take charge of project engineering required by a firm of industrial engineers in Quebec. Should be bilingual and have experience in heavy construction. Salary according to capacity. Apply File No. 3531-V

CIVIL ENGINEER with road construction experience required as assistant to county engineer in Central Ontario. Salary $4000 plus travelling expenses. Apply File No. 3533-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 Box No. 3415-V.

ELECTRICAL ENGINEERS, age 30 to 40. 5 to 10 years experience, for estimating design and general engineering for large public utility in Toronto area. Apply to File No. 3429-V.

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

ELECTRICAL ENGINEERS, preferably experienced for sales and service of motors, transformers, control equipment, etc., with an industrial firm in Montreal. Salary according to qualifications and ability. Apply File No. 3512-V.

ELECTRICAL DRAUGHTSMAN with considerable experience in industrial light, heat and power layouts is required by a consulting engineer in Montreal. Salary from $200 according to experience. Apply File No. 3528-V.

MECHANICAL

MECHANICAL ENGINEER, graduate with 4 or 5 years' experience in heating and ventilating layouts is wanted by a consulting engineer in Montreal. Apply File No. 3243-V.

MECHANICAL DRAUGHTSMAN is required in Montreal by a firm engaged in the manufacture of conveyors, crushers, elevators, etc. Applicants should be 25-40. Salary according to experience. Apply File No. 3276-V.

GRADUATE MECHANICAL OR AERONAUTICAL ENGINEER with at least five years experience in aircraft, preferably in mfg., must have a fair knowledge of mechanical a/c installation and be familiar with heat and ventilating installations, controls, de-icing, hydraulics and landing gear. Apply to File No. 3300-V.

MECHANICAL ENGINEERS, preferably ex-service men, graduates, with some knowledge of steam, piping layouts, design are required by a firm in the Niagara peninsula. Salary open. Apply to Box No. 3380-V.

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 Box No. 3393-V.

JUNIOR MECHANICAL ENGINEER with some experience on mechanical design. Preference to ex-service men. Salary from $200 to $250. Location Quebec City. Apply to File No. 3401-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-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, age 35 to 45, preferably married, with good background of shop training and experience in the manufacture of farm machinery. Salary from $350 according to qualifications. Apply to File No. 3463-V.

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 considerable experience in plumbing, heating, ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

MECHANICAL ENGINEER, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEER, recent graduate, for mechanical draughting work in paper mill in the Lake St. John area. Salary open. Apply to File No. 3478-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

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

MECHANICAL ENGINEER with considerable industrial experience is required for the staff of a firm of consulting engineers in Montreal. Salary about $250. Apply File No. 3525-V.

MECHANICAL ENGINEER, to assume charge of factory maintenance staff and help design new machines and develop new ideas in conjunction with research and methods departments, wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from $250. Apply File No. 3538-V.

MECHANICAL DRAUGHTSMAN with over five years experience in piping layout and similar work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

MECHANICAL ENGINEER with at least five years industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary $275-$325. Apply File No. 3553-V.

MECHANICAL ENGINEER, recent graduate, for the engineering staff of a pulp manufacturer in Eastern Quebec. Apply to File No. 3547-V.

MECHANICAL ENGINEERS 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.

MISCELLANEOUS

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in Western Ontario. Salary would be $300 to $350. Apply to File No. 3227-V.

ENGINEER SALESMAN, fluently bilingual, not necessarily a graduate but with some good experience on truck mechanical work and some sales background, age 35-40, is required by an automobile manufacturer for work in the Montreal area. Preference will be given to ex-service men and R.C.E.M.E. and workshop experience would be useful. Salary $250 to $350. Apply to File No. 3266-V.

ENGINEERING ACCOUNTANT, young graduate age 25-35, with engineering background and taste for accounting, is required to act as assistant to the secretary treasurer of a manufacturing concern in Montreal. Apply to File No. 3272-V.

SALES ENGINEER of proven ability is required by a Canadian manufacturer of high grade power apparatus specialties in demand by power companies, public utilities and manufacturers. Age 30 to 35 years. Apply in writing and state in detail education, experience, age, required salary and enclose photograph to Box No. 3303-V.

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual, with some practical experience, is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

INSTRUMENTS ENGINEER with five years experience in aircraft construction and installation design, of which at least 2 years should have been specialized as above, is required to act as design group leader for a company in the Montreal area. Apply to File No. 3316-V.

TECHNICAL SALES ENGINEERS are required by an oil company in the Montreal area. Candidates must be bilingual and experience may range from recent graduate up. Salary will be $150-$250 depending on qualifications. Apply to File No. 3320-V.

TWO DRAUGHTSMEN with a minimum of three years draughting experience, are required by a company in Montreal. One must have mechanical experience to specialize in refrigeration design, the other structural or architectural experience to specialize in design layout of food service equipment. Apply to Box No. 3328-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

CHIEF DRAUGHTSMAN to take charge ofengineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

QUALIFIED DRAUGHTSMAN, thoroughly capable in design and layout of industrial piping, steam, water, air etc. Salary open. Apply to File No. 3435-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. No. 3443-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.

GENERAL PLANT SUPERINTENDENT, or manager in complete charge, to organize and operate a shipbuilding plant in the Maritimes, with knowledge of both hulls and engines, mainly for repairs and revisions. Salary from $5,000. Apply to File No. 3454-V.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

FORESTRY ENGINEER graduate, 25 to 35 years, required by a large paper company in the Prov. of Quebec. Good opportunity for advancement. Salary open. Apply to File No. 3462-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-V.

INDUSTRIAL MINERALOGIST, with Ph. D. or M.Sc. in geology, mineralogy, chemistry or metallurgy and knowledge of commercial processing of industrial metals, laboratory investigations and publishing of results. Must have at least five years experience with special reference to industrial minerals. Starting salary from $275 in prov. mines dept. Apply to File No. 3492-V.

GEOLOGISTS, with Ph. D. in economic or mining geology and intimate knowledge of structural geology, diamond drilling and geophysical methods. Must have at least five years practical experience, ability to publish results of original investigations and use of aerial photographs. Starting salary from $275. in Prov. Mines Dept. Apply to File No. 3492-V.

MECHANICAL OR CIVIL ENGINEERS required as assistant engineer in Meat Packing firm with plants throughout Canada. Duties to consist of general industrial maintenance work, including building construction, steam, refrigeration and electrical installations. Positions available in Western Canada at salary of $195 to $240 depending on experience. Apply to File No. 3495-V.

MECHANICAL OR ELECTRICAL ENGINEER with at least three years experience in paper mill or steam plant operation, bilingual if possible, is required by an industrial firm near Montreal. Salary from $200 according to experience. Apply to File No. 3498-V.

CHEMICAL OR MECHANICAL ENGINEER with construction experience in the chemical field, a knowledge of hydrocarbons and at least five years experience since graduation is required by a chemical firm in Western Ontario. Salary from $250. Apply to File No. 3502-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-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.

GRADUATE ENGINEERS with experience in mechanical and chemical process layouts are required by an engineering firm in Montreal. Salary from $300-400 according to experience. Apply to File No. 3520-V.

COMBUSTION ENGINEER for sales and service with a coal distributing firm with headquarters in Montreal. Salary open. Apply to File No. 3522-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 qualificatons. Apply to File No. 3524-V.

INDUSTRIAL ENGINEER, bilingual, with considerable experience, is required by a firm of industrial engineers in Quebec. Salary according to capacity. Apply to File No. 3531-V.

SENIOR DRAUGHTSMAN is required immediately by a Calgary and Turner Valley Oil Company. Work will be mainly geological draughting. Single man preferred. Salary dependent upon qualifications. Apply to File No. 3536-V.

CHEMIST OR RESEARCH ENGINEER, to take charge of Control Development and Research staff. Must have supervisory ability and be able to show results. Wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from $200. Apply to File No. 3538-V.

DESIGN ENGINEER with several years experience in hydro-electric work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

JUNIOR ENGINEER OR DRAUGHTSMAN, preferably with experience in the design of heating and ventilating layouts, required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3545-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.

DIRECTOR

OF ENGINEERING

WANTED

BY LARGE U.S. COMPANY

Experienced executive of proved ability, aged 35 to 50, to take full responsibility for supervision of Engineering Department in a large American company operating in Canada as well as the U.S.

The man required will assume responsibility for design and development of plant additions, installation and repair of mechanical equipment, power contracts, equipment specifications, and technical advice to management. Excellent salary and other financial advantages.

We are interested in a thoroughly qualified man seeking a permanent and satisfactory position which offers unusual opportunity for advancement. He should be prepared to reside in the U.S.

Write for early personal interview, giving full details concerning experience, references, salary requirements, and enclose photograph. Replies will be treated in strict confidence. No contacts will be made with your present employer. Apply to File No. 3563-V.

THE PUBLIC SERVICE OF CANADA REQUIRES FOR THE
POST OFFICE DEPARTMENT

Two MECHANICAL ENGINEERS $4,200-$4,800 and $3,000-$3,600

One to design postal processes and layouts for new and proposed Post Office buildings and extensions to existing buildings at Ottawa, and the other to be responsible for the construction and maintenance of mechanical equipment in the Toronto Post Office.

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

WANTED

Twelve Graduate Engineers

Chemical or Mechanical

age 30, at least five years' experience in Paper Industry, to qualify as production engineers and junior executives, salary attractive, commensurate with experience and qualifications. Write for appointment stating experience and salary expected, to File No. 3554-V.

Situations Wanted

CIVIL & MINING ENGINEER M.E.I.C., R.P.E., age 45, married, seeks permanent position with large industrial concern as Maintenance and Construction or Townsite Engineer. Experienced on heavy construction, dams, shafts and tunnels, wharves, buildings, sewers, services, townsite development, general maintenance and administration. Apply to File No. 901-W.

PLANT ENGINEER, M.E.I.C., seeks position with industrial concern, preferably textile. Wide experience in charge of plant layout, all branches, design, selection and purchase of equipment, construction and maintenance. Apply to File No. 1662-W.

MANUFACTURING EXECUTIVE, mechanical engineering graduate with twenty years experience in manufacturing, engineering, production control, purchasing, storekeeping, incentive systems, budgets, cost and general accounting is now available. Apply to File No. 1871-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C. Practical experience includes eight years in tool engineering, production engineering and works planning and nine years in plant layout, general machine design and development work of patented mechanical projects. Successful record in responsible and executive positions. Good organizer. Desires either suitable position, or development work based on own patents, with large mechanical manufacutring concern or well-established firm of consulting engineers. Apply to File No. 2502-W.

MECHANICAL ENGINEER, Jr. E.I.C., age 23, single, with degree from N.S. Tech. '44, 18 months' experience as engineer officer afloat in the Royal Canadian Navy. Experience included the administration and control of the entire propelling and other machinery, and the discipline of 30 men in that department. Would prefer work of a responsible nature in a small firm doing manufacturing or installations. Have just been released from the Navy and am available for immediate employment in Canada or elsewhere depending on living conditions. Apply to Box No. 2587-W.

MECHANICAL ENGINEER, M.E.I.C. graduated N.S.T.C. 1940 age 30 years, married. Three years' experience in aircraft inspection, two years in R.C.A.F. as pilot. One year draughting, six months of which in pulp and paper. Desirous of getting more experience in pulp and paper industry. Apply to File No. 2617-W.

LECTRICAL ENGINEER, S.E.I.C., age 27, married, class of 1946, formerly a "Flight Engineer" in R.C.A.F., has approximately one and a half years' experience in mine and smelter electrical work. Position desired more along Mechanical line than Electrical. Will go anywhere, anytime. Apply to File No. 2631-W.

GRADUATE CHEMICAL ENGINEER, McGill 1946, available immediately. Plant or sales work, single, healthy and ambitious, will travel anywhere. Apply to File No. 2661-W.

GRADUATE MECHANICAL ENGINEER, (Sask. '45) age 24, married, Jr. member of The Society of Naval Architects and Marine Engineers. Experience with moulded plywood, one year general mechanical engineering in processing plant. Good knowledge of yacht design. Require position with a firm connected with the boating industry, plywood, engines, hardware, plastics, etc. Prefer Vancouver location, available August 1st. Apply to File No. 2662-W.

ENGINEER now employed seeks better position; thoroughly bilingual; had many years experience teaching chemistry, mineralogy and geology and demonstrating in connected laboratories. Acted as mining engineer in mineralogy laboratory, writing reports on samples examined and conducting prospectors' classes; also had municipal engineering experience. Age 49; seeks position as executive, town manager, construction superintendent, sales engineer. Veteran of both wars. Apply to File No. 2663-W.

CHEMICAL ENGINEER, S.E.I.C., B.A., B.A.Sc. '44, M. Eng. (McGill), age 26, single, two years experience, desires employment in Research or production control. Prefer Quebec and particularly Montreal area. Highest references from former employers. Apply to File No. 2671-W.

ENGINEER, Prof. Eng. (Civil), M.E.I.C., thoroughly experienced in structural and mechanical design, estimating and sales work, will undertake worthwhile agency or representation for manufacturer in B.C. Apply to File No. 2687-W.

CHEMICAL ENGINEER, single, age 23, B.E., McGill '46, S.E.I.C. No significant industrial experience. Interested in a position in sales engineering, production or plant control. Services available immediately. Apply to File No. 2688-W.

GRADUATE MECHANICAL ENGINEER, (McGill '45) age 22, single, seeks employment with a Canadian, American or British firm operating in South America. Growing knowledge of Spanish. Experience in construction and aircraft industries, as well as in Royal Canadian Electrical and Mechanical Engineers. Available on one month's notice. Apply to File No. 2690-W.

AIRLINE ENGINEER with degree in Mechanical Engineering (McGill). Eight years' experience with major Canadian and foreign airlines. Has been concerned with practically all technical phases of a major airline operation, including engineering, maintenance, operations, statistics, operating costs, flight testing and training of flight personnel. Administrative experience, 500 hours' experience as flight crew on Trans-Atlantic operation. Age 33. Married, one dependent. Interested in responsible position with major airline or organization concerned with air transportation in general. Apply to File No. 2691-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. Interested in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

ELECTRICAL ENGINEER, B.Sc., M.E.I.C., age 33, single, with experience in sales, purchasing, office management and production control. Very good connections with industrial plants in Ontario and Quebec. Available after July 20th. Location preference: Toronto, Montreal and Hamilton. Apply to File No. 2694-W.

SENIOR CIVIL ENGINEER, M.E.I.C., P.E.Q., with considerable experience in all building construction and specialization in reinforced concrete; seeks first class opening. Able to supervise work and qualified to take full charge of and execute contracts. Apply to File No. 2695-W.

ELECTRICAL ENGINEER, Queen's 1946, S.E.I.C., R.P.E., Ont., S.I. Radio E, veteran of R.C.N.V.R., age 24, completely bilingual, available immediately, will go anywhere. Apply to File No. 2696-W.

MECHANICAL ENGINEER, Toronto '42, Jr. E.I.C., P. Eng., age 30. Four years' experience in tool repair, machine design, estimating, instructor in tool inspection, supervisor of production inspection, charge of engineering department handling design, draughting, purchasing and testing for modern manufacturing plant. Desires position as production engineer with firm of consulting engineers or as assistant production manager in progressive industry. Prefer Hamilton or Toronto. Apply to File No. 2711-W.

MECHANICAL ENGINEER, S.E.I.C., B.Sc., Queen's 1945, age 24, married, veteran, one year experience in design of heavy machinery and draughting, course in Time and Motion Study at McGill. Interested in Industrial, Production or Maintenance Engineering. Prefer Montreal area or Ontario. Available on one-month notice. Apply to File No. 2715-W.

CHEMICAL ENGINEER, S.E.I.C., B.Eng., McGill '46. Age 24, single, bilingual. Practical experience during summers. Desires employment in pulp and paper industry. Available Sept. 1st. Will travel anywhere. Apply to File No. 2717-W.

LIBRARY NOTES

(*Continued from page 504*)

TECHNOLOGY OF PLASTICS AND RESINS:

By J. P. Mason and J. F. Manning. D. Van Nostrand Co., New York, 1945. 493 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.50.

The first section of this comprehensive work discusses the resinous and plastic states, the types and mechanisms of polymerization, and the relationship between various physical properties and the structure of plastics and resins. In the second section, the methods of preparation and the properties and uses of the more important resins and plastics are discussed, including two natural products, rubber and cellulose. The third section describes fabrication techniques: compounding and mold designs, molding, casting, laminating and coating procedures.

WAVEFORM ANALYSIS, a Guide to the Interpretation of Periodic Waves, including Vibration Records:

By R. C. Manley. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 275 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.00.

Although this book is in the nature of a guide rather than a comprehensive treatise, it includes sufficient basic theory and methods of analysis for the student to acquire a groundwork of knowledge concerning the properties of complex waveforms. The envelope method of analysis is presented in detail, with subsequent discussion of other methods. Certain useful mathematical and technical data are given in appendices, and a brief glossary is included.

VAPOR ADSORPTION; Industrial Applications and Competing Processes:

By E. Ledoux, with foreword by D. F. Othmer. Chemical Publishing Co., Brooklyn, N.Y., 1945. 360 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $8.50.

This story of adsorption, the concentration or retention of molecules on surfaces, is divided into four parts. In part I the theories and calculations of static adsorption are discussed. Part II examines the thermal changes which occur when a vapor is added to air, particularly to the saturation point. Part III covers dynamic adsorption, with a current of air, for example, acting as a carrier for the vapor. The industrial applications of adsorption described in Part IV deal mainly with various aspects of air conditioning and drying processes, and with solvent recovery.

TELEVISION SIMPLIFIED:

By M. S. Kiver. D. Van Nostrand Co., New York, 1946. 375 pp., illus., diagrs., charts, 8¼ in. x 5½ in., cloth, $4.75.

A complete, practical description of modern television is presented in step-by-step fashion without involved theory or mathematics. The author proceeds from the analysis of circuits and the operating fundamentals of frequency modulation to the repairing of television sets and the explanation of an actual trouble-shooting system. The book is intended for radio workers, owners and service men and all who are interested in television and its opportunities.

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COVER PICTURE

The cover picture shows the cenotaph conceived, designed and built at Chilliwack, B.C., by Canadian sappers in memory of all sappers of the Empire. See description, page 541.

PROPOSED RAPID TRANSIT SYSTEM FOR TORONTO

W. E. P. DUNCAN, M.E.I.C.
Chief Engineer, Toronto Transportation Commission

In January 1942, the Toronto Transportation Commission submitted to the mayor and Board of Control a proposal for the construction of a rapid transit system in Toronto as a partial solution to Toronto's growing traffic problem.

Development of Toronto

The latest authentic figures for the population of metropolitan Toronto show a population in 1943 of 925,000. The City of Toronto itself contains about three-quarters of this metropolitan population and occupies an area of 35 sq. mi.

It is not, however, the population of a city that governs the need for rapid transit service, but the location and character of its streets, and the concentration and congestion of its traffic and business activities. Present day traffic congestion has developed from the pouring into narrow streets, designed for horse-drawn traffic, the ever growing volume of passenger and commercial motor vehicles.

Except for the widening and extension of University Avenue, there has been no major improvement in the central downtown district for three decades. The increase in volume of traffic during this same period has been spectacular, and downtown traffic movements have increased almost five times. Traffic congestion on the arteries in and near the downtown district have reached such proportions as to throttle circulation in the rush-hour period.

The present rush-hour speed on Yonge Street, which is the principal north and south artery, averages about six miles per hour in the downtown section. The continuous traffic congestion on this street precludes satisfactory speeds or orderly movement for either street cars or motor cars, and each type of vehicle impedes the movement of the other.

The difficulty of handling traffic in Toronto may be illustrated by the fact that north of St. Clair Avenue there is a community of over 80,000 people who are served by only one continuous north and south street.

The Toronto Transportation Commission's proposal drew attention to the ever increasing difficulty of maintaining regularity of service and reasonable speed for transit vehicles operating through narrow streets congested with automotive traffic. It advocated separation of street car and automobile traffic on two major routes by the construction of:

(a) One north and south subway in the vicinity of Yonge Street, extending from Front St. to St. Clair Avenue.

(b) One east and west subway in the vicinity of Queen Street, extending from Trinity Park in the west to just east of Broadview Avenue in the east.

Concurrently with the investigation of the Toronto Transportation Commission on rapid transit, the Toronto City Planning Board was investigating the overall traffic problem of the metropolitan area. It concurred in the desirability of the construction of the proposed subway system.

The City Planning Board visualized, in addition to the rapid transit subways, a system of depressed limited expressways for motor traffic, and the provision of a centre mall or dividing strip between dual pavements in which to locate local transit tracks. The plan of the initial system of rapid transit subways provided for further extension of service from the subways to and along these expressways (see Fig. 1).

In 1943 the Commission created a Rapid Transit Department and retained Mr. Norman D. Wilson and DeLeuw, Cather and Company as consulting engineers, to make detailed investigations and to develop final plans for the construction of a rapid transit subway system.

The actual planning and designing is being carried out by the Commission's own staff of engineers.

The original proposals had been predicated on the operation of surface type street cars through subways which would, however, be designed to accommodate larger rapid transit cars as a later development.

Estimates of probable traffic in the Yonge Street and Queen Street subways were made, based on anticipated post-war conditions, prospective increases in population in the areas served, changes in traffic demands due to transfers from parallel routes, and traffic induced by the more rapid and more convenient service afforded by off-street operation. These estimates indicated a total one-way movement during the maximum periods of about 15,000 passengers per hour on the Yonge Street subway and from 8.000 to 9,000 passengers per hour on the Queen Street subway.

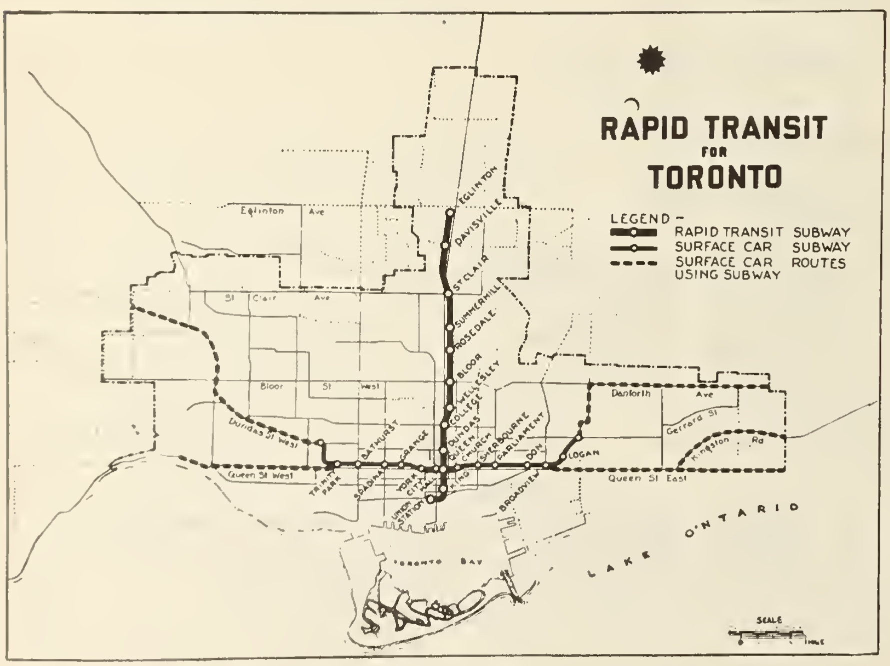


Fig. 1

Yonge Street Subway

It was evident that speeds in the Yonge Street subway, if operated by street cars, would provide but limited improvement in running time over the present surface street cars. It was further evident that the comfortable capacity of the subway with surface car operation would be taxed from the first day of its operation. It was decided therefore to consider the relative advantages of building the Yonge Street subway for immediate rapid transit operation. These studies showed:

1st That the Yonge Street subway could economically be extended north from St. Clair Avenue to a terminal at Eglinton Avenue.

2nd That the capacity for the subway,

by using modern rapid transit trains, would be three times the capacity of street car operation.

3rd That cars could be much wider than surface cars, providing more comfortable seating and a greater capacity. In addition, they could be constructed without steps and with a uniform clearance from the platform at all points of the car, thus minimizing accident hazards.

4th High level platforms could be located closer to the street surface, increasing the convenience to passengers and the loading and unloading of the cars with maximum speed because the platform and car floors would be at the same level.

5th Subways could be operated by trains of rapid transit cars, permitting minimum station stops, greater spacing of trains and higher speeds.

6th Service would be wholly free from street traffic delays and inclement weather conditions to which surface cars are subject.

In a joint report submitted by Mr. Wilson and DeLeuw, Cather & Company on April 1st 1944, the construction of a subway to provide full rapid transit operation on Yonge Street between Union Station on Front Street and Eglinton Avenue was recommended, and the Commission, after full consideration of all the factors, authorized development of plans for this subway, based on the provision of third rail rapid transit train operation.

The final route for this subway as now determined, is shown on Fig. 2, and is as follows:

> From Union Station in subway under Front Street and under Yonge Street to Carlton Street; then swinging eastward on to a private right-of-way about 150 ft. east of Yonge Street and continuing northward in subway to a point north of Davenport Road; then emerging to open-cut on private right-of-way through Rosedale; thence in subway under the C.P.R. at North Toronto Station; in open-cut to St. Clair Avenue; in subway from St. Clair Avenue to Heath Street, swinging across under Yonge Street to the west side, emerging in open-cut north of the old Belt Line Railway and continuing on the west side of Yonge Street to Berwick Avenue, with an underground terminal between Berwick Avenue and Eglinton Avenue.

In general the subway structure will be kept as close to the surface as possible, consistent with the provision of necessary coverage for water pipes and other utility services below the street level.

The total length of the Yonge Street subway is 4.56 miles, of which 3.20 miles will be in subway construction and 1.36 miles in open-cut.

The investments required by this rapid transit plan for structures and rights-of-way are estimated as follows:

Rapid transit structures.......	$19,835,000
Off-street rights-of-way.......	4,210,000
Fixed subway equipment......	4,805,000
Total...............	$28,850,000

This does not include the cost of the rapid transit cars, which will be approximately $5,000,000 additional, but which will replace an equivalent number of obsolete street cars.

SOILS

The soils to be encountered in Toronto are favourable to subway construction. The excavation generally will be through topsoil, sandy clay, tough blue clay, and sand and gravel. The Dundas shale, which underlies most of the city, is found approximately 25 to 30 ft. below the street surface along Front Street, and in this section the subway structure would be founded on this shale. Elsewhere the foundations will be in sand, sandy clay, or stiff blue clay. A series of test borings to a grade below the level of subway structures have been carried out and tests in undisturbed samples of subsoil have shown their satisfactory character. Investigations of existing records of building excavations along the line of the route have confirmed these findings.

Perforated steel pipes were installed at most of the test holes and observations are being made continually to determine ground water levels throughout the area.

METHOD OF CONSTRUCTION

The method of construction proposed is by cut and cover on the subway sections, and by open-cut on the remainder. It is proposed on the subway sections to drive heavy rolled steel sections along both sides of the line of excavation and install wood lagging to support lateral soil pressure. Steel beams will then be installed to span the subway excavation and on these there will be constructed a temporary wooden street surface to carry all normal traffic. Construction work will then proceed under this temporary street surface.

All utility pipes, cables, etc., will be suspended from the temporary steel structure during the construction period, except gas mains which will be removed from the excavation to the surface and relaid along the side of the street.

The support of buildings along the route of the subway will be included in the general contract which provides for the concrete structure only.

Subsequent contracts will include installation of mechanical equipment, electrical equipment, station finish, track and signal equipment, etc.

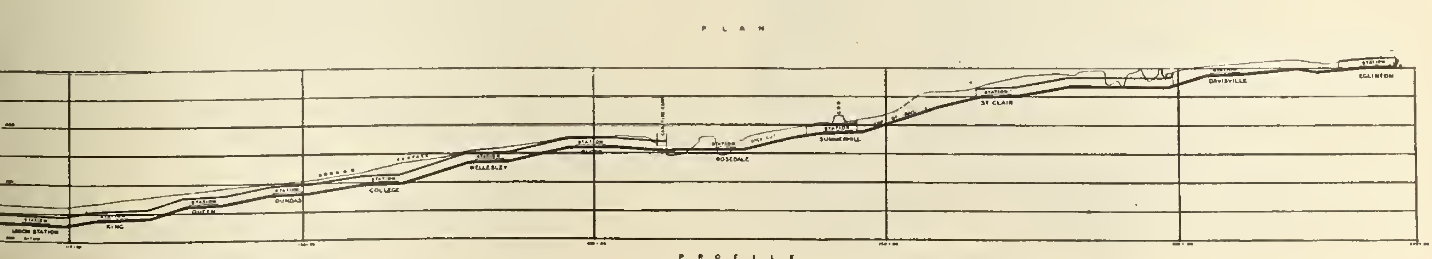


Fig. 2

PROTECTION AND RESTORATION OF UTILITY SERVICES

One of the major problems of subway construction is the maintenance of the tangled skein of utility pipes, conduits, tubes, cables, splicing chambers and man holes which lie beneath the surface of a modern street. Plans must include rigid provision for the protection, diversion or maintenance of these services during the construction period, and their relocation and restoration before completion of the job. Work in this connection has been facilitated in Toronto by the existence of a Public Utility Co-Ordinating Committee, consisting of representatives of the City Works Department, the Toronto Hydro-Electric System, the Toronto Transportation Commission, Consumers' Gas Company, Bell Telephone Company, C.P.R. Telegraph, and C.N.R. Telegraph, and other interested utilities. This committee has very complete records of all existing sub-surface utilities and acts as a clearing house for all changes or new installations. Their records have been invaluable to the subway designers.

ALIGNMENT AND GRADIENTS

In general the alignment has been laid out with long tangents and easy curves. The only curve of significant magnitude is the curve between Front Street and Yonge Street, which has a radius of 400 ft. The maximum gradient —for short distances only, south of St. Clair Avenue and south of Davisville Avenue—is 3.5 per cent.

If the alignment had been continued in subway under Yonge Street, the gradients would have been much more severe or the subway would have been much deeper at intermediate stations with consequent inconvenience and delay to passengers. The increased cost of such an alignment would have been in the neighbourhood of $6,000,000.

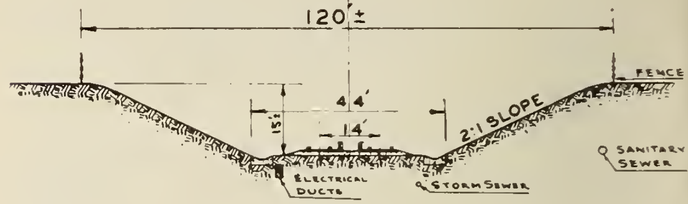
DESIGN OF STRUCTURE

For the covered subway structure a two track box section as shown in Fig. 3 has been adopted. Throughout the length of the subway structure, a constant width and ceiling thickness have been maintained for economy in formwork. The typical subway section between stations has an overall width of 32 ft. 6 in., an overall depth of 18 ft. 8 in., and inside width of 13 ft. 6 in. for each track, and a clearance over top of rail of 13 ft.

At typical station sections, as shown in Fig. 3, the subway structure is 52 ft. 4 in. wide, 19 ft. 3½ in. high, and has a transverse span of 25 ft. 5 in. between columns.

Where the depth of the subway permits, a mezzanine floor will be installed at the subway stations between the top of the subway structure and the street level. The minimum cover over the subway structure is 7 ft.

The open-cut sections (see Fig. 4) are designed with two to one slopes and a typical section will be 44 ft. wide between the bottom of the slopes. To carry cross streets over the open-cut, a fixed frame steel bridge was designed, the typical span being 48 ft. 11 in. and the minimum vertical clearance above the top of rail 13 ft.



YONGE STREET SUBWAY
TYPICAL CROSS SECTION IN OPEN CUT

Fig. 4

STATION DESIGN

Stations will be located at all main intersections, and there will be twelve stations on the Yonge Street subway. There will be mezzanine floors above the structure at Union Station, King Street, Albert and College Streets (see Fig. 5). The Dundas Station located at a high level has been designed with side platform control.

The Queen Street Station will be located at the intersection of the Yonge Street and Queen Street subways, the Queen subway passing underneath the Yonge subway at this point.

Plans for all the mezzanine stations include escalators as well as stairs for the convenience of passenger movement, and escalators will also be provided for passengers transferring between the Yonge Street subway and the Queen Street subway.

North of College Street, the subway will be on private right-of-way at high level, and stations will be located over the subway with entrances and passenger control doors at sidewalk level.

Station platforms will be 500 ft. long to provide for ultimate operation of trains of ten 45-ft. cars. Platforms at all stations except terminals will be located at the side of the stations and will be 12 ft. wide. Station platforms will be established on 0.3 per cent grades to provide drainage.

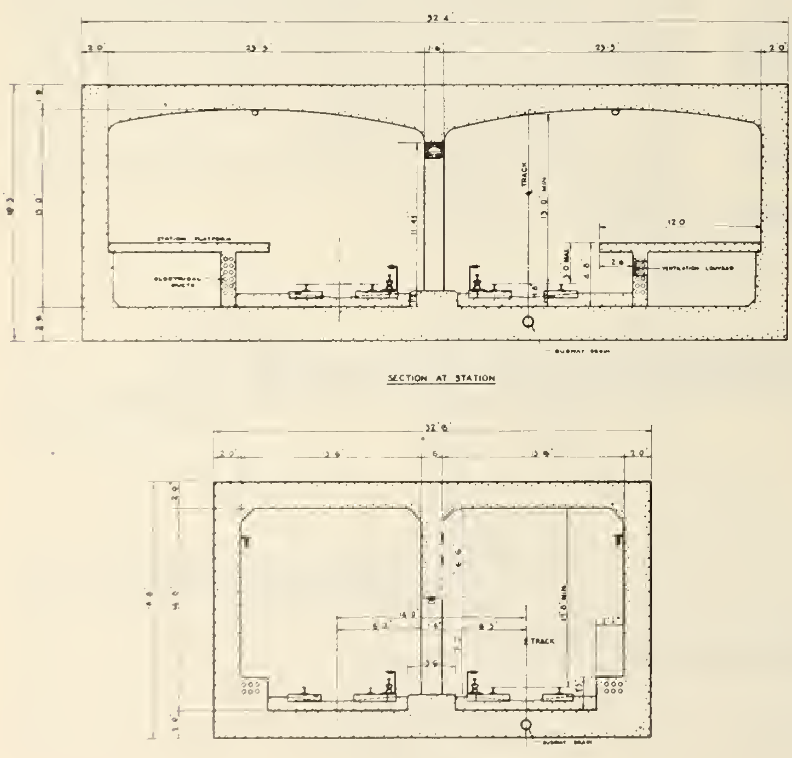


Fig. 3

VENTILATION

The ventilation system will be designed to provide sufficient air movement to dissipate the heat generated by train motors and also to provide ample fresh air. The movement of air is normally obtained from the piston action of each train movement through the tunnel. The pressure built up in front of a moving train forces air through vent shafts located at the point of transition from the tunnel to the station section. The vacuum created behind each moving train moves cool fresh air into the subway through these vent shafts located at both ends of each station and leading to gratings in the sidewalk.

DRAINAGE

Paved gutters will be provided to collect the run-off from the side slopes of the open-cut.

An intercepting sewer is planned along the easterly side of the right-of-way to collect the

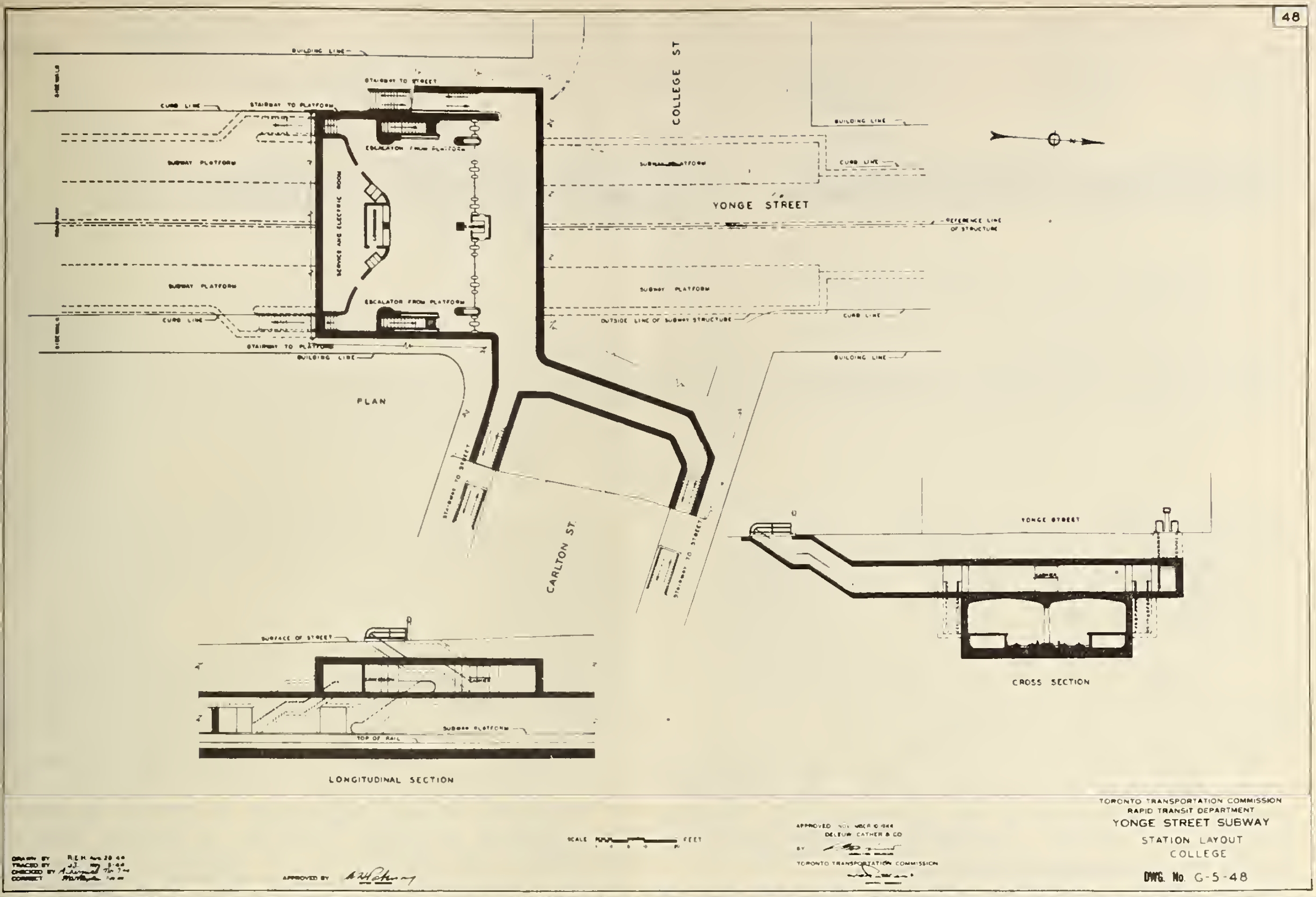


Fig. 5—College Station. Subway grades are established at the highest possible levels. Steep slopes on the streets, however, permit the construction of mezzanine stations to serve both platforms at Union Station, Albert, College and King Stations. The layout of College Station is somewhat typical of all four. Escalators are provided for upward movements of passengers from subway platforms to the mezzanine level. High level passageways connect the mezzanine to sidewalk entrances or to adjacent buildings as may be determined by local requirements.

effluent from the numerous east and west combined sanitary and storm sewers now discharging into a main sewer on Yonge Street.

ELECTRICAL EQUIPMENT

The power for operation of the train will be 600 volt D.C. and will be supplied from four modern automatic ignitron rectifier substations located at intervals of one and one-quarter miles along the route.

Power will be fed to the train by a positive contact rail about 20 in. outside and 6 in. above the running rails, and protected by an insulator guard.

The return circuit will be supplied by one of the running rails of the track.

Any additional power for operation of pumps, fans, escalators, lights, etc., will be 120 to 208 volts alternating current.

The 120 volts supplied by batteries will be installed at each station to supply power automatically to emergency light circuits during power interruptions.

A supervisory control system will be installed so that a dispatcher from a centrally located office will control all traction power and emergency fans, etc.

BLOCK SIGNALS

Trains operating in the subway will be protected by an automatic block signal system of the colour-light type. Obedience to the signal indications will be enforced by an automatic train-stop mechanism associated with each signal.

Interlocking equipment will be provided at train terminals and yard entrances.

OPERATION

The Yonge Street subway operation will be by the most modern subway equipment and the design of the car equipment is now being undertaken by the Commission's own engineers in conjunction with the manufacturers. It is hoped to develop a subway car which will have the same operating characteristics and passenger comfort as the new P.C.C. type of street cars.

Queen Street Route

On completion of the Yonge Street subway, it is proposed, as a second step, to construct a subway from east to west under or near Queen Street, as shown in Fig. 6. The plan contemplates subway construction under the street in the central section of the city with open-cut sections on private right-of-way to the east and west. The line will extend from Trinity Park in the west to Carlaw Avenue and Gerrard Street in the east, crossing the Don on a high level bridge.

Initially this route will be operated by surface street cars which will extend east, north-east, west and north-west beyond its portals.

Eventually, when traffic justifies, rapid transit equipment will be used in this subway also, and the subway structures are being designed with this end in view.

In the meantime, it is estimated that the maximum traffic on the Queen Street route, about 9,000 passengers per hour, can be satisfactorily carried by surface street cars, operating through the subway at speeds of about 15 miles per hour, including stops. The total length of the route between its connections to the surface system at each end is 4.54 miles.

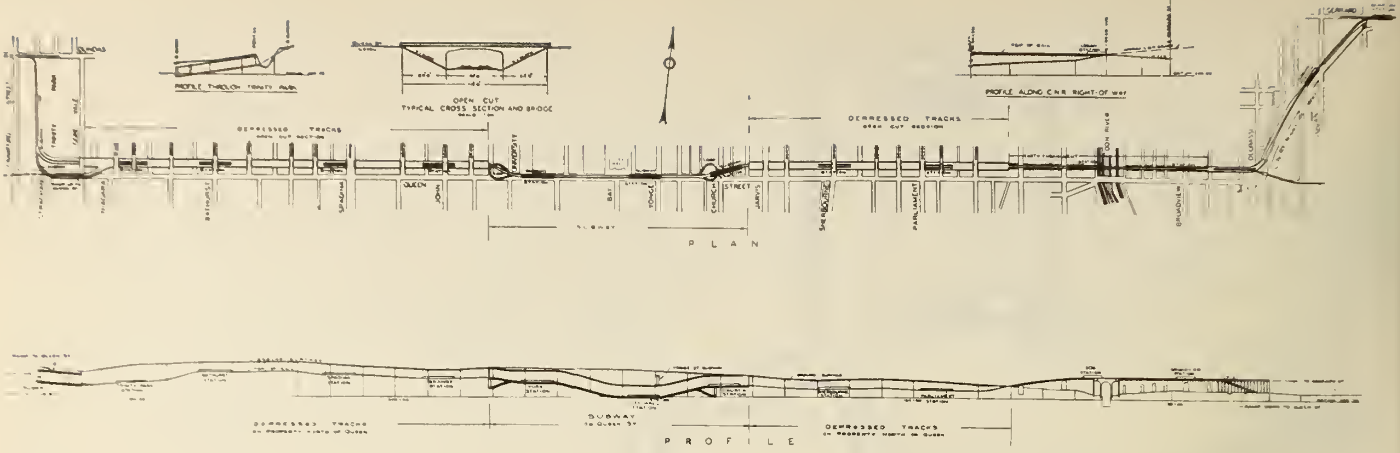


Fig. 6

The estimated cost of the work is as follows:

Structures	$11,800,000
Off-street rights-of-way	5,200,000
Fixed equipment	2,300,000
Total	$19,300,000

General

BENEFITS

The completion of the Yonge Street and the Queen Street rapid transit projects will provide a major improvement in transportation to the patrons of the Toronto Transportation System and will also confer widespread benefits on the community in general.

There will be substantial reduction in travel time as rapid transit operation will completely eliminate the many interferences to free movement of transit vehicles by vehicular and pedestrian traffic and traffic control signals on surface streets.

A definite improvement in comfort will result from the provision of enclosed stations for rapid transit passengers and this feature will be greatly appreciated, especially during the winter months and on rainy days.

For the convenience of those making local trips along the sections of Yonge and Queen Streets where the car tracks will be removed, supplementary local bus services will be operated.

The operation of the subway will be carried out as an integral part of the Toronto Transportation Commission system with free transfers between the rapid transit lines and the connecting street car and feeder bus routes. There will be no change in the present fares consequent upon the carrying out of these projects.

EMPLOYMENT ON SUBWAY CONSTRUCTION

It is estimated that approximately 40 per cent of the total cost of this project will be paid to labour; 45 per cent for materials, of which 50 per cent is labour; and 15 per cent for insurance, taxes, contractors' compensation and miscellaneous factors.

The total employment on the entire project is estimated at 7,250 man-years of skilled employment and 13,580 man-years of unskilled employment, a total of 20,830 man-years.

FINANCING

While the Commission believes in the basic principle that subway structures and rights-of-way should be provided by the City, because these are in the final analysis depressed or underground streets for the use of all citizens, the Commission is in a very sound financial position, and has, during war years, found itself with increasing revenues and without opportunity to expand its services in proportion to public demands. It believes that this situation should be reflected, as soon as possible, in improved transportation facilites, and it is prepared to assume 80 per cent of the cost of constructing the rapid transit lines.

The Commission has been advised that the Dominion Government would favourably consider the proposed subway as eligible for a timing grant of 20 per cent as part of the reconstruction proposals of the Government of Canada.

The whole project was submitted to the citizens of Toronto by referendum at the last municipal elections, and was approved by a ten to one majority, subject to the grant being obtained from the Dominion Government. The City's share is to be limited to the replacement and improvement of its own public utility services.

The Queen Street project will not be commenced until the Yonge Street subway is completed and in operation.

At the present time the Commission is proceeding with the development of contract plans and specifications for the Yonge Street subway. In order to encourage active bidding of competent contractors, the Yonge Street subway has been divided into five sections, and the plans and specifications have been completed for the first section. Plans for the second section are well under way and plans for other sections are proceeding concurrently.

The date of commencement of the work will depend on the labour and material situation, and the completion of the financial agreement with the Dominion Government.

MODERN METHODS OF CONDITIONING BOILER WATER EXTERNALLY

W. J. TOMLINSON, M.E.I.C.

Technical Director and Manager, Betz Laboratories Limited, Montreal, Que.

A paper delivered before the Saguenay Branch of The Engineering Institute of Canada on April 17th, 1945.

Classification of Softeners

Water softening equipment can be classified into two general types; base exchange softeners and chemical precipitation softeners. Both types have been in use for a good many years. However, in more recent years great strides have been taken in overcoming certain inherent difficulties with such softeners as originally designed and operated. In order to form a background for discussion on these various improvements, it is desirable to review the common type softeners and the chemistry of their operation.

The common type base exchange softener which has been in use for many years is the zeolite softener. The term "zeolite" is sometimes used loosely to cover practically all base exchange softeners. Generally, however, when used without further qualification, this term refers to the ordinary sodium zeolite unit. Although zeolite material may be natural or synthetic, it is all granular, being similar in structure to sand. The water to be softened is passed through the zeolite bed where its hardness is removed. A zeolite softener is illustrated in Fig. 1.

The chemical reaction of the softening is as follows:

$$\underset{\substack{\text{Sodium}\\\text{zeolite}\\\text{(granular)}}}{2\,NaZ} + \underset{\substack{\text{Calcium}\\\text{in solution}\\\text{(hardness)}}}{Ca^{++}} \longrightarrow \underset{\substack{\text{Calcium}\\\text{zeolite}\\\text{(granular)}}}{CaZ_2} + \underset{\substack{\text{Sodium}\\\text{in solution}}}{2Na^+}$$

(Same reaction for magnesium—Mg^{++})

Assuming that calcium represents the hardness in the water, it will be noted that this reacts with the sodium zeolite to form calcium zeolite and sodium in solution. When so much sodium has been removed from the zeolite bed that it is no longer capable of satisfactorily removing additional calcium from the water supply, it is necessary to regenerate the bed using a strong salt solution. When regenerating, the softener is taken off the line and the strong salt solution added in order to promote the re-conversion of the calcium zeolite back into sodium zeolite as shown by the following reaction:

$$\underset{\substack{\text{Calcium}\\\text{zeolite}\\\text{(granular)}}}{CaZ_2} + \underset{\text{Salt}}{2\,NaCl} \longrightarrow \underset{\substack{\text{Sodium}\\\text{zeolite}\\\text{(granular)}}}{2\,NaZ} + \underset{\substack{\text{Calcium}\\\text{chloride}\\\text{run to waste}}}{CaCl_2}$$

It will be noted that salt is consumed in the softening process. The regeneration reaction is not stoiciometric and a considerable excess of salt must be present in order to drive the reaction in the proper direction. After regeneration, the softener is rinsed until all the calcium chloride has been purged out and a test shows the rinse water to be soft. The unit is then placed back on the line for further softening of the water supply.

The type of chemical precipitation softener which has been in use for a good many years is the hot lime and soda softener. Discussion on cold process lime soda softening is being omitted here as it has a limited application for boiler water treatment. Better softening is obtained in the hot; and, inasmuch as the water must be preheated before sending it to the boiler, it is the usual practice to use a hot softener rather than cold for boiler water conditioning. There are, of course, certain exceptions to this, where, for example, the steam plant water might be drawn off from the plant process water supply following cold lime and soda softening.

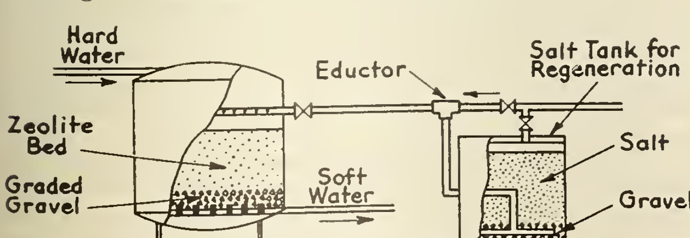


Fig. 1.—Zeolite softener.

Figure 2 illustrates a hot lime soda softener

It will be noted that the water is first heated and then treated with the proper chemicals which in this case would be lime and soda ash. It is then allowed to settle, normally for one hour, during which time the reaction goes to completion and the precipitated matter is allowed to settle out in the sedimentation section. The water then passes through filters in order to remove the suspended matter not retained in the sedimentation section. In the case of hot lime and soda softening, the filtering medium is usually anthracite coal. Sand used for this purpose would tend to increase the silica content of the water due to its solubility in a hot alkaline solution.

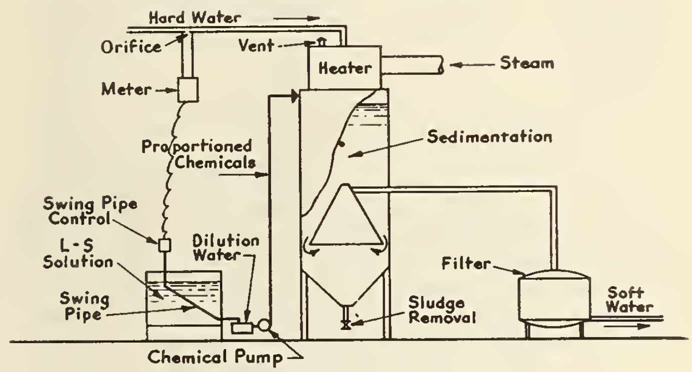


Fig. 2.—Hot lime soda softener.

It is important that the water be heated sufficiently as temperature plays a very important part not only in promoting the reaction but in improving the sedimentation. As such softeners are continuous in their operation, the chemical proportioner is a very important part of the unit. There are various types of chemical proportioners in use. It is necessary at intervals to remove the precipitated solids from the softener. This is accomplished by a desludging valve at the bottom of the sedimentation section. Last, but not least, the filter is important in order to provide a softened water free from precipitated matter.

The chemistry of lime and soda softening can be illustrated by the following reactions:—

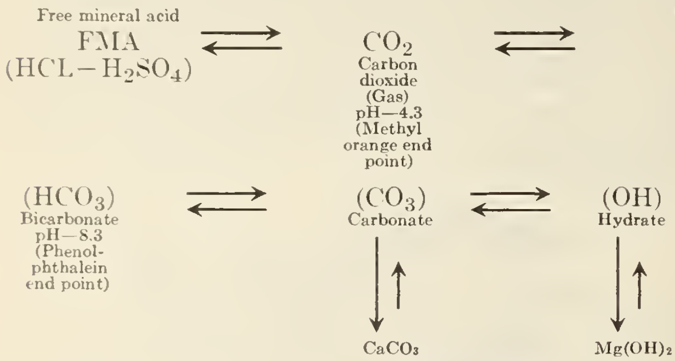
1. $$\underset{\substack{\text{Calcium}\\\text{bicarbonate}}}{Ca(HCO_3)_2} + \underset{\text{Lime}}{Ca(OH)_2} \longrightarrow \underset{\substack{\text{Calcium}\\\text{carbonate}}}{2CaCO_3\downarrow} + \underset{\text{Water}}{2H_2O}$$

2. $$\underset{\substack{\text{Calcium}\\\text{sulphate}}}{CaSO_4} + \underset{\substack{\text{Soda}\\\text{ash}}}{Na_2CO_3} \longrightarrow \underset{\substack{\text{Calcium}\\\text{carbonate}}}{CaCO_3\downarrow} + \underset{\substack{\text{Sodium}\\\text{sulphate}}}{Na_2SO_4}$$

3. $$\underset{\substack{\text{Magnesium}\\\text{bicarbonate}}}{Mg(HCO_3)_2} + \underset{\text{Lime}}{2Ca(OH)_2} \longrightarrow \underset{\substack{\text{Magnesium}\\\text{hydroxide}}}{Mg(OH)_2\downarrow} + \underset{\substack{\text{Calcium}\\\text{carbonate}}}{2CaCO_3\downarrow} + \underset{\text{Water}}{2H_2O}$$

The temporary hardness of the water supply can be represented by calcium bicarbonate. It will be noted that its reaction with lime results in complete precipitation not only of the calcium bicarbonate but also the lime, both being converted into calcium carbonate, the principal precipitate formed in a lime and soda softener. Accordingly, there is a reduction in total solids and alkalinity. The second reaction illustrates the softening with soda ash by precipitation of the permanent hardness. In this case it will be noted that although the hardness is precipitated as calcium carbonate, the original calcium sulphate has merely been replaced by sodium sulphate. Accordingly, there is no reduction in total solids. It should be noted in accordance with reaction (3) that magnesium calls for greater quantities of lime than an equivalent amount of calcium. Magnesium hydroxide is more insoluble than magnesium carbonate and accordingly magnesium precipitates as the hydroxide. In rare cases, reaction (2) is used to reduce the natural soda ash content of the water by addition of calcium sulphate. This has the effect of substituting sulphates for carbonates in the water supply, thereby reducing alkalinity.

A proper chemical balance in a lime soda softener is based upon the rather complicated considerations of acidity and alkalinity. The following illustrates some of the chemical equilibriums involved:



Precipitates in lime soda softener

If it were not for carbon dioxide, the alkalinity and acidity relationships would be relatively simple. In other words, we would have in a water either free mineral acids and neutral salt, or neutral salt and caustic. However, the presence of carbon dioxide sets up certain other intermediate products which buffer the *pH* value of the water at various values. It can be seen that present in the water we may have free mineral acid and carbon dioxide, carbon dioxide and bicarbonate, bicarbonate and carbonate, or carbonate and hydrate. We cannot have present at one time a combination of three of these forms of alkalinity or acidity. For example, if we have bicarbonate, carbonate, and hydrate present in a water, the bicarbonate would react with the hydrate in order to form the intermediate product of carbonate. The remaining constituent in addition to the carbonate would depend upon which was present in excess, either the bicarbonate or hydrate. These points can be refuted by pure physical chemistry, but the relationship is exacting enough upon which we can base a great deal of water conditioning and control work. It should be pointed out here that theoretically pure bicarbonate in water solution would give a *pH* value of 8.3 which corresponds to the phenolphthalein end point. Similarly pure carbon dioxide dissolved in water would give a *pH* value of 4.3 which corresponds to the methyl orange end point. These facts are very useful in control work for determining the extent of the alkalinity and in what form it is present. For example, it can be shown by mathematical proof based upon the considerations just outlined that the hydroxide content of the water is equal to twice the phenolphthalein titration minus the methyl orange titration. It can also be shown that the carbonate alkalinity is equal to the total alkalinity to the methyl orange end point less the hydrate alkalinity as calculated. Using this as a base, the quantities of lime and soda ash are controlled in order to keep the alkalinity of a softener principally in the form of carbonate with a slight excess of hydrate. By keeping the alkalinity in the form of carbonate, the solubility of calcium carbonate in the lime and soda softener is kept low. In actual practice, water from a lime and soda softener may run approximately 15 to 25 p.p.m. of hardness expressed as calcium carbonate as the precipitated calcium carbonate is soluble to this extent at the temperatures and pressures involved. By keeping a high carbonate content in the softened water there is a tendency to reduce the solubility of calcium carbonate, thereby producing a lower hardness in the finished water. A slight excess of hydrate is also carried in order to promote the precipitation of magnesium as magnesium hydroxide.

The application of heat will upset the original equilibrium in a water between the various forms of alkalinity and acidity. Heat will tend to drive carbon dioxide gas out of solution. In the case of natural waters of *pH* between 4.3 and 8.3, release of carbon dioxide will increase the *pH* value. The *pH* approaches the value of 8.3 for bicarbonate as the CO_3 is removed. In addition, bicarbonates tend to break up into sodium carbonate and carbon dioxide. This is another factor which tends to increase the *pH* value, although this latter reaction only takes place to a very limited extent at usual feedwater temperatures.

However, when the feed water reaches boiler temperature, not only do the bicarbonates decompose into sodium carbonate and carbon dioxide, but the sodium carbonate further decomposes into caustic soda and carbon dioxide as shown here:—

$$1.\ NaHCO_3 \rightleftarrows Na_2CO_3 + CO_2\uparrow + H_2O$$

$$2.\ Na_2CO_3 + H_2O \rightleftarrows 2\,NaOH + CO_2\uparrow$$

This latter reaction does not go to completion but it will account for a considerable amount of the carbon dioxide present in the steam. It is for this reason that all steam contains some carbon dioxide even though the free carbon dioxide may have been removed in the feed water heater.

Comparison of Lime-Soda and Zeolite

The comparison of these two general methods of water softening show that each has its particular advantages and disadvantages. In the first place, due to the solubility of calcium carbonate in a hot lime and soda softened water it is not possible to produce zero hardness. As previously stated, this hardness will probably run between 15 and 25 p.p.m. On the other hand, a zeolite softener will produce a water of much lower hardness. However, even with zeolite, a small quantity of residual hardness remains. Although the water may show zero hardness by the soap test, gravimetric determination will show the presence of anywhere up to 4 p.p.m. of hardness following the zeolite softener. On the other hand, one advantage the lime and soda unit has over the zeolite is that of reducing total solids of a water. As previously shown by the reactions for lime-soda softening, the lime reaction with calcium bicarbonate not only softens but also reduces total solids. In reducing the total solids, it also reduces alkalinity. It will be noted that, whereas the water originally contained bicarbonate, which is one of the forms of alkalinity, nothing remains soluble and accordingly alkalinity also has been reduced. The high alkalinity remaining in a water after zeolite softening has often been one of the principal objections to zeolite due to its effect upon foaming characteristics of the boiler water and caustic metal embrittlement, unless overcome by a high rate of blow down on the boilers. Of course, some waters have an initially low alkalinity and accordingly are quite suitable for sodium zeolite softening.

The reduction in alkalinity by lime also reduces the amount of fixed carbon dioxide which is available for release in the boiler. It is highly desirable to keep carbon dioxide in the steam at a minimum in order to reduce corrosive tendencies of the steam and condensate. With zeolite softening, all the bicarbonates present in the original water are unaffected in the softening reaction and accordingly are free to decompose in the boiler, releasing carbon dioxide.

Where economizers or closed heaters are used, lime and soda has the disadvantage of possibly forming deposits. This is due to the fact that such water is saturated with calcium carbonate and any increase in temperature tends to cause further precipitation. This can be overcome by acid treatment or certain surface active chemicals.

A comparison of chemical costs for softening must of course take into consideration the particular water in question. The consumption of salt cannot be figured stoiciometrically based upon hardness removal. Accordingly, although salt is a very cheap chemical, costs may not be low as relatively large quantities are required. For example, in actual practice it takes about 3½ lb. or salt to remove one pound of hardness expressed as calcium carbonate. On the other hand, with lime, whose price is comparable with that of salt, approximately 0.8 lb. is required for every pound of hardness removed. Of course, this becomes 1.6 lb. for the magnesium hardness. It is therefore apparent that removal of hardness with lime is considerably cheaper than with salt. However, in most cases, soda ash must also be used with the lime in order to remove the permanent hardness. It should take approximately 1.1 lb. of soda ash for every pound of hardness removed, although some excess of soda ash is also required. In comparison with the other two chemicals, soda ash is relatively expensive, being about two or three times more per pound than salt or lime. Of course, these relationships are entirely dependent upon market conditions, freight rates, and quantities purchased.

A comparison of internal treatment costs following either lime and soda softening or zeolite softening definitely favours the use of zeolite. As previously explained, a much lower hardness is obtainable with zeolite softening and accordingly only small quantities of internal treatment are required. As phosphates used in internal conditioning are considerably more expensive than salt, lime, or soda ash, the greater hardness of the lime-soda softened water will considerably increase the overall chemical costs when using lime and soda as compared with zeolite. Furthermore, in certain instances it is possible that the lime and soda softener will not produce as clean a boiler as the zeolite, due to the greater quantity of hardness passing through the softener.

An objectionable feature of zeolite softening is the need of a clear water supply. In other words, if any appreciable turbidity exists in the water supply, preliminary filtration should be provided. Such filtration would not be considered adequate without chemical coagulation. Accordingly this fact alone can increase the capital cost considerably in addition to chemical costs and maintenance. Turbid water will tend to foul up the zeolite beds and render them inefficient or unusable. Further disadvantages of the zeolite system are limiting factors of temperature and *pH* value. The ordinary zeolite should not be used where the water runs over 100 deg. F. Furthermore, the *pH* value should be somewhere between 6.5 and 8.0. In addition, recurring costs take place with zeolite due to the necessity of renewing the beds at intervals. Although the whole bed may not be renewed at once, for purposes of calculation it is well to figure the life at approximately five years.

Improvements in Base Exchange Softeners

However, many of the objections to the ordinary zeolite and lime and soda softeners have been overcome by present-day improvements. In the case of base exchange softeners, the use of carbonaceous zeolite has allowed higher water temperatures to be used and more latitude in the *pH* range of the water. However, there are still certain limitations which must not be exceeded.

One of the earliest means of overcoming high alkalinity following zeolite softening consisted of acid treatment. In other words, sulphuric acid is added to the softened water which reduces the alkalinity and releases carbon dioxide. It is the practice in such cases to aerate the water, following the addition of acid in order to drive off the liberated carbon dioxide. Unless this is done, the *pH* value of the water remains low, making it corrosive. Although such treatment reduces alkalinity it merely replaces it with sulphate and accordingly there is no essential change in total solids of the water. Of course, the addition of acid directly to the water can be based upon a stoiciometric relationship as a direct reaction takes place.

A further development has been the use of hydrogen zeolite. Hydrogen zeolite can be operated not only in the calcium sodium cycle but in addition it can be operated in a calcium sodium hydrogen cycle. In other words, calcium, magnesium, and sodium ions are all replaced by the hydrogen ion. This, of course, converts all the salts present into their respective acids. For example, all the chlorides in the water become hydrochloric acid, all the sulphates become sulphuric acid, and the bicarbonates become carbonic acid. This is shown as follows:—

$$\underset{\substack{\text{Hydrogen}\\ \text{zeolite}\\ \text{(granular)}}}{HZ} + \begin{matrix} Ca^{++} \\ Mg^{++} \\ Na^{+} \end{matrix} \longrightarrow \underset{\text{(Granular)}}{\begin{matrix} CaZ_2 \\ MgZ_2 \\ NaZ \end{matrix}} + \underset{\substack{\text{Acid}\\ \text{ion}}}{H^{+}}$$

Carbonic acid is carbon dioxide dissolved in water and accordingly all the original alkalinity is converted into carbon dioxide. The regeneration uses sulfuric acid as indicated:—

$$\underset{\text{(Granular)}}{\begin{matrix} CaZ_2 \\ MgZ_2 \\ NaZ \end{matrix}} + \underset{\substack{\text{Sulphuric}\\ \text{acid}}}{H_2SO_4} \longrightarrow \underset{\text{(Granular)}}{HZ} + \underset{\text{To waste}}{\begin{matrix} CaSO_4 \\ MgSO_4 \\ Na_2SO_4 \end{matrix}}$$

As with salt for straight zeolite softening, the amount of acid required is considerably more than would be required for a direct reaction. The amount of acid required will vary depending upon the characteristics of the water. This may range from 1.5 to 4.0 lb. of sulphuric acid for every pound of combined calcium, magnesium and sodium expressed as calcium carbonate. The chemical costs from the standpoint of alkalinity reduction are therefore greater than with straight acid treatment of zeolite water. In addition, the chemical costs for softening are higher as acid will cost approximately 2 cents a pound as compared with about 0.7 cents a pound for salt. On the other hand, the acid serves two purposes in one, that of softening and reducing alkalinity.

Of course, for boiler water use, it is not desirable to have free mineral acid in the water. Accordingly, the general practice calls for softening part of the water through a sodium zeolite softener and the remaining portion through hydrogen zeolite. The effluents from the two softeners are then mixed and the free mineral acid following the hydrogen zeolite is used to reduce the alkalinity of the sodium zeolite softened water, resulting in further liberation of carbon dioxide. As with regular acid treatment, the water can then be aerated for removal of carbon dioxide. Such a system has many desirable features. In the first place the hardness of the water is reduced to a very low value. The hardness after the hydrogen zeolite will even be lower than following the sodium zeolite as the calcium and magnesium are removed first before the sodium reacts. Accordingly, by the time the sodium is removed, very little calcium and magnesium will remain in the water. In the second place, alkalinity can be reduced to any value desired by merely regulating the proportion of hydrogen zeolite softened water to sodium zeolite softened water. In addition, alkalinity is removed without replacing it by some other constituent. This results in a material reduction in total solids. In most waters the reduction in total solids with such a system is very high as bicarbonates form a large portion of the total solids. Furthermore, due to the reduction of alkalinity to any degree desired with subsequent release of carbon dioxide, this system leaves a minimum of bicarbonate remaining in the water before passing to the boiler. This results in very small quantities of carbon dioxide being released in the boiler.

Theoretically, it would be possible to pass all of the water through the hydrogen zeolite, aerate it for removal of carbon dioxide, and then add caustic soda in order to establish suitable alkalinity free of any fixed carbon dioxide. This type of system would be more expensive to operate due to the relatively high cost of acid as compared with salt. In addition, caustic soda for re-establishing the alkalinity would further increase the costs. The advantage would lie in practically complete removal of carbon dioxide. Although the removal of carbon dioxide would theoretically be complete, in actual practice this would not be attainable as aeration of the water to liberate carbon dioxide cannot effect complete removal. Accordingly, as soon as caustic soda were added in order to re-establish the alkalinity, the reaction with the remaining carbon dioxide would form either bicarbonate or carbonate which could then decompose later in the boiler. Nevertheless, such a system would produce a steam with the lowest possible carbon dioxide content. Present studies and research on the problem of condensate line corrosion due to carbon dioxide is emphasizing the importance of this subject. At the present time many plants accept corrosive conditions due to carbon dioxide as being quite normal. A great deal of work is being done on the subject at the present time.

One possible method of operating hydrogen zeolite which is rather interesting is that of regenerating a softener with a mixture of salt and acid. The proportion of acid is controlled in order to give the desired alkalinity reduction. Such a system is actually in use at the present time, but experience with the method is lacking.

A further advancement with acid treatment or with hydrogen zeolite is the possible elimination of the aerator. When water containing carbon dioxide is passed through a feed water heater, removal of carbon dioxide takes place. However, the purpose of the aerator is merely to prevent corrosion of the piping and part of the feed water heater itself. By designing special feed water heaters for handling greater quantities of carbon dioxide and by providing a section in the heater capable of withstanding the corrosive condition, it is possible to eliminate the need of an aerator. No advantage in capital cost can be expected as the special heater would at least offset, if not more than offset, the cost of the aerator. However, by eliminating the aerator the system contains one less piece of equipment that must be maintained and operated. In addition, power requirements for the necessary air and additional pumping of the water is eliminated. One difficulty with elimination of the aerator is that the carbon dioxide is not released until the water is heated. Accordingly it is not feasible to store the water for use when the softeners are being regenerated unless some heat is to be lost in the stored water. However, this can be overcome by providing multiple zeolites such that remaining units can carry the load while one is being regenerated.

A further very interesting advancement in base exchange equipment is that of demineralization. Although demineralization has not found a practical use as yet in boiler water conditioning, it is a very interesting outgrowth of base exchange softeners worthy of some comment at this time. It has found use in other water conditioning problems. The first step in demineralization is to pass a water through a regular hydrogen zeolite softener in order to convert all the salts into their respective acids as previously described. This water is then passed through a second unit whose bed is capable of adsorbing the entire acid molecule, as indicated:—

$$\underset{\text{Acids present after HZ}}{\begin{matrix}HCL\\H_2SO_4\end{matrix}} + \underset{\text{(Granular)}}{\underset{\text{Demineralizing Bed}}{X}} \longrightarrow \underset{\text{(Granular)}}{\begin{matrix}X.HCL\\X.H_2SO_4\end{matrix}}$$

Carbonic acid is not adsorbed, but it is later removed by aeration. It will be noted that the reaction is not similar to the usual zeolite reaction. The entire molecule of hydrochloric acid or sulphuric acid is actually adsorbed on to the bed leaving nothing in the water in its place. It is then regenerated with soda ash which reacts with the adsorbed acid and leaves the bed in its original state with the respective salts of sodium chloride and sodium sulphate passing to waste. Regeneration is shown by this reaction:—

$$\underset{\text{(Granular)}}{\begin{matrix}2X.HCL\\X.H_2SO_4\end{matrix}} + \underset{\text{Soda ash}}{Na_2CO_3} \longrightarrow \underset{\text{(Granular)}}{X} + \underset{\text{To waste}}{\begin{matrix}2NaCL\\Na_2SO_4\end{matrix}} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$$

It can be seen that the net result of the two processes in series, followed by aeration, is to produce a water free of all dissolved substances with the exception of silica. As yet nothing has been devised in the base exchange field for silica removal. This method can be used where distilled water is required as long as the silica does not interfere.

Improvements in Chemical Precipitation Softeners

As with base exchange, many advancements have been made in the field of chemical precipitation in order to overcome certain objections to the usual lime and soda softener. In the first place more accurate proportioners are now being produced in order to maintain better chemical balances consistently. It might be pointed out here that some of the older methods of mechanically proportioning chemicals were very ingenious, but it was difficult to keep the proportioners functioning properly at all times. The problem of course consisted of supplying lime and soda in direct proportion to the flow of raw water. As the flow of raw water varies with the square root of the pressure differential across an orifice, it was necessary to devise mechanical means of taking the square root out of the equation. As previously stated, some of the mechanical means of doing this were quite ingenious but still subject to maintenance problems. At the present time the tendency is toward electrical methods of proportioning and one of the popular types consists of a swing pipe in a chemical tank whose drop is directly proportional to the water flow.

One method of improving conditions with a hot lime and soda softener is to use boiler water recirculation. In other words, part of the continuous boiler blow down is returned to the softener. This not only affects the operation of the softener but also changes the conditions within the boiler. Many factors are affected by boiler water recirculation, but one of the principal uses is to allow higher alkalinity to be carried in a softener thereby producing a lower hardness without at the same time excessively increasing boiler water alkalinity. In the boiler itself the principal advantage of recirculation lies in its ability to lower the ratio of alkalinity and suspended solids to the other constituents in the water. Some of the boiler water alkalinity can be used up by replacing some of the lime and soda being added. Any boiler water recirculated has its suspended solids removed in the softener and subsequent filtration. In other words, as far as the boiler is concerned it is similar to taking water out of the boiler, removing its suspended solids and returning it to the boiler. Soluble constituents such as chlorides and sulphates remain the same. The reduction in suspended solids is highly desirable as this plays an important part in scale formation and carry over characteristics.

Many methods are now available for improving the sedimentation and accelerating reactions in the lime and soda softener. Boiler water recirculation, as just described, is one such method due to the suspended matter from the boiler returning to the softener. In this case the boiler water suspended matter acts as seeding points for the precipitation of calcium carbonate. This accelerates the build-up of particles of calcium carbonate in the softener which is necessary in order to allow the precipitates to properly settle. Another method gaining considerable favour is that of recirculating a portion of the sludge from the bottom of the softener back to the top of the softener. The previously precipitated calcium carbonate in this case acts as the seeding points for the freshly precipitating material. It should also be mentioned that automatic desludging is now available for relieving the concentrations of sludge at the bottom of the softener at regular intervals. Mechanical stirring somewhat in the nature of a coagulating paddle is also used to intimately mix the incoming chemicals with the water and accelerate precipitation.

It is also common practice to use a chemical coagulant in addition to the lime and soda in order to form a floc which settles very readily. In settling, the floc tends to enmesh the smaller particles of calcium carbonate thereby hastening their sedimentation as well. The two principal coagulants used for this purpose are sodium aluminate and magnesium oxide. These coagulants do not always work the same in all waters and a method of trial and error is probably best for determining which suits the individual case. The disadvantage of sodium aluminate lies in the fact that incorrect dosages might result in passage of soluble aluminum into the boiler. Other magnesium compounds can also be used for coagulation, but the use of the oxide prevents other ions from entering the system. For example, the use of magnesium sulphate will result in an increase in sulphate concentration in the system.

A great deal of attention has been paid to the problem of silica removal with the continually growing evidence of its importance in scale formation and also carry over. Although an ordinary lime and soda softener does effect some silica removal, it has been found possible to greatly increase the silica removal by the use of magnesium compounds, preferably magnesium oxide as just explained. The reaction for silica removal is not stoiciometric. Sludge recirculation is highly desirable along with the use of magnesium oxide where it is desired to reduce silica to a low value. The amount of magnesium oxide required depends on the amount of magnesium originally in the water and the degree of silica removal desired. Certain grades of magnesium oxide exhibit greater silica removal ability than others. Where magnesium might be present in excessive amount, silica might be used for magnesium reduction. However, the advisability of this is questionable in view of potential problems due to silica.

Improvements have also been made in filtration practices following lime and soda softeners as this can be the source of considerable difficulty if not properly handled. Any calcium carbonate carried through the filters will increase the sludge of the boiler and also require more phosphate due to the reaction of phosphate with calcium carbonate. Various means are now available for breaking up the sludge which accumulates at the top of the filter prior to backwashing. It is very important that proper backwashing remove the accumulated sludge in order that it does not build up to prohibitive quantities. One method consists of a rotating pipe containing jets of water which impinge upon and stir up the accumulated sludge bed in order to aid the backwashing.

The use of external phosphate has greatly extended the field for the hot process softener. This is essentially the same as a lime and soda softener except that phosphate is used as a precipitating agent instead of lime and soda. The reaction is as follows:

$$\underset{\substack{\text{Calcium}\\ \text{carbonate}\\ \text{(After L-S)}\\ \text{Ca (HCO}_3)_2\text{ if}\\ \text{no presoftening}}}{3CaCO_3} + \underset{\substack{\text{DSP}\\ \text{Di-sodium}\\ \text{phosphate}}}{2\,Na_2HPO_4} \longrightarrow$$

$$\underset{\substack{\text{Calcium}\\ \text{phosphate}}}{Ca_3(PO_4)_2\downarrow} + NaHCO_3 + Na_2CO_3$$

The pH value in the softener must be carried at about 9.5 in order to properly promote the phosphate softening reaction, and in many cases caustic soda is used along with the phosphate in order to establish the desired pH value. The caustic also precipitates the magnesium:—

$$\underset{\substack{\text{Magnesium}\\ \text{sulphate}}}{MgSO_4} + \underset{\substack{\text{Caustic}\\ \text{soda}}}{2NaOH} \longrightarrow \underset{\substack{\text{Magnesium}\\ \text{hydroxide}}}{Mg(OH)_2\downarrow} + \underset{\substack{\text{Sodium}\\ \text{sulphate}}}{Na_2SO_4}$$

A small excess of phosphate is carried in the softener. This cannot be held too high as otherwise the phosphate in the boiler water would be excessive due to the amount of concentration which takes place. In this connection the recirculation of boiler water is particularly advantageous with external phosphate softening as it allows a higher phosphate value to be maintained in the softener without at the same time creating an excessive phosphate value in the boiler.

The principal advantage of the phosphate over lime and soda lies in the very low hardness that can be maintained. It can be considered as zero hardness. In spite of this, however, external phosphate systems are definitely susceptible to forming economizer deposits as the water is completely saturated with calcium phosphate even though its solubility is extremely low. Accordingly, any rise in temperature tends to precipitate out a small amount of calcium phosphate. Over a period of time this can become excessive and cause difficulty in economizers and closed heaters. This problem can be overcome by feeding acid following the softener in order to take the edge off the saturated condition of the water. However, the use of acid tends to complicate the system and increases the amount of equipment which must be maintained and operated. Certain surface active chemicals can also be used for the purpose of preventing economizer deposits.

External phosphate has the disadvantage of using a comparatively expensive chemical, namely, phosphate, in order to remove hardness. Accordingly a straight external phosphate softener is not practical for use with a high hardness water. In such cases, however, it is possible to pass the water first through a hot lime and soda softener and then through an external phosphate unit. In this way the advantage of hardness reduction with relatively cheap chemicals together with the advantages of reduced total solids and alkalinity is effected in the lime and soda unit, yet no hardness remains after the phosphate softener. Different phosphates can be used, such as monosodium phosphate, disodium phosphate, or phosphoric acid. Where lime and soda is not used first, the phosphoric acid would have the advantage of releasing carbon dioxide which could be driven off in the heater of the softener provided provisions were made for this. Caustic soda added after the heater at the top of the softener could then re-establish the desired pH value. This of course would result in reduction of available carbon dioxide in the system. However, following lime and soda softening the use of phosphoric acid would not reduce the pH value sufficiently low to allow carbon dioxide to be

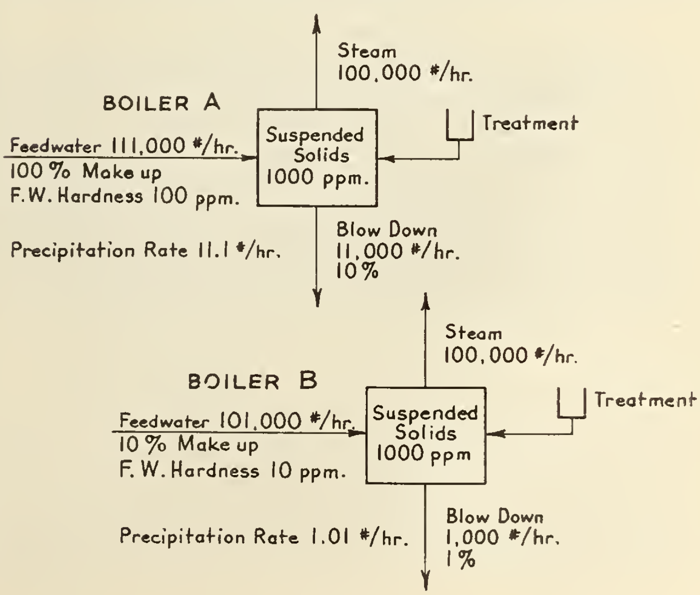


Fig. 3

driven off in any appreciable quantity. It therefore becomes a question of chemical cost and the necessary alkalinity or acidity required to maintain a *pH* value of 9.5 in the softener. Market conditions are such in Canada that disodium phosphate would be the cheapest means of providing phosphate. Monosodium phosphate is more expensive for equivalent phosphate content than the disodium phosphate, and phosphoric acid is still more expensive. Furthermore, special equipment is necessary in order to feed phosphoric acid due to its acidity. The same is true for monosodium phosphate.

The external phosphate system has one disadvantage similar to that of the zeolite. It produces a low hardness but considerable excess alkalinity is free to concentrate in the boiler. In such cases, alkalinity may become a factor determining blowdown. This can be overcome by acid treatment as previously described for preventing economizer deposits.

There is a growing tendency to incorporate a number of stages into one softener. For example, it is quite common for the softener to contain a special section for heating the condensate separately from the raw water. The condensate is then added to the system after the filters. A further development is to incorporate a third section inside the softener where the combined condensate and softened water are returned together for complete deaeration. The steam to such a unit can pass in series through the three heaters, namely, the deaerating heater, the heater for the raw water section, and the heater for the condensate. With the advent of combined lime and soda external phosphate softening, softeners are available which contain a section within the lime and soda softener for the phosphate softening. Some softeners have also been designed with sections for storing backwash water for the filter. Of course, such consolidation of units tend to save capital costs and space but in such cases capacities may suffer in order to place all the equipment into one unit. For example, where a separate unit is used for external phosphate it is more likely to be designed for the desired 45-minutes retention than if it is incorporated as part of the lime and soda unit. In such cases, retention might be cut down to 30 minutes in order to limit the size of the phosphate section.

Another trend tending to improve the results of hot external softeners is that of raising the pressure at which they operate. The conventional unit operates a little under 5 lb. pressure. By raising this pressure to approximately 50 lb., the corresponding increase in temperature greatly accelerates the reactions and they proceed further to completion. In other words, lower hardnesses can be produced in a lime and soda softener when operating at the higher temperatures. Due to the size of a lime and soda softener, however, such an increase in pressure may materially affect the capital cost.

Effect of Condensate

Throughout this discussion no mention has been made of the effect of condensate. This can prove to be quite important. For example, under certain conditions, straight internal treatment might be adequate provided there is about 50 per cent condensate, whereas straight internal treatment with a 100 per cent make up would not produce a clean boiler. At first thought this might not seem reasonable as it can be argued that the same chemical balance would be maintained in a boiler with 100 per cent make up as compared with 50 per cent make up provided additional treatment were added to the boiler and the blow down were increased in order to effect the same total solids. However, Fig. 3 indicates that this is not the case. It will be noted that under both systems (A) and (B) the boilers are producing the same amount of steam per hour. System (A) is operating with 100 per cent make up and a 10 per cent blow down rate resulting in 1000 p.p.m. of suspended solids in the boiler. System (B) produces the same amount of steam and uses the same quality make-up water but it has a much lower feed water hardness due to the use of 90 per cent condensate. By limiting the blow down to one per cent, Boiler (B) will carry the same amount of suspended solids. This is based upon the feed water hardness being precipitated as suspended solids part for part. In other words, one pound of feed water hardness becomes one pound of suspended solids in the boiler. This is approximately correct when precipitating with phosphate as 300 lb. of calcium carbonate is equivalent to 310 lb. of calcium phosphate. Although the chemical balance including the quantity of suspended solids is the same in Boiler (A) and Boiler (B), the fact remains that the hardness is being precipitated at the rate of 11.1 lb. per hour in System (A) whereas it is only 1.01 lb. per hour in System (B). Experience has shown that this rate of precipitation is very important, and undoubtedly Boiler (B) will be considerably cleaner than Boiler (A).

Choice of System and Determining Factors

From this discussion it can be seen that there are many factors affecting the choice of softening equipment. In addition there is always a question as to whether straight internal treatment should be used. In certain cases all three methods would produce satisfactory conditions. Accordingly, the economics of capital and operating costs is the determining factor. In other cases, straight internal treatment, for example, may not be capable of producing satisfactory conditions and therefore it must be ruled out as a possibility. Where high pressure boilers are to be used or even modern boilers at ordinary pressure, exacting water conditions are necessary. To just what extent a plant will go in installing a suitable system may depend on just how good the conditions must be maintained. For example, some plants prefer to accept the necessity of regular boiler cleaning rather than make the additional capital expenditure for a more complete system.

Many factors play their part in determining the final system to be used. One factor may be sufficient to make the decision. The principal items to be considered are hardness, alkalinity, total solids, silica content, temperature of water, *pH* value, turbidity, acceptable boiler outages, boiler pressure and design, and percentage condensate. In attempting to solve the equation where x represents the most desirable system, it can readily be seen that a very complicated equation is required due to the multitude of variables which must be considered. A true comparison can generally be made only by calculating through the chemical balances to be maintained under various systems in order to draw a comparison between the final water conditions, capital costs, and operating costs. There are hardly two jobs in existence in which the equation is identical and it is rare indeed when each individual plant is not a separate and distinct problem.

DISCUSSION ON

THE WINTER TEMPERATURE CYCLE OF THE ST. LAWRENCE WATERS

A Plea for More Data

A paper by J. G. G. Kerry, M.E.I.C., presented before the Sixtieth Annual General Professional Meeting of The Engineering Institute of Canada, on February 8th, 1946, and published in the January, 1946, issue of *The Engineering Journal*.

NOTE—Because of the length of several discussions and the restrictions on the use of paper, the Publication Committee has abridged the material substantially. Many statements and comments have been omitted entirely because, in the opinion of the committee, they were not related to the topic and, though interesting in themselves, did not advance the specific subject. Readers who desire to study any of the discussions in full may secure them by inquiring at Headquarters—(Ed.).

P. E. Church[1]

A study of the temperature cycle of Lake Michigan conducted by the Institute of Meteorology (University of Chicago) was carried out vigorously for three winters and two summers or from November 1941 to March 1944. Since that latter date observations still have continued but less frequently than before. Only a portion of the data have yet been published.

The three winters were of different character with respect to average air temperatures, average water temperature, and heat content of Lake Michigan. Table IV illustrates this.

Table IV

Milwaukee	Mean of Dec., Jan., Feb., Mar.		
	Winter, 1941–42	Winter, 1942–43	Winter, 1943–44
Ave. Temps	28.0°F.	22.6°F.	27.1°F.
Wind Vel., Ave. MPH	12.6	12.5	13.0
Total snow in inches	24.8	41.3	26.9
Mean Lake Temp. min. for winter, °F.	36.5	32.9	35.0*
Mean Lake Temp., Feb. 12-15.	37.5	34.5	36.3
*Rough extrapolation.			

For the sixty years, 1871-1930, the four months, December through March, average 25.4 deg. F. for Milwaukee. The winters of 1941-42 and 1943-44 were definitely warmer than normal and the winter 1942-43 definitely colder. Using a mean for the same months, but for the twenty-five years 1919-20 to 1943-44, as 26.9 deg. F., 1943-44 was close to average, 1941-42 was above normal and 1942-43 was much below normal. Only two winters in the past twenty-five years have been colder than 1942-43 and they were 1919-20 and 1935-6. Both of these winters had severe ice conditions, for navigation, between Milwaukee and Muskegon.

There appears to be a definite relation between the mean temperature of the air at Milwaukee for the four months, December through March when the lake is vertically isothermal and cooling is in progress, and the temperature of the lake.

A very rough formula, based on only three years of lake data, would be:

$$T_w = T_a + 9.0°$$

Where T_w is the mean temperature of the lake at its minimum, and T_a is the mean air temperature at Milwaukee for December through March.

or

$$T_w{}^1 = T_a + 10.5°$$

Where $T_w{}^1$ is the mean temperature of the lake between February 12 to 15th.

This implies that from mid to late March, when Lake Michigan has its minimum temperature, there would be no heat gain if the air temperature averaged 23.0 or lower for the four months. There are other variables, of course, and some of these have been mentioned by Mr. Kerry. In addition to those he mentioned, it would be well to consider the heat loss to the water by falling snow.

A rough estimate of the amount of snow which falls on Lake Michigan would be about 50 inches or, using a conversion figure of 10 inches of snow equals 1 of water, in the metric system the snow would equal 25 cm. of ice. Using $80/\text{cal}/^{cc}$ as the heat of fusion the lake would, during the winter, lose 1600 $\text{cal}/^{cm^2}$. In the St. Lawrence valley, where it is snowier than over Lake Michigan, the heat loss owing to falling snow would be correspondingly larger.

I am glad to note that Mr. Kerry has stressed the point that when temperatures become uniform in a "deep lake" further cooling is a slow process. This is because at temperatures below that of maximum density of fresh water (4 deg. C.) the whole lake will continually turn over if the wind is sufficient to cause stirring. When an ice cover prevents this mechanical stirring the water will stratify with the warmer water at the bottom. Conduction of heat from the bottom will bring a slight rise to bottom water.

In preparing a third report on Lake Michigan, I have computed, tentatively, the values of heat gain and loss by the processes of incoming radiation, evaporation, nocturnal radiation, and conduction. The losses were computed from formulae developed by Dr. R. Montgomery of the Woods Hole Oceanographic Laboratories and are in mimeograph form only. No attempt has been made to compute heat gain or loss from condensation, or precipitation. All figures are based on air temperature, relative humidity, cloudiness, and wind velocity at the Muskegon, Mich., airport. In Table V are some summary figures which may be of interest. Thus far they have been computed for December 1941-42 and January, February and March of 1942.

Table V

	Dec., 1941	Jan., 1942	Feb., 1942	Mar., 1942	Dec., 1942
Total incoming Cal/cm²/month	2,100	2,520	3,500	5,270	1,980
Total outgoing Cal/cm²/month	7,320	9,500	9,880	5,800	11,600
Incoming-outgoing Cal/cm²/month	−5,220	−6,980	−6,280	−530	−9,620
Heat loss or gain in lake cal/cm²/ for depth of 7,700 cm.	−8,000	−8,000	−8,500	−6,000	−17,000

While there is a large discrepancy between calculated and observed losses it must be remembered that losses were computed from atmospheric observations on the lee side of the lake and that currents are more active in the lake in winter.

[1] Associate Professor of Geography and Meteorology, Department of Geography, University of Washington, Seattle, Wash.

F. L. Lawton, M.E.I.C.[2]

While not necessarily subscribing to the hypothesis that the navigation season can be greatly extended, I think that much of the argument is of immediate interest in another field, namely the operation of the extensive hydro-electric developments in Canada, and particularly their storage reservoirs.

This problem is of such wide national interest that The Engineering Institute of Canada might well set up a committee to serve as a focal point for compilation of data, their analysis and dissemination to the profession.

No doubt a considerable volume of information, which could be utilized to advantage, exists in the files of the operators of large storage reservoirs associated with hydro-electric systems.

A wider field of application, and one of more immediate application than the extension of the navigation season on the St. Lawrence-Great Lakes waterway is the relatively accurate prediction of the probable date on which breakup will occur and new water enter the storage reservoirs and rivers feeding power developments.

The temporary loss of water from storage reservoirs due to the formation of frazil and anchor ice in the waterways leading to the power plants is another problem of major interest. How can it be minimized?

I submit, therefore, that The Engineering Institute of Canada would perform an outstanding service to widely diversified groups by forming a committee which would deal with the many problems entering into ice formation, breakup, etc.

E. Wendell Hewson[3]

The problem of which Mr. Kerry treats is important and of great complexity. Many more data must be available before a solution can be achieved. The following points should be kept in mind when considering its meteorological aspects.

1.) Insolation. The prevalence of cloud affects solar radiation, for an overcast sky cuts off about eighty per cent of the incoming solar energy. Even measured values at land stations around the lakes cannot be accepted without reservations, for the amount of cloud and fog is appreciably greater over the lakes than over the adjacent land. A fuller knowledge of cloud conditions over the lakes is needed.

A further point which should be considered is the reflection of the sun's rays by the water surface. This is small when the sun is near the zenith, but amounts to 30 to 40 per cent when the sun is low on the horizon, as it is in winter. The percentage is even greater when there are waves.

2.) Terrestrial or Back Radiation. The loss of heat by this process proceeds 24 hours a day. A ceiling of low cloud cuts off nearly all back radiation. The average cloud cover would have to be considered in conjunction with Prof. Richardson's formula; furthermore, it is doubtful if the constants are the same for the Great Lakes as for California.

In these latitudes, with clear skies in winter, the loss by back radiation is substantially greater than the gain by insolation.

3.) Convection. The losses by this process shown in Table III would seem to be too large. Molecular diffusion of heat in the atmosphere is negligible in comparison with the turbulent diffusion by eddies. In unsaturated air, eddies carry heat upward when the temperature decreases with height at a rate greater than 5½ deg. F. per 1,000 ft., and downward when it decreases with height at a rate less than this. There is no transfer when the decrease is 5½ deg. F. per 1,000 ft. Thus, when relatively cold air sweeps over the lakes from the north-west, heat is carried upward, but it is carried downward with warm air from the south. With saturated air the heat transfer is not substantially different. Bowen's ratio does not make adequate allowance for the turbulent transfer of heat, and computations based on it are subject to error. Other investigations lead one to believe that the heat loss or gain in this manner is very small in comparison with the loss by back radiation and evaporation.

James H. Brace, M.E.I.C.[4]

My experience from time to time with ice conditions in the St. Lawrence, particularly frazil, beginning at Sault Ste. Marie in 1903 and extending at intervals until the present time near Montreal harbour, makes me doubtful whether an open ship channel can be maintained throughout the year, but the subject is of such importance as to warrant a thorough investigation.

I am not enough of a physicist to pass judgment on the various theories that have been put forward as to the formation of ice under controlled conditions of flow in narrow channels, but I think the study should be carried on both from the point of view of observation and of theory. As Mr. Kerry says, this is too large a task to be undertaken by anybody except Government authority, and the work should be international. If Canada and the United States would get together more than they appear to do now on their observations and interpretations, this would be of great benefit to both countries.

Mr. Kerry has not said much about frazil, but I presume he believes that with a regulated river, no great amount will be formed. This is probably true with the exception of the Lachine section. In that section the plans in the 1926 Report would not help conditions in Montreal harbour and below. Conditions in this section should be thoroughly restudied both in connection with prevention of frazil and to make possible a more complete utilization of the power possibilities.

If the St. Lawrence Waterways are to be started in the near future, I would not like to see the work delayed to obtain data or make plans for construction in an attempt to provide an open channel, but care should be taken not to build structures that would seriously interfere with its future development, if later study warrants. In this connection, it may be well to consider whether an experimental section cannot be developed as an all year waterway, say, in the Detroit, St. Clair or St. Mary sections, to determine whether the whole scheme is practicable.

Edwin Rose[5]

Mr. Kerry has presented data on the growth of ice sheets, lake temperatures and the rate of cooling of lakes in the fall and winter months. He has also given an interesting treatment of the geophysical laws controlling the exchange of heat energy in the waters of lakes and rivers. He cites the need for more observational data, particularly for the Great Lakes region, to permit the intelligent and scientific utilization of the heat stored in the deep lakes to keep the outflowing river waters free from ice.

The Bureau of Reclamation has gathered some data on reservoir water temperatures in the western part of the United States. While most of this material was obtained in the southwest where the winter air temperatures are generally above freezing, it is believed the limited information available in the colder regions of the U.S. will be of interest.

Observations of water temperatures at various depths in the lake and also mean weekly air temperatures have been made at Grand Lake, Colorado, for the years 1940 and 1941. The winter air temperature conditions there are probably similar to the conditions encountered in the vicinity of the Great Lakes and the St. Lawrence. Due to the higher elevation at Grand Lake, the summer air temperatures may be somewhat lower than in the Great Lakes region.

[2] Assistant Chief Engineer, Aluminum Company of Canada Limited, Montreal, Que.

[3] Air Services, Meteorological Division, Dept. of Transport, Toronto, Ont.

[4] President, Fraser-Brace Engineering Co. Ltd., Montreal.

[5] United States Bureau of Reclamation, Denver, Colo.

The figures show that the lake temperatures beyond a depth of about 100 ft. remain within a degree or two of the temperature of water at maximum density, about 39.4 deg. During the fall months, the upper portion of the lake cools until the temperatures throughout the entire depth are about 39 deg. This condition of uniform temperature occurred about December 1, after which time, until about April, the temperature remains about uniform except in the upper 10 ft. or so, where the temperatures decrease to the freezing point at the under side of the ice sheet, which usually forms in December.

These data indicate that the minimum water temperature at depths greater than about 50 ft. is not less than 37 deg. F., and for the most part remains about 39 deg. It is noted that the minimum temperature of Lake Michigan is about 36 deg. F. throughout. The effect of the wind velocity in the Great Lakes region in creating turbulence is probably a factor which tends to overcome the stratification tendency, thereby giving a slightly lower uniform temperature than would occur in an ice-covered lake such as Grand Lake.

The above record, although actually very limited in extent, does provide substantiation of the author's statement that the winter temperatures of deep lake waters are relatively warm.

Edward L. Cousins, M.E.I.C.[6]

We who have been concerned with Great Lakes transportation in conjunction with the St. Lawrence fully appreciate the fact that, in the past, it has been more or less taken as an accepted thing that river movements east from Montreal close some time during the last two weeks in November and as far as Great Lakes ports are concerned, cease around the 1st of December.

Mr. Kerry's suggestion for the collection of more data will, I think, be acceptable to the membership of the Engineering Institute, particularly those interested in navigation. This applies equally to the ports on the Great Lakes in the U.S.A.

The problem will require much study and it might be helpful to establish a committee including representatives from The Engineering Institute of Canada and the American Society of Civil Engineers. A problem of this nature might ultimately be referred to the International Joint Commission. As to Canadian representation on this committee, I would suggest that consideration be given by the Institute to the following: Department of Public Works, Department of Transport, Hamilton Harbour Commission, Toronto Harbour Commission, National Harbours Board, representatives from the Department of Physics of Toronto, McGill and Queen's Universities.

It is possible that the committee studying this matter may consider the availability of atomic energy as a source of heat.

S. R. Frost, M.E.I.C.[7]

There is a challenge to Canadian and American engineers in the suggestion that year-round navigation on the Great Lakes and St. Lawrence waterway may not be impossible.

The St. Lawrence and Great Lakes region contains some 50 per cent of the industrial development of the United States and 90 per cent of Canadian industry. This is largely due to transportation facilities provided by the great waterway which have permitted movements of bulk freight cargoes for rates as low as eight one-hundredths of one cent per ton mile.

That these navigation movements should cease abruptly in early December has to most of us seemed inevitable. It does seem possible that the use of these transportation facilities might be extended. At the present time, probably 90 per cent of Lake Ontario is open water and there is hardly any harbour that could not be kept open if required.

But the hazards of winter navigation are grim realities to those of us who have seen late ship arrivals in the upper lakes.

Most engineers will agree that Mr. Kerry has made a good case for the collection of more complete meteorological and geophysical data.

John Murphy, M.E.I.C.[8]

The coupling of Mr. Kerry's name with the ice question reminds me that, many years ago, I secured some patents in the United States and Canada regarding ice control. One of my licensees had some waterwheels made in Germany for a plant at Hull, Que., and they are still in successful operation. Shortly after these waterwheels had passed, successfully, through several winters, I met a Montreal engineer and I proceeded to tell him about my ice-fighting waterwheels. He interrupted me by saying:—"Walk down McGill Street to the harbour. There you will see hundreds of thousands of tons of ice. God put them there. Man cannot undo what the Creator does every winter. Now, don't talk like that any more. They'll put you in an asylum if they hear you!"

In the meantime, Dr. Barnes with his micro-thermometer let a flood of light in on the ice question. His work gave me courage to do things which proved the practicability of some of his contentions. My studies show to what a tremendous extent the agitation of the water in a stream is responsible for ice formation.

In a flowing river, measurements of the stream-flow at the period when the ice was forming indicated that 144,000,000 times more water went "down the river" than was turned into ice. Investigation also shows that frazil is, at times, so light that it will rise considerable distances in a flowing stream.

Another point not generally known about water is that its weight at different temperatures and at different depths is practically constant. Text books state that water at 32 deg. F. weighs 62.418 lb. per cu. ft., and at 39 deg. F. its point of maximum density, it only weighs .007 lb. more per cu. ft. At the Bubbler installations at power house racks or screens, there is not much work for the lifting air to do.

I would like to see Mr. Kerry put in charge of a committee to continue his study of the ice question.

A. E. K. Bunnell, M.E.I.C.[9]

Without question, great economic benefits would accrue to Canada and her neighbour to the south if all-year seagoing navigation could be obtained over the entire extent of the Great Lakes and St. Lawrence River waters.

Mr. Kerry has a clear-thinking analytical mind. His plea for more data should therefore be supported by the engineering profession in both countries.

I would accordingly urge that The Engineering Institute of Canada and the American Society of Civil Engineers should petition their respective governments to refer the matter to the International Joint Commission, and place adequate funds and staff at its disposal to carry out a full inquiry into the feasibility of the objectives envisioned by Mr. Kerry.

Prof. Robt. W. Angus, Hon.M.E.I.C.[10]

The author has not only given a brief and comprehensive review of the sheet ice problem as it affects the Great Lakes, but has presented much valuable data on lake temperatures and ice formation. Surely every member of the Institute will support Mr. Kerry's plea for more data. Further study of the problem should certainly be made.

While the paper deals almost exclusively with sheet ice and its effect on navigation in the St. Lawrence, it must be remembered that ice is also a serious problem in water power developments, and many of our Canadian plants have

[6] Consulting Engineer, Toronto Harbour Commission, Toronto, Ont.
[7] Chemical Administration, Montreal, Que.
[8] Ottawa, Ont.
[9] Consultant to Ontario Department of Planning and Development, Toronto, Ont.
[10] Professor Emeritus of Mechanical Engineering, University of Toronto, Toronto, Ont.

suffered much from it. The power companies undoubtedly possess valuable information. Waterworks engineers are also concerned with this matter, particularly where the water is drawn from the Great Lakes, although their chief enemy is frazil ice, which has, at times, blocked up intakes in water 20 ft. or more deep. So far as the writer knows, little has been done to determine the conditions under which frazil ice forms in such quantities as to cause serious trouble, nor does there appear to be much information on how to get rid of the trouble.

As far as the St. Lawrence goes, it has been generally assumed that navigation on it must be suspended during the winter. The author has suggested some possible lines of attack on the tremendous problem of handling the river ice. It is difficult to see, however, how the "warm" waters of the lakes could be drawn off while the colder parts are left.

The construction of a new channel from Lake Huron to a point below Montreal, which would be free of ice during the entire year, would indeed be a difficult undertaking. Nearly thirty years ago the writer made a study for the Hydro-Electric Power Commission of Ontario in connection with the intake for the Queenston plant at Niagara. In this case, it was desired to draw a large volume of water from the shallow Niagara River for the plant. There are times when quantities of broken sheet ice come down the Niagara River, much of it coming close to the Canadian shore where the intake had to be placed.

A brief summary of work covered is given in the writer's paper "Intakes for Power Plants", presented to the American Society of Mechanical Engineers in 1924.[11]

In this case the intake had to be designed to keep floating ice out, but some of the things observed there may be of help.

It was observed that where ice was very thick, anything that slowed up the river water caused the ice to pile up and make greater difficulty in clearing it from the stream. The author's proposed channel would require to be made to carry a good proportion of the total flow and this would slow up the water in the main channel and cause further ice concentration. It would appear, therefore, that an effective channel might have to draw off so much water that the resulting flow in the river would be too low. The writer is not trying to show that the author's suggestion is impracticable, but rather that it offers difficulties only soluble through intensive study and very complete model tests.

The writer wishes to congratulate Mr. Kerry on his presentation of such an important matter in so clear, brief, and interesting a manner.

Alfred W. G. Wilson[12]

Most of my old observations had to do with surface currents and shore conditions rather than with river flow and ice movements. However, there is one point on which I can at least make a note. On page 28 (*Engineering Journal*, Jan. 1946), about the middle of the first paragraph, the American Meteorological Society for 1944 is quoted as stating—"Lake Ontario was frozen over during the winter of 1933-34; this is the first time on record that such a condition has been reported".

Popular opinion does not agree with this statement, for references to the lake freezing over will be found in the files of the local papers at both Port Hope and Cobourg; it seems to have occurred about every ten or fifteen years.

It is not likely that any planes made records before 1933. I think it probable that the lake was frozen over in 1918 and I have a recollection of seeing it frozen over in a year between 1885 and 1889.

Of course the width of the lake at the point of observation and the impossibility of accurate checking, as with a plane, casts doubt on the accuracy of the observations of myself or of the earlier "Oldest Inhabitants", still I could certainly see at least half way across, and the notable absence of rising vapour gave some indication of the conditions prevailing.

A heavy cloud of vapour almost always shows above the lakes during the winter months, especially when the wind velocity is low. This cloud condition would not completely disappear if the lake were completely frozen—it would, however, be reduced in density.

Any freezing that does occur is infrequent, and is only for a very short time and would really have no bearing on the river flow at the east end. The ice that might make trouble is the massive—sometimes very massive—blocks and even small bergs from the ice foot. At the east end of the lake the ice foot is higher than in the vicinity of Grafton to Toronto. The movements of these bergs in the spring is—when they get afloat at all—controlled completely by prevailing winds. It is extremely doubtful if any of these reach Montreal, or even past the first rapids below Prescott, where they would probably ground. It is thus suggested that it is the marginal river ice that has to be diverted and controlled, so far as the St. Lawrence is concerned. On Lake Huron the lake ice from the ice foot must reach the river, and the problem will be quite different.

An extension of such shore studies to all the lakes and to winter, and especially spring, conditions is one of the first steps needed to find out first what the ice actually does.

C. G. Andrus[13]

I wish to ask one question referring to the "Conclusions", on page 34 of the *Engineering Journal*, for January 1946, and it concerns subparagraph No. 3. The question centers on the word "never"; we wonder if Mr. Kerry meant to say "never in the freezing or in the winter months".

F. H. Peters, M.E.I.C.[14]

The severe conditions of cold in the Great Lakes and the St. Lawrence Waterway region cannot be changed by man but it is not beyond reasonable imagination that the consequent adverse conditions may be ameliorated. Mr. Kerry throws down the challenge when he says "Historically, the struggle against the forces of ice and snow has been active for a century past and one gain after another has been achieved by the (engineering) profession."

His paper leaves no doubt that there is a very wide field of research and study which must be fully covered before any definite opinions and conclusions can be reached.

Evaporation is possibly one of the most weighty factors which bear on the balanced water levels throughout the Great Lakes Waterways. This point is brought forward merely to illustrate how delicate is the balance between supply and discharge, and how essential it is that none of the governing factors be disturbed without full knowledge of the ultimate effect.

If the latent heat in the waters of the Great Lakes is used or drawn upon to a greater extent than by nature, might it not tend to change the ratio of evaporation to precipitation?

Some ten years past, certain studies were made of this balance between precipitation and evaporation, for the watersheds of the Great Lakes and the Ottawa River. For the forty-five year period 1890-1934, it was found that the average annual loss by evaporation was 66 per cent of the precipitation in the Great Lakes watershed, but only 45 per cent in the Ottawa watershed. This difference of some 20 per cent is probably due to the enormous areas of the Great Lakes.

If this average of 66 per cent loss by evaporation were reduced to even 60 per cent, it would without doubt increase the discharge and therefore raise the average water levels throughout the waterways. It would possibly raise Lake Ontario by about 8 in. which might be a benefit to

[11] Intakes for Power Plants, A.S.M.E. Trans., Vol. 46, 1924. Paper No. 1945, pp. 1131-64.

[12] Consulting Engineer, Ottawa, Ont.

[13] Meteorologist, United States Department of Commerce, Weather Bureau, Cleveland, Ohio.

[14] Surveyor General and Chief, Hydrographic Service, Department of Mines and Resources, Ottawa, Ont.

navigation during low stages, but would not have been appreciated during the past few months by the land owners along the shores of Lake Ontario.

Major Richard Altman and Mr. Sherman Moore[15]

(The discussion on which these two collaborated expresses the privately-held opinions of both.)

The writers are in agreement with Mr. Kerry that a plea for more data on the winter temperature cycle of the St. Lawrence waters is long past due. A thorough knowledge of terrestrial heat absorption and radiation is essential to competent construction on and around the Great Lakes, and this cannot be obtained without a concentrated effort by the engineering profession as a whole. The United States Lake Survey Office has been observing and recording water-surface temperatures for many years as time and available facilities permit. At the present time, observations are being made only from the survey steamer. The amount of data collected probably is not sufficient for derivation of any set rules of ice formation.

The characteristics of snow blanketing and snow melt are under study by the United States Bureau of Reclamation, the Corps of Engineers, United States Army, and by other organizations in this country. The data are published as frequently as conclusions can be drawn from the observations made. In like manner, the United States Weather Bureau maintains a fairly dense pattern of observation stations. Weather conditions are meticulously observed and precise recordings have been maintained for a considerable period of time.

Similar activities are being carried on by the several agencies of the Canadian Government and undoubtedly these can be augmented by records compiled from the observations of individuals whose scientific approach to the problems can be assured. The efforts, then, on the part of the two governments, and of interested individuals, should act as a stimulus to the entire engineering profession.

To be complete, water temperature records, at various depths and covering a reasonably long period of time, must be analysed with proper regard to the possible influences of sun, wind, air temperature, snow, etc. Latent heat has a direct bearing on the period of time and the amount of ice that forms on the surface of lake waters; but it, in itself, is not conclusive because of changing air temperatures and changing conditions of roughness due to wind action.

Freezing of flowing water is less affected by the loss of latent heat than by movement of the mass. Flow conditions, therefore, must be considered along with other factors when considering Mr. Kerry's recommendation for transference of "hot" water from one location to another. The water may be kept free from icing by movement alone, but it will freeze over when velocity is low and depths are small.

Granting that sheet ice and float ice are the principal hazards to winter navigation in the Lower St. Lawrence, those conditions alone do not govern the desirability for winter navigation on the Great Lakes. The demands for winter shipping, when made, come from installations on shore that are affected by many conditions totally unrelated to the existence or non-existence of open navigable channels. Reaction of the boat operators to these demands is seldom, if ever, favourable because of the known tendency for mist and spray to form ice above the water line—at times it completely covers the ships superstructures to thicknesses in excess of 12 in. This added weight, combined with reduced operating efficiency, makes winter navigation risky to life and property. Consequently, before winter navigation on the Great Lakes becomes economical, the hazards cited must be eliminated or controlled. The Lake Carriers' Association and governmental bureaux of both countries have some data on these factors and perhaps would be interested in further pursuing the study.

Open channel connections that would flow free of ice are conceivable. From practical and economical considerations, however, it seems probable that the resulting detriments would greatly exceed the possible benefits. For instance, it is considered that an open channel without locks as proposed by Mr. Kerry at the Soo would require a width of about 600 ft. and a depth of about 30 ft. Such a channel, if uncontrolled, would for a time develop a flow sufficient to prevent icing because the drop between Lake Superior and Lake Huron is about 19 ft. It would also develop an outflow greater than the total mean supply of Lake Superior. This would reduce the lake level to such an extent as to render present shore installations useless and would eventually reduce the flow to less than enough to maintain navigation through the channel in any season. If the channel is constructed with locks there will not be a continuous flow, and the channel will freeze.

The watershed of Lake Erie is not sufficient alone to maintain the level of that lake. If the St. Clair River were diverted around Lake Erie, evaporation eventually would render the lake dry.

Detrimental results must be considered and outweighed by known benefits before any plan can be said to be effective. The writers, therefore, cannot concur in Mr. Kerry's recommendations. They are in firm agreement, however, with his plea for more data.

F. Graham Millar[16]

The Meyer evaporation formula was determined empirically from data observed at shore stations. No allowances were made for the frictional errors of anemometers, nor for the fact that wind velocity in the middle of a lake averages higher than at the most freely exposed shore station. Nor does it allow for the reduction in midlake of the difference in vapour pressure between the air and the water; this difference is reduced by the presence of additional vapour. On account of the formation of a vapour blanket, there is an area effect, so that larger bodies of water evaporate less per unit area than smaller ones. If suitable adjustments are made to the data, the Millar formula on page 10 of Mr. Kerry's paper gives results in fair agreement with Meyer's formula. The theoretical formula supposes the data to be measured over an infinite water surface, within the vapour blanket.

J. R. Freeman compared the evaporation by Meyer's formula with the deficit in water supply on the Great Lakes, obtained as the difference between the visible water supply and the outflow. There was fair agreement. Therefore Freeman adopted values of evaporation adjusted to give some weight to the determination by Meyer's formula on one hand, and the deficit in the water budget on the other.

H. C. Hickman did not make due allowance for the area effect when he applied the data on evaporation observed in pans and tanks to the Great Lakes. His figures are too large. The conclusion is that Freeman's estimates are better.

The constant in the Bowen ratio should be .501 instead of .46. This constant is the same as the psychrometric constant used in determining relative humidity from wet and dry bulb readings. The derivation of the constant is given in Humphreys' "Physics of the Air", pages 13 and 14. The constant found by Humphreys, when multiplied by 760 mm. normal pressure, is .501.

The pyrheliometric readings at Toronto exceed those for Chicago and Madison (Fig. 7) for June, July, and August. For other months, the agreement is excellent, but the peak rises to 1950 B.T.U./day sq. ft. for July. It is not known whether the difference is climatic or instrumental. Since radiation has economic importance in the design of heating installations for buildings, the subject is receiving increasing attention from the weather bureaux of the United States, Canada and other countries.

The components of the heat budget of lake waters due to evaporation, convection, and insolation, have been esti-

[15] War Department, U.S. Lake Survey Office, Army Map Service, Detroit, Mich.

[16] Air Services, Meteorological Division, Department of Transport, Toronto, Ont.

mated to the correct order by Mr. Kerry. The preceding considerations would effect refinements to the numerical values, but would not change them seriously. The one remaining factor, nocturnal radiation, has not been treated satisfactorily. Low clouds cut off nocturnal radiation almost entirely; high clouds have little effect. Therefore, the outgoing radiation is about equal to the radiation on a clear night, multiplied by the average percentage of sky free from low clouds.

Night data on cloudiness have only been collected by meteorological services in recent years since airlines began scheduled night operations. There is no quantitative information on this for the open lakes, though the cloudiness over the open lakes assuredly exceeds the amount over shore stations in fall and winter. The data for land stations could be applied to the St. Lawrence.

On the whole, Mr. Kerry seems to have reached a true conclusion, that a regimented St. Lawrence River could be kept virtually ice free. He is justified in calling for more data, as he has opened the door to a field of great theoretical interest and economic importance.

Charles G. Abbot[17]

I am glad to express my appreciation of Mr. Kerry's paper and my entire agreement with his basic conclusion that experimental data are very much needed in these fields. Mr. Kerry presents a valuable summary of important considerations regarding the formation and disposal of ice. One is particularly pleased by his suggestions that something helpful can be done about it. But though he points out hopeful ways of improvement, he also points out that we lack much of the data which are needed to justify the expenditure of large sums for engineering works. It is a gratification to me that my successor as Director of the Smithsonian Astrophysical Observatory, Mr. L. B. Aldrich, in cooperation with the Quartermaster Corps of the U.S. Army, has installed powerful and ingenious automatic apparatus for observing various wave-length intervals of sun and sky radiation, and proposes to make a long study at various points of the earth's surface in these lines. While these measurements are perhaps remote from Mr. Kerry's problems, it is hopeful that a great branch of public service like the U.S. War Department should see its way to cooperate in obtaining data of public value urgently needed.

Robert E. Kennedy[18]

The writer has been especially interested in the use of the energy equation as set forth in Richardson's paper and cited by the author.

The main handicap to this theory is the lack of data, but progress has been made since that paper was issued, notably in the measurement of atmospheric radiation. Prof. Richardson's equation for back radiation may well be superseded by Elsasser's Radiation Chart.[19]

The construction and use of this chart was made the subject of lectures 14 and 15 by J. R. Fulks, Weather Bureau, Washington, D.C. at a Regional Technical Conference at Oakland, Calif., 1941. The lectures were out of print when the writer inquired in 1943. They may be available now. At least they should be, for the writer found them helpful.

The author mentions the Bowen ratio. In English units of inches and degrees Fahrenheit it is:

$$R = 0.01 \frac{P}{29.92} \frac{(T_w - T_a)}{(E_w - E_a)}$$

This relationship is still the subject of controversy twenty years after it was first published. An excellent discussion of its validity by H. V. Sverdrup is available in a separate section of the Annals of the New York Academy of Sciences.[20]

H. C. Hickman[21]

The subject of Mr. Kerry's paper may appear to be academic, at the present time, but it becomes more and more important as the economic growth of the Great Lakes-St. Lawrence area continues. A complete revaluation of our water resources remains a vital necessity.

I propose to duscuss four inter-related subjects which have been considered in the preparation of Mr. Kerry's paper and in which I have a special interest, namely:

1. The lack of hydrological and meteorological data in the Great Lakes—St. Lawrence basin;
2. The inadequacy of present evaporation formulae;
3. The feasibility of warm water channels;
4. The importance of a new International Policy towards conservation of water resources.

Speaking only for the United States, the lack of hydrological and meteorological statistics, not only in the St. Lawrence basin, but throughout the nation, is a national disgrace. The necessity for scientific facts which can be used to solve an emergency problem seems to become apparent only when the problem arises. For instance, government agencies have been collecting rainfall data at various locations for over a hundred years. The locations have been selected by chance with no consideration for all problems involved and, as a result, the meteorological coverage for large areas is woefully inadequate.

Inadequacy of records extends to most other hydrologic fields. Discharge records on the tributary streams of the Great Lakes, for instance, are better in the Canadian wilderness than they are in the populated areas of the Border States. This condition is due primarily to the understanding of Canadian agencies regarding the problems involved, and the lack of foresight on the part of American political agencies. The fact still remains, however, regardless of conditions, that no one single stream in the Great Lakes-St. Lawrence system is adequately gaged. Very little, if anything, has ever been done on the investigation of ground water storage, snow surveys, lake currents, lake temperatures, land evaporation, and evaporation from open water surfaces. The only careful, long range investigation of hydrologic factors in the lake regions worthy of the name has been the work of the United States Lake Survey on discharge through the connecting channels of the Great Lakes and the records on lake levels. These records are necessary for the maintenance of channel and harbour depths for navigation. Whenever we plead for better data the answer is always "Why spend public money for purely academic research. We have water to waste in the Great Lakes area." Maybe so, but let me mention some of the results of such a policy.

In the Thumb District of Michigan, the farmers and many of the villages and towns are concerned because their wells have gone dry, despite the fact that rainfall, lake levels and snow-melt all appear to be above normal, while population and industrial demands have remained constant. Similarly the area around Wausseon, Ohio, in the Maumee River Valley, is experiencing a serious ground water shortage, so serious that farming and industrial operations may have to be suspended. Cities in Michigan are now required by law to treat their sewage wastes because our streams no longer are able to dissipate these wastes due to decreasing stream flow. We do not have an unlimited supply of water in the Great Lakes area, and unless we begin *now* to keep accurate scientific records on all factors of the hydrologic equation, we may in the very near future be faced with a problem we cannot solve.

[17] Smithsonian Institution, Washington, D.C.

[18] United States Bureau of Reclamation, Boulder City, Nevada.

[19] Harvard Meteorological Studies, No. 6, "Heat Transfer by Infrared Radiation in the Atmosphere", by Walter M. Elsasser, 107 pages, published by Harvard University, Blue Hill Meteorological Observatory, Milton, Mass., 1942, $1.25.

[20] Annals of the New York Academy of Science Vol. XLIV Art. 1, pages 1-104 "Boundary-Layer Problems in the Atmosphere and Ocean", published by the New York Academy of Sciences, Central Park West of Seventy-Ninth Street, New York, 1943, $1.25.

[21] Formerly Captain, Corps of Engineers, War Department, Detroit District, Detroit, Mich.

We are dissipating our water resources at an alarming rate. We *must* collect the necessary scientific data so that we can intelligently face the future. We must devise a plan for conservation of water resources backed by reliable hydrological and meteorological statistics.

The remarks I have just made regarding lack of data are very well illustrated in Mr. Kerry's paper. Take just one item—the inadequacy of present evaporation formulae. Investigations into this factor of the hydrologic equation have been made and have been based on the fundamental equation of differences in vapour pressures or upon one of the popular solar radiation equations. All evaporation formulae have had their individual uses and each in itself contributes to the knowledge of hydrology. Records on evaporation, however, have not been kept for a long enough period to determine what formula is best suited to Great Lakes conditions. No formula that I investigated in my studies on water losses from the Great Lakes would give me accurate results through a temperature range in water temperatures from 33 deg.F to 85 deg.F. and through a range of air temperature from 10 deg. below zero to 95 deg. above. No one, in studying losses from large bodies of water, had ever considered evaporation as an important factor during winter months. They knew the lakes were not entirely frozen over during winter months but they assumed that at low temperatures air could not possibly carry much suspended water vapour.

But, during winter months, such evaporation does take place and at a rapid rate. There are two reasons: one—because whenever there is a difference between water and air temperatures, regardless of whether the air temperature is above or below that of the water, conditions are such that water vapour is given off from the body of water; and, two—vertical air currents over large bodies of water carry away vapour at a tremendous rate, the latter condition not being reflected in most evaporation formulae.

In reviewing Mr. Kerry's paper, I find that my monthly values of evaporation from Lake Huron, when used in his calculation for rate of heat loss in B.T.U. per sq. ft. per day from open water surfaces, give the best results. Mr. Kerry has used a purely scientific computation which any engineer can check. His results compare very well with computations made in other parts of the country under decidedly different conditions. None of the other evaporation formulae when applied to Great Lakes conditions give him a value which will even approximate the figures he used. I point this out, but do not attempt to criticize other formulae as such. All I say is that we know very little about certain factors of the hydrologic equation, and unless we start to collect records, and study them, there may come a day in the near future when we shall be in a tight spot.

To pass from the scientific portion of Mr. Kerry's paper to the practical, I feel that without the necessary data to approximate a preliminary design, one cannot even guess at what would be necessary to provide warm water outlets for winter navigation through the lakes. The scheme as presented seems within the realm of possibility from a scientific standpoint but I do not know whether it is practical from an economic standpoint.

The channels of the Great Lakes have been greatly improved during the last 50 years. I believe that water transportation in the Great Lakes area is here to stay, modified perhaps in the years to come. In any event, the final plans for the St. Lawrence Waterway should not be completed until the question of providing for warm water channels has been thoroughly investigated.

During the last five years we have been confronted with navigation and water supply problems of major importance. There has been a demand for deeper drafts in our navigable channels. Shall we deepen channels and build more vessels, or shall we increase the navigation season by building all-year channels? If we had the necessary scientific data, we could determine what the economical answer should be.

Similarly, certain industrial and metropolitan areas are at the peak of their productivity and growth because their water resources are being depleted. We must begin to study the problem from a scientific standpoint. This cannot be done on a small scale by local communities.

I should like to close my discussion with a request which will summarize Mr. Kerry's paper and the remarks I have just made, namely:

> That an International Hydrological and Meteorological Joint Commission be appointed by The Engineering Institute of Canada and the American Society of Civil Engineers for the purpose of—
>
> 1. Formulating long range plans for the conservation of water resources in the Great Lakes-St. Lawrence Basin;
> 2. Collecting and analyzing hydrologic and meteorologic data necessary to the successful operation of the above plan;
> 3. This commission should have the sanction of both the Canadian and American governments and further, public funds should be appropriated to carry on its work.

W. L. Bird, M.E.I.C.[22]

The outlet of the Kaministiquia Power Company lakes has been found to remain open during the most extreme sub-zero weather. Figure 10 indicates conditions at outlet of our Dog Lake storage dam where a 12 in. overflow over our spillway dam keeps channel open for 300 ft. above the dam, as well as below, even in extreme sub-zero (38 deg. below zero) weather. We thereby free our dam of ice pressure hazards.

At our reservoir control dam at Kakabeka Falls, we use an air bubbler system for the same purpose, which it does most effectively. At this point we closely conserve all water waste.

In the winter of 1936, we were faced with the advisability of lowering lake storage in anticipation of an advance of heavy spring freshets. On March 18, 1936, we increased the flow from Dog Lake dam from 1100 to 1800 cu. ft. per sec.

By March 31st, the river had opened clear to Dona, some 18 miles below the dam, and continued to open clear to Kakabeka Falls, some 35 miles below Dog Lake dam, before the tributary creeks and streams opened up.

During the period in question, the temperature frequently dropped below zero as late as April 8th.

An aerial observation was made confirming these conditions. The spring freshets did not commence until April 17, 1936.

Our Dog Lake dam discharge is by means of underflow gates which draws the warmer water from 20 ft. below lake level. Dog Lake is at elevation 1380, and is located about

[22] Vice-President and Manager, Kaministiquia Power Company Limited, Fort William, Ont.

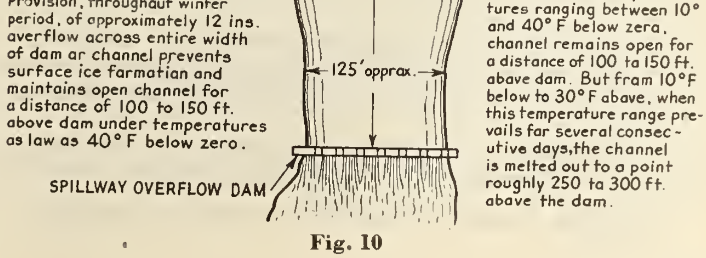


Fig. 10

50 miles northwest of Fort William on Lake Superior. Minimum temperatures are around 30 to 40 deg. F. below zero and have been as low as an extreme of 50 deg. below.

Based on our experience, I would say there are possibilities along the lines proposed by Mr. Kerry. While making these observations, I am not entering into the problem of economics or other difficulties involved under all our extremes of climate.

Frederick W. Cowie, M.E.I.C.[23]

Mr. Kerry's paper is a work showing much study. It mentions authorities such as T. C. Keefer, John Kennedy, and Dr. Barnes, whose names bring to mind much of success and of failure.

Thos. C. Keefer, as consultant on the construction of the Victoria Bridge in 1860, has never received the credit his country should have bestowed.

John Kennedy was a mechanical genius, of a family well known for invention and design.

Of scientists, Dr. Barnes was prominent in ice engineering. For many years he investigated our ice and frazil problems.

However, credit is due not only to Barnes, Kennedy and Keefer, but also to Dr. Robert Bell, the geologist, to Murphy of Ottawa, to Wilson of the Light Heat & Power, who, with Holgate, experimented and nearly won the battle of frazil.

At the time of the Montreal Flood Commission in 1886-87, Mr. Keefer sent me as observer to Lake St. Peter to find out how the ice took. The ice on the lake started to form on the shallows, and due to shipping and gales, was swept down to Nicolet and Pointe-du-Lac, where it grounded in side jams and, on December 1st, closed the gap.

The next event was the trial of three armoured tugs at Sorel. They could rip through 6-in. ice, buck 8-in., and, working together, break through 10-in. ice. But they had difficulty in keeping their condensers from choking from "snow ice" floating under the channel ice. This was frazil from Lachine Rapids.

Then the young observer was sent to Ottawa for consultation with Dr. Robert Bell, Geological Survey. Dr. Bell said he knew a lot about anchor ice. It formed under water on the rocks on a cloudy day and floated in sunshine. It did not form under a bridge or close to a shelving rock. It floated in rapids in lines of the swiftest water.

Then, in Montreal, there was a jam early in April 1887. Over the wharves, up to Beaver Hall Hill. What a flood! The jam was from Laprairie to above Longue Pointe. Experiments to break it were made with black powder, Giant powder, nitroglycerine, and 60 per cent dynamite. The last was the best. The first lot during good sleighing passed over the Laprairie road, the second was halted by the police opposite the City Hall. The iron shod runners grinding on the pavements caused a shower of sparks which did not look well under a loard marked "Dynamite—Dangerous". Go on? No! Go back? No! What could a poor man do?

But the dynamite was safely taken to a warming shanty on the ice, and the observer, unlucky as being the only bachelor, had to handle the job. It all had to be exploded before the break-up, which looked imminent. The next day, the ice bridge broke, but away over on the south side more than half a mile from the nearest shot.

From personal observations made at that time, and from personal observations of the work of the *Lady Grey*, the *Ernest Lapointe*, or the *N. B. McLean*, I am convinced that such ice breakers could have broken the 1887 undynamited ice-jam in a week.

In 1905 the Transportation Commission presented a splendid report and the result was the putting into operation of the Ice Breaking Service of the River St. Lawrence Ship Channel.

Now comes a question for Mr. Kerry: At the present time, when research is the vogue, do you suggest the use of atomic heat to warm the waters of our lakes or rivers, so that ice will not be the menace of winter navigation?

Can scientists produce split atoms which will, in any form possible, apply such intense heat without danger to fish life or any other life? Can Mr. Kerry answer that?

[23] Consulting Engineer, Montreal National Harbour Board, Montreal, Que.

J. K. Sexton, M.E.I.C.[24]

Mr. Kerry has dealt with ice control from the point of view of navigation. In the case of irrigation or hydro-electric work, it is frazil and slush that have to be controlled instead of sheet ice. When an ice cover forms on a reservoir or canal, it provides effective insulation to reduce heat losses, and, as a general rule, puts an end to the hydro-electric engineer's troubles. However, in the case of canals it is not always feasible to reduce velocity sufficiently to permit the formation of such an ice cover.

Over the past few years, the Montreal Engineering Company has been investigating both methods of heat conservation described by Mr. Kerry, namely:

1. Raising the temperature of reservoir discharge by withdrawing water from as great a depth as possible.
2. Lowering heat losses from open water surfaces in canals by reducing the ratio of surface area to discharge.

Using Negretti and Zambra deep sea thermometers, sub-surface water temperatures have been measured at several lakes in Alberta, Nova Scotia and Newfoundland to determine the temperatures available at various depths. This work has been carried on chiefly in winter time when it could be fitted into the routine of the operating staff. Hence, continuous records are not yet available. Wherever the ratio of inflow to reservoir volume was low, the sub-

[24] Montreal Engineering Company Limited, Montreal, Que.

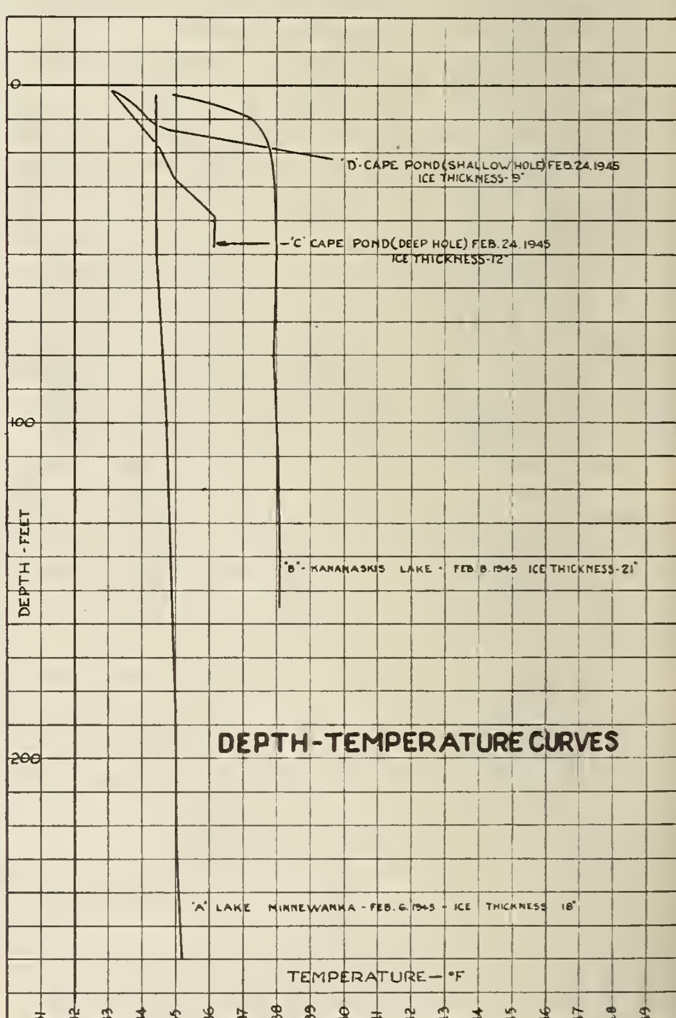


Fig. 11

surface temperatures were found to be well above 32 deg. F. after the formation of an ice cover. However, much variation was encountered in the depth temperature curves, even for lakes in the same locality. This is illustrated by the curves in Fig. 11. Curve A shows the temperatures of Lake Minnewanka near Banff, Alberta, on February 6th, 1945. Throughout a depth of 260 ft., the temperature was near 35 deg. F. Curve B shows conditions existing at Upper Kananaskis Lake, 48 miles to the south, two days later. The latter lake, although shallower, had a temperature of 38 deg. F. between depths of 25 and 165 ft. Curves C and D show conditions existing in the shallow Cape Pond in Newfoundland on February 24th, 1945, the former being measured near the centre of the lake and the latter in shallower water near the edge. These conditions are fairly typical of Newfoundland lakes.

Unlike the lakes of Newfoundland, those of Alberta appeared to have a fairly constant temperature gradient over their entire area.

The important thing from the hydro-electric point of view is that the evidence to date indicates that the deep, warm water can be drawn off throughout the winter at a temperature corresponding to its elevation. This is illustrated by the curves of Fig. 12 for the Ghost reservoir in Alberta on December 21st, 1944. Curve A was measured 200 ft. from the intake, and Curve B was measured at a further distance of some 2000 ft. in the Ghost arm of the reservoir. It will be noted that the temperature of the tailrace discharge corresponded closely with that of the elevation of the intake. This close relation was found to continue throughout the winter.

As for the heat losses from exposed water surfaces, we have accepted the figure of 95 BTU./°F. /sq. ft./day recommended by the Joint Board of Engineers in their

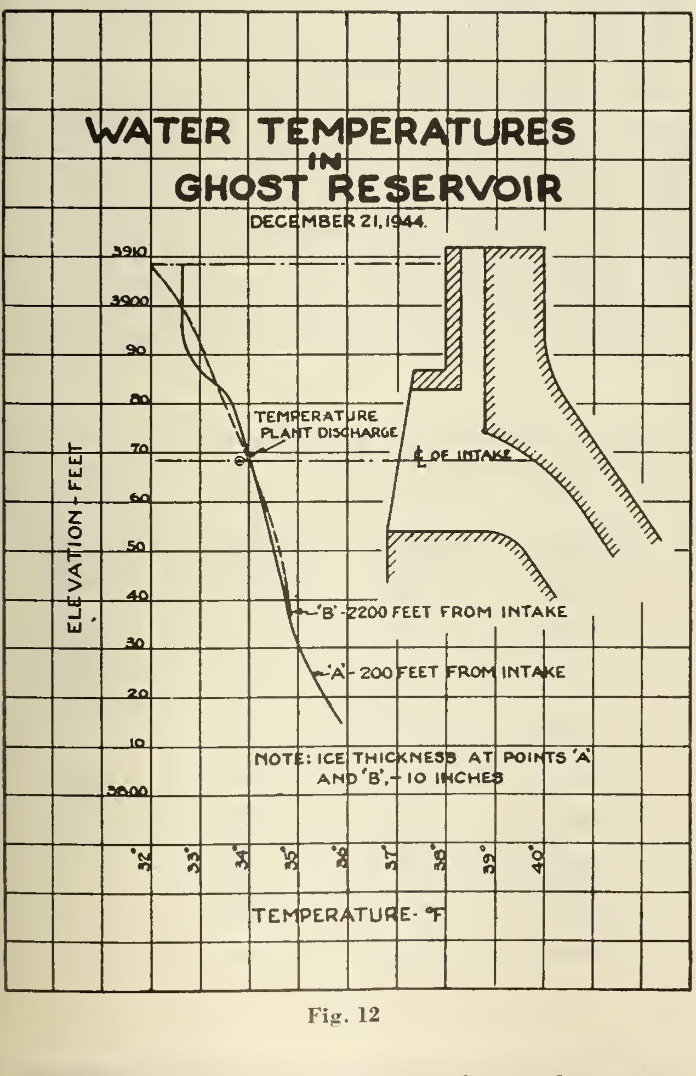


Fig. 12

1926 report. During the past two winters a number of attempts have been made to check this value on the LaManche Canal in Newfoundland but to date the results have shown a great deal of variation. Some of these may be eliminated as our technique improves. On the whole, the average values of the heat loss constant found have been lower than that of the Joint Board. This is probably due to the shelter from transverse winds that is provided by the comparatively high banks of the narrow canal. Results indicate that wind velocity may cause more variation in the heat loss than other factors.

The case of the LaManche Canal mentioned above offers an example of successful application of heat conservation theory. This canal, some 3 miles long, forms part of a chain of lakes and streams supplying water to the Rocky Pond and Tors Cove power developments. Water is discharged through the control structure at the outlet of Cape Pond. From there it flows down two miles of rapid, open river channel, before being diverted into the canal in question, where it continues at too high a velocity to permit the formation of an ice cover. On starting up operations in 1942, it was found that by the time the water reached the diversion dam in cold weather its temperature had dropped to 32 deg. F. and serious ice troubles developed in the canal. Using a heat loss constant of 95 Btu./°F./sq. ft./day it was calculated that the freezing point could be moved sufficiently far downstream to avoid this trouble if the area of exposed water surface between the control and diversion dams could be greatly reduced, and if the temperature of the discharge from Cape Pond could be prevented from falling much below 33 deg. F. To meet the first requirement, a deep, narrow canal with high velocity was substituted for the two miles of river bed between the two dams. An attempt to meet the second was made by placing a curtain wall in front of the stoplog openings at Cape Pond dam in order to draw off water from as great a depth as possible. Owing to the shallow depth prevailing at the outlet it has not always been possible to obtain discharge water at 33 deg. F., but apparently the temperatures obtained have been sufficient to improve operating conditions materially. The remedial measures have now been in effect since the fall of 1944 and no serious ice troubles have occurred since that time.

E. B. Strowger[25]

In his paper, Mr. Kerry has presented the analysis of a great mass of data which should encourage a comprehensive scientific study of the temperature cycles of the Great Lakes and of the possible beneficial use of the stored heat energy they contain.

Under the heading of "Sheet Ice", the author pleads for an extended survey on ice formation and ice movement on the Great Lakes, including a study of the possibility of designing and constructing detour channels and of creating barriers to keep the ice from the natural channels. In this connection it may be of interest to mention the operations of The Niagara Falls Power Company in combating ice troubles.

It is generally agreed that ice troubles in power plants occasioned by frazil and anchor ice will not exist provided the intake canal and the river above the intake have a sufficiently thick coating of ice. The problem of providing a means to get rid of the sheet ice as it is broken up would still remain, however. In the case of The Niagara Falls Power Company, sheet ice is taken care of by means of floating booms installed parallel to the flow of the river. The booms, which are chained to concrete piers, prevent the floating ice from entering the intakes of the power canals and power tunnel. The velocity of the water underneath the booms is kept low and for this purpose a channel has been dredged out from the main power canal to a point beyond the booms. When ice tends to clog the river channels

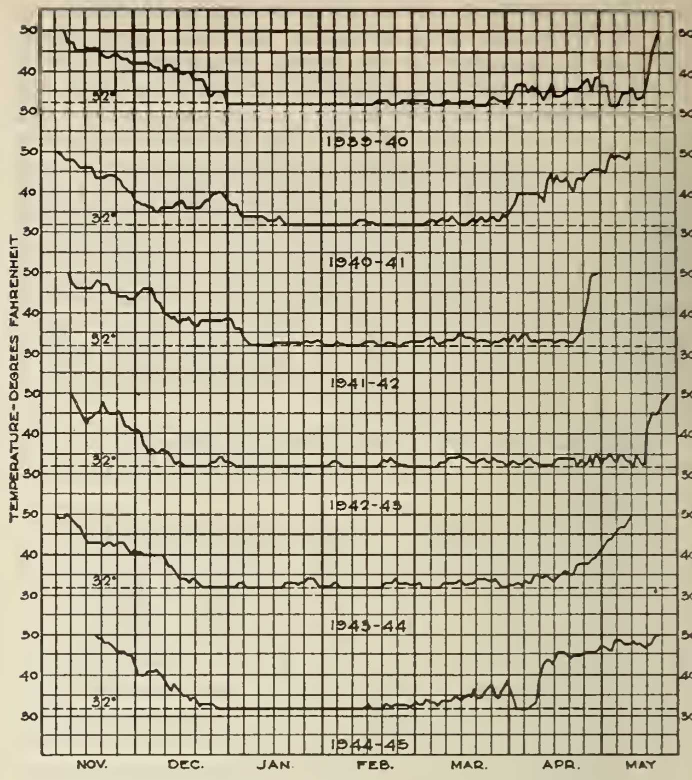
[25] Hydraulic Engineer, The Niagara Falls Power Company, Niagara Falls, N.Y.

near the boom structure, ice breaker tugs are put in operation. Any sheet ice which does get beneath the booms and into the power canal is removed at the gate house near the power plants by means of an ice skimmer and mechanically operated rakes, or is passed through the turbines which generally are operated in the winter time with racks withdrawn.

One problem connected with Niagara River operations is the formation of ice jams in the upper river. These have formed in the shallow water at the head of Goat Island, have extended upstream on the river shoals and have at times gradually encroached on the deeper channels. On several occasions the jams have reached the boom structure referred to above, and have caused serious power plant interruptions. This condition has not been experienced to any serious degree during the last four years because of the existence of relatively high lake stages and the building of the Niagara River submerged weir in 1942 in the Canadian channel of the Chippawa-Grass Island pool, a short distance upstream from the first cascade. The weir was built for the purpose of improving conditions for the generation of power because of the war emergency and at the same time for improving scenic conditions. While not enough time has elapsed since the construction of this weir to subject it to the most severe conditions which might prevail, so far it has been considered as very successful.

The weir has increased the levels in the Chippawa-Grass Island pool and thus has improved the conditions at the power plant intakes which draw water from this pool. It has also increased the discharge of the channel leading to the American Falls from approximately 9,400 to approximately 18,000 cu. ft. per sec. for a given total river flow and thereby acts to sluice more ice past the intake structures.

In order to be prepared to schedule river tug operations and the "pulling" of the steel racks, a record of the temperatures of the Niagara River water and of the levels of the river and of Lake Erie are kept. A series of winter temperature readings for the last twelve years are shown in Figure 13. During each of the winters of 1935-36 and 1937-38, there was a long period when the water temperatures were at or near 32 deg. F. During these two seasons there were severe ice jams in both the upper and lower sections of the river, the worst conditions existing in 1935-36 when the lake and river stage was extremely low. The effect of the ice jams resulting from the combination of low levels and the extended cold period upon power plant operations at Schoellkopf Station is shown in Figure 14 by the low levels existing at the Grass Island gauge for part of January and a major portion of February 1936, this



SURFACE TEMPERATURES OF NIAGARA RIVER WATER
TAKEN AT SCHOELLKOPF STATION OF
THE NIAGARA FALLS POWER Co.

Fig. 13

gauge indicating the head water level of this development. Similarly, the rise in level of H.E.P.C. gauge No. 12 shows the rise in tailwater level at the Queenston plant of the Hydro-Electric Power Commission occasioned by the ice jam in the lower river during this period.

Mr. Kerry points out that the studies of Mr. Church on the surface and subsurface temperatures of Lake Michigan indicate that the "water temperatures at depth coincided almost exactly with those on the surface". It should be noted that all of the curves derived from Mr. Church's observations except possibly one, shown in Figure 4, are based upon observations taken when the lake is at or near the temperature of maximum density of water; that is, 39.4 deg. F. It should perhaps be pointed out that, at this temperature, it is reasonable to expect a uniform tempera-

Table VI

Surface and Subsurface Temperature Measurements on Six Reservoirs in New York State

Reservoir or Pond	Trenton Falls	Caroga Lake	Inghams	Flat Rock	Pecks	Hinckley
Character	Small pond with large outflow	Small lake with small outflow	Small pond with large outflow	Small pond with large outflow	Large pond with small outflow	Large reservoir with large outflow
Date of Observation	1/29/29	2/15/29	2/6/29	2/9/29	3/16/29	1/30/29 and 3/19/29
Ice Cover	2¼″ to 4″	19″	27″	Not measured	18″	15″
Outflow—cfs	1200	0	446	—	0	—
Approximate pond volume—mcf	11.2	109	147	156	245	3500
Drainage Area—sq. mi.	376	8	278	268	19	373
Surface Area—sq. mi.	0.01	1	0.27	0.24	1.5	4.1
Temp. at Surface—°C.	0	0.45	0.01	0.1	0.05	0.1
Temp. at lowest depth observation—°C.	0.10	3.35	0.48	0.56	4.4	0.6–2.3
Depth of lowest depth observation—ft.	40	40	45	53	15	44–56

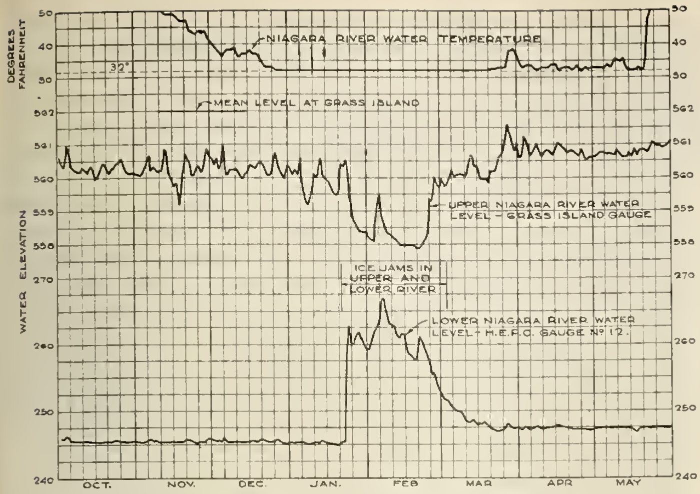


CHART SHOWING EFFECT OF LONG LOW TEMPERATURE (WINTER OF 1935-6) AND LOW WATER STAGE ON FORMATION OF ICE JAMS IN NIAGARA RIVER

Fig. 14

ture gradient. Where the surface temperature of a large deep reservoir drops below that corresponding to maximum density and approaches the freezing point, the temperature increases rather rapidly with depth, the temperature near the bottom approaching 4 deg. C. (39.4 deg. F.).

During the winter of 1928-29, the Hydraulic Power Committee of the Empire State Gas & Electric Association, of which the writer was a member, made observations on the temperature gradients in six reservoirs in New York State using accurately calibrated deep sea thermometers of the inverting type.

The purpose of this work was to ascertain what the variations were and the conditions under which temperatures were extremely close to freezing or measurably above that point.

Tests made to ascertain the characteristics of the thermometers used showed them to have an accuracy within approximately 0.01 deg. C. The committee measured the sub-surface temperatures of six reservoirs varying in size from a small pond of 11 mcf capacity to a large reservoir having a capacity of approximately 3.5 bcf. Some of the results of the observations are shown by Table VI and by Figure 15.

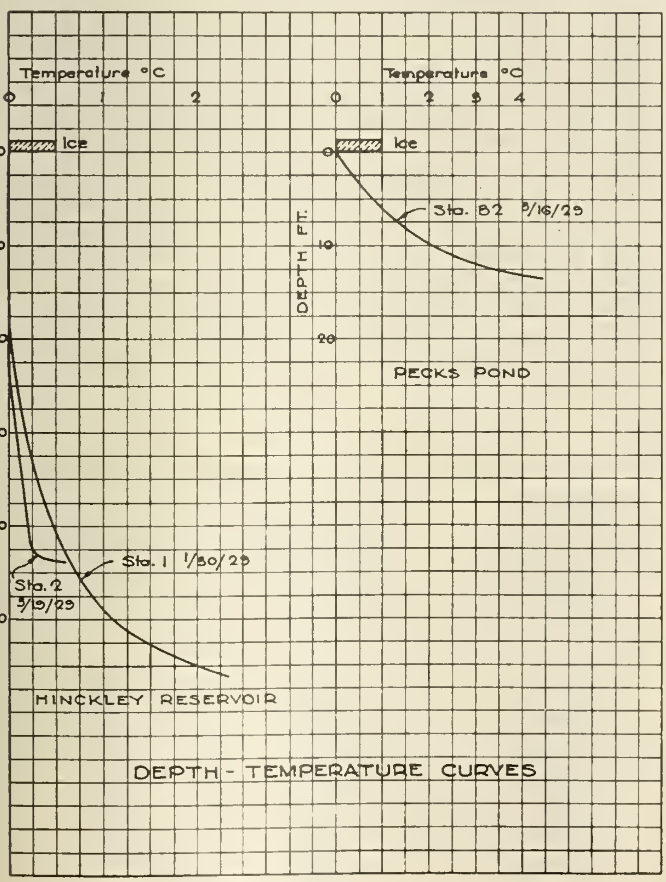


Fig. 15

The committee concluded that large bodies of water with small outflow and inflow assume maximum temperatures near the bottom of approximately 4 deg. C. As the ratio of inflow to capacity increases the maximum temperature falls as well as the temperature gradient from the undersurface of the ice to the bottom. Where the surface temperature is close to 0 deg. C., the temperature gradient increases from the underside of the ice to the bottom of the pond in a form approximating a parabolic curve with the vertex at the bottom of the pond.

The Author

The most important feature in the discussion on this paper is the unanimity of opinion of all contributors as to the desirability of further research into the annual temperature cycle of the waters of the Great Lakes and of the St. Lawrence River. The variations from year to year in the results obtained by Professor Church and by Mr. Millar indicate that dependable conclusions cannot be reached until a long series of observations has been made available. It is not to be expected that the results obtained by Professor Church on Lake Michigan will prove to be sure guides for estimating the temperatures of the other lakes during the winter months.

In view of the opinions expressed by so many members of mature experience, the Council of the Institute surely would be justified if it decided to draw the attention of proper authorities both at Ottawa and at Washington to the desirability of an extensive international study of the whole question of these water temperatures. The profession will not be in a position to make beneficial use of the stores of natural heat in the Great Lakes until engineers' observations have been co-ordinated with conclusions drawn from scientific study by geophysicists.

This question is perhaps more important to Canada than it is to the United States because in Canada the ice problem becomes increasingly more difficult to deal with as one goes northward from the border line, whereas it steadily diminishes in importance and finally disappears altogether as one goes southward. Any lessons learned on the St. Lawrence River can in the future find applications in such rivers as the Nelson, the Saskatchewan, the Peace and the MacKenzie. The MacKenzie River resembles the St. Lawrence in the great area of its tributary lakes and, no doubt, much can be done to increase the beneficial use of its waters by storage and by temperature control.

The comments of Dr. Abbot, who became internationally famous for his studies of solar radiation, show how much his work must have been hampered by official indifference to his aims and by lack of financial support. Steady pressure from a great organization like The Engineering Institute of Canada would help to secure proper official support for the needed studies of water temperatures.

The problem, however, has not been altogether overlooked. The contributions to this discussion of Dr. Hewson and Mr. Millar of the Dominion Meteorological Branch, of Messrs. Rose and Kennedy of the U.S. Reclamation Service, and of Mr. Moore and Major Altman and Capt. Hickman of the U.S. Lake Survey are evidence to the contrary, but there is no evidence that government, either in the United States or in Canada, has seriously attempted to find out how much conditions in the winter months on the major interior waterways of the continent can be improved.

It is interesting to compare the simultaneous records from the work of Professor Church and of Mr. Millar.

	1941–42	1942–43	1943–44
Av. winter temp. at Muskegon, Mich. (Church) four months, Dec. to Mar., incl.	28.0 F	22.6 F	27.1 F
Av. winter temp. at Kingston, Ont. (Dom. Metero. Observ.), four months	23.4	19.8	22.8
Lowest isothermal temp. of Lake Michigan (Church)	36.5	32.9	35.0(Est.)
Lowest surface temp. of Lake Ontario—in mid-lake (Millar).	36.0	34.5	34.5

It will be noted that Lake Ontario does not respond as quickly to major changes of air temperature as does Lake Michigan. Considering the differences in the methods of observation and of deduction, the results of the two series of observations are in very fair accord and they furnish data which may be used in estimating the possible temperatures that would be found in a canalized St. Lawrence River. It is fortunate that the records of both observers extend over the exceptionally cold winter of 1942-43.

If Professor Church's estimates of total heat content of Lake Michigan for that winter are plotted, they will be found to outline a smooth curve from which the rate of heat loss at ten day intervals can be determined. The same is true of Mr. Millar's records of the surface temperatures of Lake Ontario, although being surface temperatures, they are somewhat less regular in their rate of fall.

Assuming a canalized river of 64 ft. depth with an average current velocity of two miles per hour and a defined width sufficient to provide for the necessary discharge of the river, the results shown in Table VII can be calculated from the data taken in the winter of 1942-43.

Column 2 has been read off from a smooth curve drawn through a plotting of Mr. Millar's observations.

Column 3 has been calculated on the assumption that each sq. ft. of water surface is underlain by 4000 lb. of water which is true for a depth of 64 ft. The figures give the number of B.T.U.'s required to raise the temperature of 4000 lb. of water from 32 deg. F. to the temperature indicated in Column 2.

Column 4—The heat loss per sq. ft. per day used in calculating Column 4 has been read off from a smooth curve drawn through the points determined by Professor Church's figures. It has been assumed that the average time required by the waters to flow from Lake Ontario to Montreal will be four days. The assumption is in rough agreement with a steady current speed of two miles per hour.

Column 5 has been determined by subtracting the figures in Column 4 from those in Column 3.

Column 6 has been arrived at from the figures in Column 5 by reversing the calculating process used for Column 3.

Whether a rate of heat loss derived from Lake Michigan can properly be applied to the waters of the St. Lawrence River is a matter that can only be determined by further studies. Professor Church's rates of loss per sq. ft. per day, during the month of December, are at least in agreement with the severest losses recorded by the Joint Board of Engineers in their studies made in December of the years 1923-4 and 1924-5 on the St. Lawrence River.

Attention should be drawn to the effectiveness of internal motion in a water mass in preventing the formation of an ice crust over open water, whether such motion is caused by wind or by the flow of the river. The cause of such currents in the Great Lakes is at present receiving much attention.

It was suggested during the discussion of this paper at the Annual Meeting that the design of the channel of the St. Lawrence Waterway should be based on the principle of heat conservation. This requires the narrowest channel economically possible and a current velocity to be limited only by the demands of navigation.

It was with this principle in view that the current velocity of two miles per hour and the channel depth of 64 ft. used in the calculation of Table VII were adopted. In the St. Lawrence River, both the depth and current velocity could be controlled by the designing engineers.

Professor Angus has raised the question of ensuring the flow of "warm" water into the canalized river. This problem troubled the author until the records of the work of Professor Church came into his hands. It may be assumed for the present that the waters in the great pool of Lake Ontario are isothermal in winter, like the waters of Lake Michigan, and if the entrance into the river is moved far enough westward by the construction of guard embankments it will ultimately reach the isothermal area where nothing but "warm" waters are present. The section of Lake Ontario lying between the present west end of the river and Galloo Island is relatively shallow and will cool off rapidly. To reach the deep pool lying west of Galloo Island is a formidable undertaking but is necessary if the river is to be improved to the best advantage.

Mr. Brace has raised the question of testing, on a substantial scale, the theories of temperature control. Possibly if the temperatures of the deep pool of Lake Ontario were determined by the methods developed by Professor Church and if a series of carefully taken temperature measurements were made in the late fall on such waterways as the long reach of the Welland Canal or the headrace of the Beauharnois Power Company's development, satisfactory data as to the amount of heat available and as to the rate of heat loss could be secured for design purposes. These waterways are of such length that temperature changes in the water passing through them could be recorded and they are of uniform cross section and depth.

Mr. Brace also deprecates possible delay in this great enterprise arising out of changes of plan, but points out

Table VII

Date	Surface Temp., Lake Ontario F.	Heat Content under 1 Sq. Ft. of River Surface at Lake Ontario B.T.U.'s	Loss of Heat from 1 Sq. Ft. of River Surface During Four Days' Flow B.T.U.'s	Heat Content under 1 Sq. Ft. of River Surface on Arrival at Montreal B.T.U.'s	Isothermal Temperature of River at Montreal F.
Dec. 10/42	41.7	38,800	7,920	30,880	39.7
20/42	41.0	36,000	8,480	27,520	38.9
30/42	40.3	33,200	7,600	25,600	38.4
Jan. 9/43	39.5	30,000	6,160	23,840	37.9
19/43	38.6	26,400	5,560	20,840	37.2
29/43	37.8	23,200	5,560	17,640	36.4
Feb. 8/43	36.8	19,200	4,000	15,200	35.8
18/43	35.7	14,800	3,520	11,280	34.8
28/43	34.7	10,800	2,920	7,880	34.0
Mar. 10/43	34.2	8,800	2,360	6,440	33.6
20/43	34.7	10,800	+1,480	12,280	35.1

that the official plans for the waterway east of Lake St. Louis must be revised owing to the growth of the city of Montreal. The author thinks that at this point the waterway should be within the present bed of the river at Lake St. Louis level as far east as Longueuil. The large quantities of embankment material needed could most readily be secured from the bed of Lake St. Louis by modern construction methods.

It is unfortunate that the contours of the rock underlying Lake St. Francis and Lake St. Louis have never been determined by geophysical surveys. The position of these contours might determine the location of the 64 ft. deep channels across the two lakes. The construction of such channels would involve the movement of immense quantities of material, but only a relatively small cash outlay if modern gold dredging methods were used.

The only other immediate modification of the official plans which seems advisable to the author is the deepening of the cut across the Galops Ridge to give a depth of 64 ft. The material from this cut could well be used to build a dividing embankment across the pool extending from Brockville to the Galops so that the working cross-section of the river at this point could be reduced to the area required by the heat conservation principle.

Assuming the construction of the proposed Barnhart Island dam, the St. Lawrence River from Galloo Island to the dam will be so deep that only moderate local excavations will be needed for a 64 ft. waterway, provided always that the cut across the Galops Ridge has been made to full depth. The conclusion to be drawn from the evidence now available indicates that the creation of an always open waterway between Lake Ontario and Montreal is simply a matter of proper authority becoming willing to undertake the necessary expense of construction.

The other plea in the original paper, namely the need for a scientific study of the drift ice on the Great Lakes, has evoked hardly any discussion, probably because the subject has suffered from almost complete neglect. The author has no doubt that scientific study will show that this difficulty can be greatly lessened but the problem is so great and it is so much affected by local conditions that it cannot be profitably discussed until comprehensive surveys of the life cycle of such drift ice have been made and studied.

Mr. Cowie's reminiscences of the work of the Montreal Flood Commission are interesting and point out a line of attack that may be wisely used as a precedent in future work. They are also a timely and kindly tribute to the memory of the great engineers who fathered the Institute in its boyhood days.

Forty years ago Mr. John Murphy taught the engineering world how to keep its metal structures free from ice adhesion and reduced that problem to one of operating expense. Mr. Murphy's contribution to this discussion might point the way to deal with the icing of ships during winter storms. The great freighters are constantly wasting much heat from their condensers that might be used in winter.

The application of first principles to overcome ice difficulties as developed by the Montreal Engineering Company is most interesting. This practice might be extended where natural conditions are favourable by one further step, namely to see that the stored reservoir waters are brought to the highest possible temperature in summer. Opportunities for such practice are rare except in the mountains, but there the Montreal Engineering Company has been active. This possibility can be illustrated by a fantastic example. Most Canadians are familiar with the locations of Lake Champlain and Lake George. Lake George has an area of 44 sq. mi. and its water level is about 30 ft. above Lake Champlain. The dividing ridge is in places less than three and one-half miles wide. The author has seen no record of soundings in Lake George but assumes that its topography is similar to that of Lake Champlain, narrow and of great depth. Mr. Rose's very accurate depth-temperature curves as contributed to this discussion show that there is little change in the temperature of the waters of such a lake below the 50-ft. depth level. The deeper waters remain at a temperature close to 39 deg. F. Topographical maps show that no serious physical divides exist between Lake George and the upper reaches of the Hudson River, a swift mountain stream. Following a practice employed in British Columbia, it would be a not difficult engineering feat to drain Lake George into Lake Champlain by a low level tunnel, which would draw off all its colder waters. These could be replaced by a diversion in summer of the flow of the upper Hudson River with temperatures well in excess of 60 deg. F., thus raising the temperature of the whole content of Lake George to a figure never recorded in any natural lake of like dimension and location. No material gain could develop from this practice unless and until the engineer-inventor of the future has developed a method of insulating large bodies of water from surface heat losses or of reducing the rate of surface loss very materially. If this should be accomplished, the practice would provide a simple means of raising the temperature of adjoining rivers in cold winters by perhaps two or three degrees F. Even without insulation, the warmer the waters of the reservoir are, the longer they will take to cool down.

Mr. Peters has questioned whether the creation of the open waterway would adversely affect the natural evaporation losses from Lake Ontario. The author thinks that this is unlikely but the question could wisely be studied by the trained meteorological staffs of the United States and Canada. The proposed change would result in the earlier freezing up of certain areas at the east end of Lake Ontario, thus reducing evaporation losses but would also increase to a nearly compensating extent the open water surface between Kingston and Montreal thus increasing evaporation. The total draught from the Great Lakes would not be affected by the proposed improvements as this will be under direct control at the Barnhart's Island dam.

Dr. Hewson's comment concerning the effect of the obliquity of the sun's rays should not be overlooked. This effect has been noted by many engineers who have worked on the more northern areas of Canada and adds greatly to the difficulty of removing ice obstruction from Canada's more northern waterways in spring.

Mr. Bird's experience on the Kaministiquia River suggests a possible means of keeping such harbours as Port Arthur open throughout the winter. Thunder Bay is relatively shallow but it is close to the very deep waters of the Isle Royale Channel where the continued presence of "warm" waters may be safely predicted. It is only a pumping problem and not too great a one at that to drive a great river of "warm" water into Thunder Bay with the aid of such guide embankments as a study with models would indicate to be necessary. The "warm" waters might be as much as 24 hours in circuit and certainly would not cool off completely in that time. The action of the pumped waters and their relatively high temperature would prevent the formation of ice cover over a selected area in the main harbour.

The comments of the trained geophysicists, Dr. Hewson, Mr. Millar and Mr. Kennedy are all very much to the point and indicate how wide a field the St. Lawrence problems offers to men of their experience and training.

The criticism offered by Mr. Andrus of the wording of the third tentative conclusion given in the paper is well founded and the conclusion would have been more accurately stated had his wording been used.

The vigorous discussion sent in by Captain Hickman covers a much wider field of hydrological study than has been dealt with in the paper. His views on water conservation merit very close attention. It will be gratifying to him to note that his recommendation for the appointment of an International Hydrological and Meteorological Commission has been endorsed by so many contributors to this discussion.

The author is pleased to note that Captain Hickman with his wide opportunities for observation, considers the open waterway to be a scientific possibility although he is uncertain concerning its economic value. The author, in preparing the paper, rigidly excluded all thought of economics from his field of consideration. The purpose of the paper was to expose the suggestions contained in it to a purely technical criticism by his brother engineers. The economic study of the project may properly begin, now that so many contributors to the discussion have recognized the value of the scientific facts upon which the outlines for the projected improvements are based. Whether the benefits to be secured by such a piece of construction justify the cost involved is a matter that lies outside the proper field of activity of the professional engineer.

The author has not studied the possible use of atomic energy as a source of heat as suggested by Mr. Cousins and Mr. Cowie nor the possible use of the internal heat of the earth. The author questions whether the use of such aids will be found to be necessary on the St. Lawrence waterway, but their possibilities should be known as providing reserves to be drawn upon under abnormal conditions.

The author is glad to note the approval given by Mr. Moore and Major Altman to the plea for the accumulation of more data on water temperatures and ice conditions, for the organization that they are associated with, the U.S. Lakes Survey, is the oldest and probably the most highly organized engineering bureau working on the problems of the Great Lakes. The control of the levels of the Great Lakes is one of the greatest of the international engineering problems, and judging from Captain Hickman's observations difficulties may become more acute in the future.

Messrs. Altman and Moore do not concur in certain recommendations appearing in the paper but their comments seem to be based on a misconception of the author's thoughts, for which the author is himself to blame. Those recommendations were a plea for study only and were made as brief as possible in order that attention should not be diverted from the underlying problem of the variations in water temperatures and the causes of them. However, it seems proper as the recommendations have been questioned that they should now be dealt with in somewhat more detail than in the original paper. The author has always considered the Grand Central Terminal in New York City as one of the finest pieces of engineering design in North America. He has been informed that this was because innumerable small "project squads" studied every suggested change in design to make sure that no meritorious improvement would be passed over. The vast group of possibilities that are to be found in the Great Lakes area merit an equally comprehensive study. The governments of the United States and Canada have not been over liberal in their attitude towards the improvement of the great national water assets which they control and it is perhaps regrettable that the principle of self-liquidation has not been introduced into the plans for such improvements. The vast traffic in the St. Mary and St. Clair Rivers would not be appreciably affected by a system of small tolls and desirable improvements could then be made without experiencing the delays that so often occur in securing the necessary appropriations of funds by political authority. It may be that the navigation interests themselves have been short-sighted in their attitude towards such a policy.

The paper under discussion was a war baby. It was commenced when the need of a first class internal waterway between Montreal and New York could be regarded as an international necessity, owing to U-Boat activity. For the same reasons the recommendations for improvement of ice conditions were thought of not as being commercially desirable but as essential to the continental safety. Keeping that forethought in mind, the recommendations themselves merit a brief discussion.

The author's study of the St. Mary River arose out of the frequent reports of float ice obstruction in Whitefish Bay in the spring and fall, which drew the author's attention to certain records secured by Mr. Millar in 1937. These showed that on December 5th the lake temperature at Whitefish Point was 39.8 deg. F. while less than 50 miles away, in the St. Mary River, it was recorded that the water temperature was 31.8 deg. F. This situation indicated the desirability of studying the possibilities of a closed channel from Whitefish Point to the Sault locks with sufficient current in it to make sure that the waters were always in turbulent flow, and that the time of transit was reduced to a reasonable minimum. An inspection of the charts published indicated a possible location that would follow the west and south shores of Whitefish Bay, but as this channel would be nearly fifty miles long its operation would involve a definite drop in level which in turn would affect the depth over the sills of the existing locks at Sault Ste. Marie. The author, having served on the location and construction of the Canadian Pacific Railway Company's branch into Sault Ste. Marie in 1886-87, had a fairly clear recollection of the topography of the lands lying between the Sault locks and the Georgian Bay, and thought that a possible canal location could be found rougly paralleling the railway line in that area. This impression he has confirmed by consulting the profile of the railway lines which were supplied to him by the courtesy of Mr. J. E. Armstrong, vice-president of the Institute and chief engineer of the Canadian Pacific Railway Company. A completed channel over this route to a point in the Georgian Bay opposite the Mississauga Channel would be well over 100 miles long and its slope could be counted on to absorb most and at times all of the fall between the two main lakes. One end of the channel would reach deep water in Lake Superior and the other deep water in Lake Huron. Presently available evidence indicates that such a channel would remain clear of ice throughout the year but to what extent control of its discharge would be necessary, the author has not yet studied. The author never contemplated free waste of the waters of Lake Superior which to his mind is the most valuable of storage basins, especially as the Ontario Hydro-Electric Power Commission has added some 5,000 cu. ft. per sec. to the water resources of the Great Lakes Basin by water diversion from the Hudson Bay watershed into Lake Superior. The recommendation in the paper is not a recommendation for action but for a study of an engineering possibility that might have a far-reaching effect. The rapid industrial development now taking place along the north shore of Lake Superior makes this possibility one of much interest to Canadians.

The study of the possibility of utilizing the inland waterway between Lake Michigan and Lake Huron arose from the report of ice obstruction in the north end of Lake Michigan and amongst the islands screening the entrance to the straits of Mackinac. The desirability of making this improvement would depend upon studies to be made following the methods of Professor Church to determine whether the natural temperature conditions in the waters approaching Little Traverse Bay are more favourable than those in the waters leading to the straits of Mackinac. A study of the charts indicates that the construction of a major channel from Little Traverse Bay in Lake Michigan to Cheboygan on Lake Huron would not be an unusually heavy piece of construction work. The author had contemplated the installation of a guard lock of very low lift and the creation of a safety current through the channel during the winter months by the use of large pumps. The power consumption would be low, as the head necessary to create a current through such a short channel with ample cross section would be very modest. This recommendation again is limited to the study of an engineering possibility which may be of value when the demand for the removal of ice obstruction from the main waterway becomes insistent.

The suggestion of a winter channel along the North Shore of Lake Erie arose from consideration of the shallowness of this lake and the certainty of abundant ice formation within its area. The most striking evidence as to the winter temperature of Lake Erie is to be found in the temperature curves submitted as part of this discussion by Mr. Strowger of the Niagara Falls Power Company.

The flow of the Niagara River probably is isothermal and the measurements taken by Mr. Strowger indicate a probable isothermal temperature in Lake Erie approaching 32 deg. F. for three months in each winter. A possible remedy lies in conveying the "warm" waters of Lake Huron into the Niagara River without letting them waste their heat content whilst flowing over the shallows of Lake Erie. There is abundant flow in the St. Clair River to maintain a satisfactory discharge through the proposed channel and at the same time to maintain the levels of Lake Erie, but the establishment of a control dam at the east end of Lake Erie would be necessary. All this planning is necessarily conjectural for at present we know little or nothing concerning the actual temperature cycles of the waters of either Lake Erie or Lake Huron. The few facts now available only serve to emphasize the need for more data.

The improvement of the St. Lawrence River below Kingston may perhaps be passed over here as it has been touched on lightly elsewhere in this discussion except that the author would like to state that he places great weight on the possible extension of the Lake St. Louis levels as far east as Longueuil. Such an extension will provide an ideal waterway, an economical site for a great hydro-electric power plant, a very notable site for a high level extension of Montreal Harbour and a very effective connection between the St. Lawrence waterway and the proposed Lake Champlain branch. It is believed that the cost of construction between Barnhart Island and Longueuil on this location will be less than that appearing in the official estimates.

The last recommendation for study, namely the Lake Champlain branch of the St. Lawrence Waterway, is in the author's opinion at once the knottiest and the most important of them all for it would furnish deep draught transportation on an all-year round basis from all the cities bordering on the Great Lakes and on the St. Lawrence River to the great population areas surrounding New York, Philadelphia and Baltimore, and to the tropical wealth of the West Indies and South America. From a Canadian standpoint it would furnish a safe winter route from the Maritimes to Central Canada. It may be noted that the sailing distance from Halifax or Saint John to Montreal does not greatly differ whether the route followed lies via New York and up the Hudson Valley or by the Gulf of the St. Lawrence.

The engineering problems involved in the construction of such a waterway through the Lake Champlain-Hudson River Valley would require a separate paper for their discussion. At present no data are available concerning the water temperatures of Lake Champlain. Possibly in parts the cycle of its water temperatures would be similar to those taken by Mr. Rose in Grand Lake, Colorado, and in parts similar to those observed by Professor Church in Lake Michigan. It seems probable that internal currents do not occur in this lake, a fact which would account for its freezing over nearly every winter.

The situation here appears to call for a much bolder engineering vision than has been granted to the Deep Waterways Commission. Briefly, as envisaged by the author, the waterway would consist of a canal of about 40 ft. depth extending from Laprairie on the St. Lawrence River to a point opposite the Pointe aux Roches lighthouse on Lake Champlain and possibly following the Alburgh Passage. Deepening and narrowing of the area of the lake extending from Port Henry to Whitehall would be necessary and a deep cut about 35 miles long through the ridge separating Lake Champlain and the Hudson River. The present regulated level of Lake Champlain is between Elev. 92.0 as a minimum and 95.0 as a maximum and the summit level of the existing Whitehall and Albany Canal is 140.00. The route of the Whitehall Canal might be followed to a point in the vicinity of Troy and the present Hudson River Waterway would require further improvement to a point about 25 miles south of Albany.

The natural flow of the Richelieu River and of the Upper Hudson River would provide ample water for lockage purposes but a much stronger flow than either of them could provide would be necessary to keep the canals at the north and south ends of the route free from ice during the winter months and to provide the agitation necessary to prevent the freezing over of the deep section of Lake Champlain. The author would favour a large diversion of flow from the St. Lawrence River into Lake Champlain from about December 1st to March 1st in every winter, a supply perhaps most economically effected by power pumps placed near Laprairie. The lift would be about 30 ft., the proposed regulated level of Lake St. Louis being 71.0. This diverted water, with a minimum temperature of perhaps 35 deg. F. combining with the great stores of natural heat impounded in the depths of Lake Champlain could be expected to keep the waterway clear of ice until tidewater is reached on the Hudson River.

The possibilities of the project outlined above justify the preparation of preliminary plans and estimates by a "project squad," so that the economic value of the project can come up for discussion. As stated by the Deep Waterways Commission in its report on the subject, the Lake Champlain section of the deep waterway will be of value only as providing a safe entrance to traffic originating in or seeking access to the industrial areas surrounding the Great Lakes and the St. Lawrence River.

It will be noted that several of the foregoing recommendations contemplate the construction of canals comparable in magnitude to such undertakings as the Welland Canal and the Panama Canal. This fact in itself is no valid objection to the study of them. The traffic that would use them is comparable to that in many existing canals of commercial importance, and it is possible that much of the traffic that now passes through the Panama Canal would find its way to its destinations in the Great Lakes area by water if the St. Lawrence and Lake Champlain Waterways were available.

The author is much pleased by the courteous attention that has been given to his essay by so many engineers and scientists of broad experience and knowledge and desires to express his thanks to them. It is to be sincerely hoped that the recommendations that these gentlemen have so freely made in favour of an intensive study of the water temperature problems will be generously dealt with by proper authority.

AIR CONDITIONING A WINDOWLESS TEXTILE MILL

G. LORNE WIGGS, M.E.I.C.,
Consulting Industrial Engineer, Montreal, Que.

This paper was presented at the 1946 Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, in Montreal, and was published in the July 1946 issue of the Journal of the Society, *Heating, Piping and Air Conditioning*. It is reproduced here with the kind permission of the editors.

SUMMARY—This paper sets out the considerations governing the decision to construct a mill without windows. It describes the construction details with particular reference to the insulation of walls and ceiling, the air conditioning system and certain provisions which were made to permit economical expansion when this is required.

The tremendous industrial expansion in Canada and the great engineering advances in both the textile machinery and textile mill construction fields in the United States during the war years have resulted in a new trend of textile mill design. Reflecting this recent trend is the new textile mill described in this paper.

The mill is located in the town of Ormstown, Que., situated approximately 40 miles southwest of Montreal. The mill was designed and constructed for producing spun rayon yarns, rayon and wool blends and worsted yarns on the latest type of machinery for handling long staple fibre. It will house a complete unit of 5000 spindles.

A perspective view of the new plant is shown in Fig. 1. It will be seen that the plant consists of a complete spinning mill, approximately 100 ft. by 300 ft., which is a single storey, completely windowless building, along the front of which are located the general offices, the men's and women's wash rooms, the first aid room, the cafeteria, the boiler room and the machine shop on the ground floor, with the executive offices on the second floor. A penthouse, running practically the length of the mill, houses all the air conditioning equipment. A covered loading platform with a railroad siding is also located along a portion of the front of the mill. An electrical substation and an artesian well and pump house are located at the back of the building. Probably the most striking thing about the plant is the small size of the chimney. The design was so made that by constructing additions at each end, the mill could readily be enlarged to increase the unit to one of 10,000 spindles. Further expansion could be made by building a second 10,000 spindle unit along the back of the present unit.

In designing a unit to produce the various yarns mentioned, the prime consideration was to design a building which would not only be an efficient operating unit but one in which the particular air conditions required for spinning each different yarn could be readily obtained at any time. Although the outdoor temperatures in this locality vary from a minimum of about —30 deg. F. in winter to a maximum of almost 100 deg. F. in summer and there is a very large concentrated internal sensible heat gain in the mill, the problem of designing the air conditioning system is not a particularly complex one. The difficulty lies in the determination of the best type of system to be used, in providing the proper air distribution so as to maintain a uniform temperature and humidity throughout the mill without objectionable draughts and in selecting equipment and controls to take care automatically of the widely differing conditions the system must encounter.

There was considerable difficulty in obtaining an authoritative statement of the exact air conditions which should be maintained in the mill for each different type of spinning. It was finally agreed, after consultation with the management and various authorities, that for spinning rayon yarns the air conditions to be maintained should be as follows:

Dry bulb temperature, 75 to 80 deg. F.

Relative humidity, 60 to 65 per cent.

In spinning rayon and wool blends and spinning worsted yarns on the so-called French spinning system, the air conditions required would be as follows:

Dry bulb temperature, 75 to 80 deg. F.

Relative humidity, 75 to 80 per cent.

Since the mill is initially to spin rayon yarns and since it will probably be some years before rayon and wool blends or worsted yarns will be spun, the management decided to have the plant designed and constructed for the spinning of rayon yarns only, but to design the walls so that, at a later date, when other yarns are to be spun, the additional insulation required in the walls to prevent condensation from occurring on these surfaces could be added. These considerations required a thorough study of many different possible types of wall and ceiling construction and of various insulating materials available, so as to produce an economical wall, especially when it is considered that at the time these studies were made many common building materials were extremely scarce in Canada and others were not available at all. The usual type of so called mill construction could not be adopted because of the shortage of lumber.

Reverting to the air conditions required in the mill when spinning rayon yarns, the following design conditions were adopted for the mill proper:

	Summer	Winter
Outside dry bulb temperature....	90° F.	—30° F.
Outside wet bulb temperature....	73° F.	....

	Summer	Winter
Inside dry bulb temperature......	75° F.	75° F.
Inside relative humidity.........	65%	65%
Inside wet bulb..................	66.6° F.	66.6° F.
Inside dew point.................	62.5° F.	62.5° F.

By reference to the graph, Fig. 4, Chapter 6 of the 1946 Heating, Ventilating and Air Conditioning Guide of the American Society of Heating and Ventilating Engineers, showing the permissible relative humidities for various transmission coefficients, it will be seen that, for an outside temperature of —30 deg. F., an inside temperature of 70 deg. F., and a relative humidity of 65 per cent, the wall, roof or glass heat transmission coefficient U must be less than 0.20. The same graph shows that for an outside temperature of —30 deg. F., an inside temperature of 70 deg. F. and an inside relative humidity of 80 per cent, the wall, roof or glass coefficient U must be less than 0.115. The coefficient U of single, double and triple thickness of glass being respectively 1.13, 0.45 and 0.281, it is obvious

Fig. 1.—Windowless textile mill.

that for either of the above winter conditions, even if triple thicknesses of glass are used in the windows, condensation will occur on the glass whenever the outside temperature drops below 0 deg. F. This, with the condensation which would occur on the window frames, would present a difficult problem when the relative humidity of the mill was maintained at 65 per cent and would be serious if the relative humidity were raised to 80 per cent. In addition, since the heat transmissions of glass windows or of glass bricks are all so much higher than those of well insulated walls, the omission of all windows materially reduces the cooling load in summer and heating load in winter and at the same time results in more uniform conditions in the mill. Because the omission of windows eliminates a difficult condensation problem and at the same time reduces the size of the air conditioning installation and the heating plant, it was decided to construct the mill proper without windows and with a minimum of exterior doors. However, in order to offset any possible objections that the plant employees might have to work in a completely windowless plant, windows were provided in the offices and services portion of the mill, where condensation is not a problem.

In order to allow for any possible lower temperatures at their inside surfaces, it was decided that the wall coefficient should initially be less than 0.15 and ultimately less than 0.10, while that of the roof should be less than 0.10.

After study, it was decided to construct the plant with concrete foundations and a single reinforced concrete floor, with a structural steel frame, with exterior walls constructed of white brick bonded with 8 in. terra cotta blocks and with precast light weight aggregate concrete roof slabs, supported on steel bar joists, thus giving a fire resistant construction.

The many different insulating materials commonly used were then investigated. A number of desirable insulating

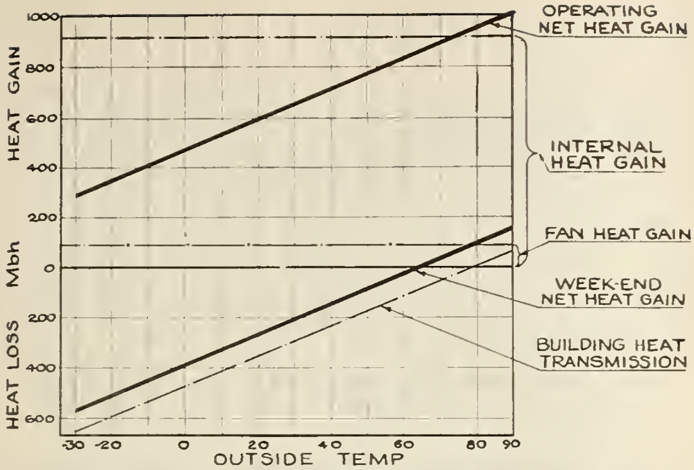


Fig. 2.—Variation of heat gains and losses of various outdoor temperatures.

materials were not available at the time. Finally it was decided to adopt for the exterior walls a slab insulating material made from shredded wood and cement, which has a conductivity k of 0.46 and which bears the approval of the Underwriters Laboratories. With a 2 in. thickness of this insulating material the value of U for the wall, neglecting the interior finish, is then approximately 0.14. When, at a later date an additional 2 in. thickness of insulation is added, the heat transmisson coefficient U will be less than 0.09.

The insulating board has a rather rough finish, so that in order to obtain a smooth interior finish, it was decided to give the board a coat of neat cement plaster. After this was thoroughly dry, the plaster was given two coats of emulsified asphalt cement, in order to provide a satisfactory vapor barrier. As an additional seal and in order to

Table I—Tabulation of Heat Gains and Heat Losses

	Summer		Winter			
	Working Day	Week-End	Working Day		Week-End	
	Heat Gain	Heat Gain	Heat Gain	Heat Loss	Heat Gain	Heat Loss
Picker Room:						
Heat Transmission, Solar Heat Gain and Infiltration	9,800	9,800		99,900		99,900
Fan and Duct Heat Gain	8,900	8,900	8,900		8,900	
Internal Heat Gain	29,800		29,800			
			38,700	99,900	8,900	99,900
				38,700		8,900
Net Heat Gain or Loss	48,500	18,700		61,200		91,000
Carding & Drawing Room:						
Heat Transmission, Solar Heat Gain and Infiltration	78,100	78,100		822,200		822,200
Fan and Duct Heat Gain	25,400	25,400	25,400		25,400	
Internal Heat Gain	188,300		188,300			
			213,700	822,200	25,400	822,200
				213,700		25,400
Net Heat Gain or Loss	291,800	103,500		608,500		796,800
Spinning Room:						
Heat Transmission, Solar Heat Gain and Infiltration	62,600	62,600		656,900		656,900
Fan and Duct Heat Gain	81,100	81,100	81,100		81,100	
Internal Heat Gain	865,500		865,500			
			946,600	656,900	81,100	656,900
			656,900			81,100
Net Heat Gain or Loss	1,009,200	143,700	289,700			575,800

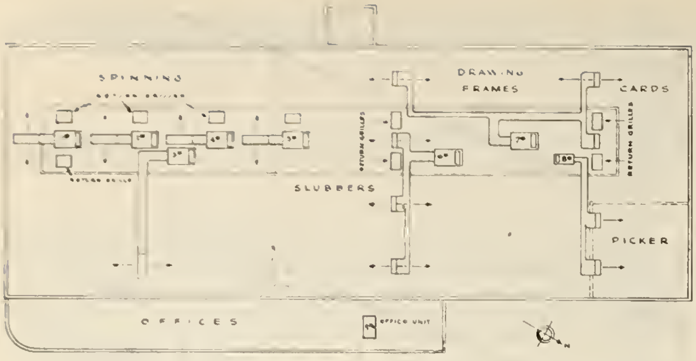


Fig. 3.—Plan of mill showing location of air conditioning unit.

prevent any possibility of the asphalt bleeding through the interior paint finish, the emulsified asphalt was given two coats of aluminum paint, which was finally painted with two coats of paint of a light green pastel shade.

The roof was insulated with wood fibre board insulation, 2 in. thick, which, with the light weight concrete roof slabs, gives U value for the roof of less than 0.10. The inside surface of the roof was sprayed with two coats of emulsified asphalt to provide the necessary vapour seal. Finally, a ceiling of gypsum board was attached to the bottom chords of the roof joists.

Incidentally, the roof of the mill was designed to be dead flat and the rain water leaders have been provided with removable standing waste pipes so that, in summer, the roof will be flooded with water approximately 2 in. deep.

The mill was designed so that its floor level would be at the level of a standard railway car floor which, due to the fact that the property is practically flat, meant that the mill floor is roughly 4 ft. 5 in. above grade. The plant floor, the walls below floor level and the foundation walls were all constructed of reinforced concrete, the floor being 4 in. thick and the concrete walls 12 in. thick. The amount of exposed concrete wall was reduced by backfilling against the wall on all sides of the plant to a height of 3 ft. 10 in. above the grade.

The wall and roof construction of the office and service section of the plant was modified slightly from that used in the mill proper, because the relative humidity to be maintained in this section of the plant is to be that commonly maintained in offices and the like.

The construction of the walls and the roof of the penthouse also are different from that of the plant, but were designed to have the same U value as those of the plant.

The mill proper is without windows of any kind and the only doors in the walls are those between the mill and the offices, one leading to the shipping platform and the regulation number of fire escape or panic doors. The panic doors were constructed similarly to standard refrigerator doors so as to minimize condensation on them and to prevent the doors from freezing in winter.

Fig. 4.—Spinning room before installation of machinery.

Having adopted the foregoing construction for the mill, calculations were then made to determine the various heat gains and heat losses of the mill for both summer and winter conditions.

Table I gives a list of the various heat gains and heat losses. It is notable that because of the large internal heat gains in the mill, particularly in the spinning room when it is in operation, even at -30 deg. F., the spinning room requires cooling during the working days. The variation in the heat gains and heat losses in the spinning room at various outdoor temperatures are shown in Fig. 2. This graph is not strictly accurate, but it serves to show the relation between the various heat gains and heat losses for any given outdoor temperature. It might be mentioned that, had the building been constructed with windows, the slope of the inclined lines would have been increased and both the maximum heat gain in summer and the maximum heat loss in winter would have been increased.

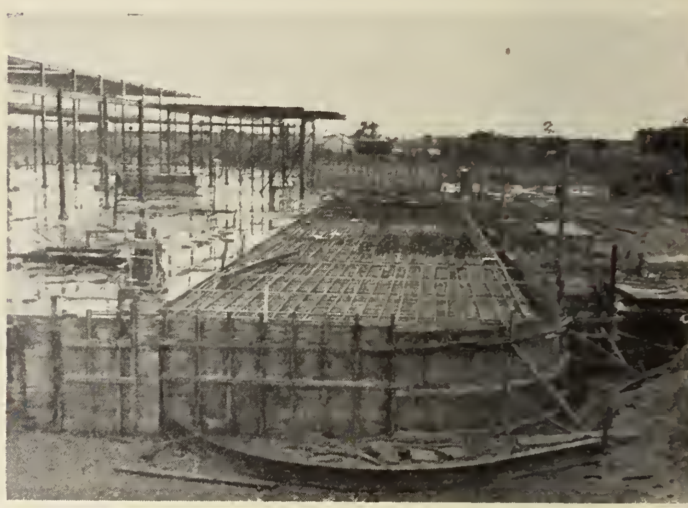


Fig. 5.—Radiant heating coils before concrete was poured.

With the tabulation of heat gains and heat losses, a study was made of the various types of air conditioning systems available, among these being the system having spray atomizers combined with mechanical ventilation. to provide both humidification in winter and evaporative cooling in summer and standard air conditioning systems, both central station type and unit type, to provide year round air conditioning. The unit air conditioning type was finally adopted, because of its flexibility, the ease of its installation and, particularly, because very little of the installation would be exposed in the mill. In order to expedite delivery and to keep costs to a minimum, eight standard unit conditioners were adopted for the mill proper, one being provided for the picker room, two for the carding and drawing room and five for the spinning room. A separate unit was provided for the offices and service areas. All the unit conditioners are factory assembled units, each including standard capillary cells, heaters, fan, pump, motors, etc. The unit conditioners are located as shown in Fig. 3. The outside air inlets to the units are located immediately above the units, while the entire penthouse acts as a return air plenum. The exhaust air is discharged outdoors through the wall of the penthouse. The conditioned air is supplied to the mill through conditioned air inlets of the type shown in Fig 4, which also shows the continuous lighting troughs and the pendant automatic sprinkler heads. Since the spinning frames

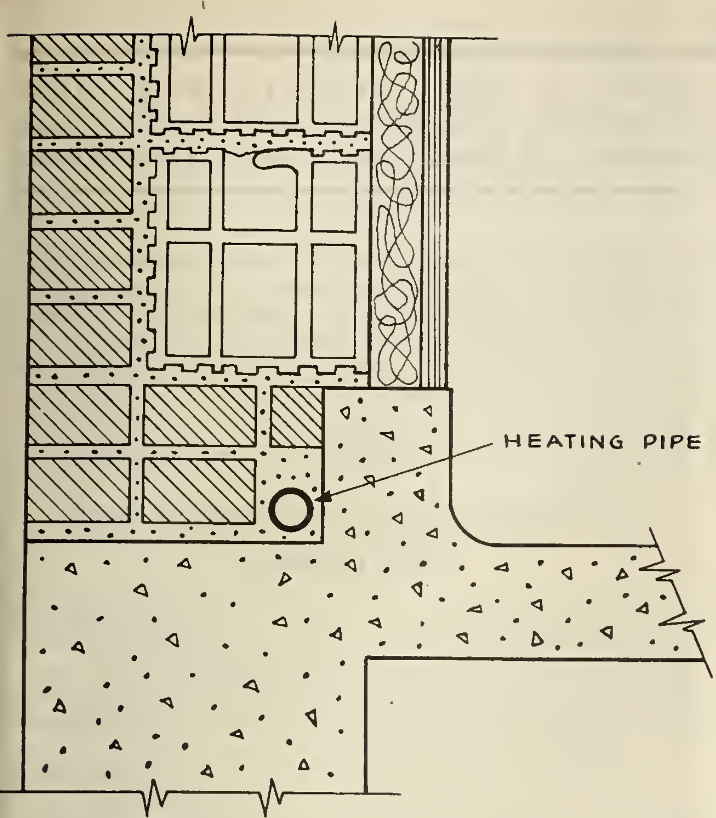


Fig. 6.—Detail of single heating coil in exterior wall.

will be driven by individual motors, there will be no overhead shafting or belts, with the result that the present clean cut appearance of the mill will be maintained even when the textile machinery is in place.

At the time that the mill was designed, all refrigerating equipment was "frozen" in Canada. However, prices were obtained on the required refrigerating installation, including evaporative condensers, but at the same time a study was made of the few deep wells in the vicinity and of the geology of the locality. The geological surveys and reports available indicated that the ground in the area, under an overburden of about 60 ft. of clay, had an underlying area of Nepean (Potsdam) sandstone formation of such a character and grain size that it could be expected to yield sufficient water at a reasonably low temperature to cool the plant.

Because of the uncertainty of obtaining refrigeration equipment, while a source of sufficient chilled water appeared to be available from a deep well, and because both the operating and maintenance costs of a deep well and of a deep well pump would be materially lower than that of a refrigerating unit, it was decided to sink a deep well

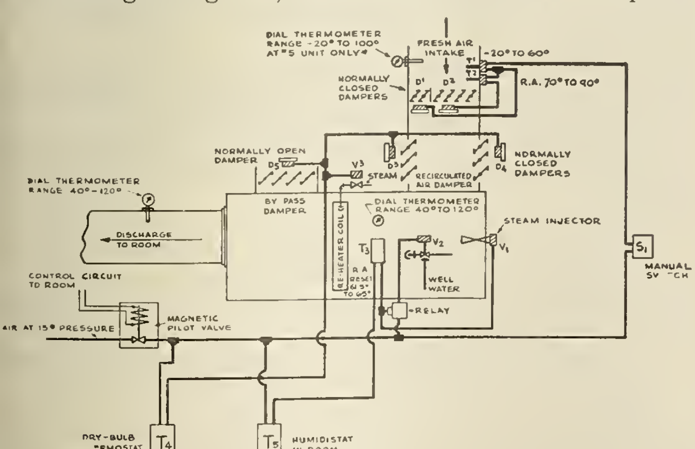


Fig. 7.—Schematic diagram control system for a typical factory air conditioning unit.

12 in. in diameter. The well was drilled to a depth of about 130 ft. of which about 65 ft. is through clay and 65 ft. is in bedrock. Later a pumping test of the well was made. After pumping continuously for 24 hours, the official 8-hour test showed a delivery averaging 686 Imp. gal. per. min. with a draw down of less that 20 ft. The temperature of the water was found to be 42½ deg. F. and, while its hardness was high, it was otherwise very satisfactory. As a matter of interest, the well drillers reported that they had run the test pump at various capacities to determine the ultimate capacity of the well, but they reached the limit of the capacity of the test pump at about 2075 Imp. gal. per min. without seriously increasing the draw down of the well.

Based on a well water temperature of 45 deg. F. the quantity of chilled water required for cooling the plant and offices amounts to a total of 266 Imp. gal. per min. As a result, the well has not only ample capacity to cool the present mill, but will also be sufficient for cooling the future additions.

The heating of the mill proper will be done by means of steam heating coils in the unit conditioners, while the heating of the offices and service areas will be provided by a low temperature radiant panel heating installation in the concrete floors of those areas. The partly fabricated floor coils are shown in Fig. 5. The radiant heating system utilizes forced hot water as a heating medium. In order to prevent the possible occurrence of condensation on the concrete floor of the mill proper, along its junction with the foundation walls, a single pipe coil was built into the junction of the exterior walls and the concrete foundations. The coil is connected to the radiant heating system. A detail showing just how this coil was built into the wall is shown in Fig. 6. The boiler plant consists of two oil-fired low pressure steam boilers, which provide steam for the heating of the plant and for heating the domestic hot water. Each boiler has a rated heating capacity of 4500 sq. ft. EDR when mechanically fired. When the textile machinery is in operation one boiler only will be used, even during the coldest weather, but both boilers will be required during the week-ends when subzero temperatures occur. It is due to the fact that the plant is windowless that such a small boiler capacity is required and that consequently the size of the chimney is so small in comparison to those usually found on mills of similar size. It is planned that, at a later date, electric heaters will be installed in the conditioned air supply ducts so as to take care of the weekend heating. In this way the steam boilers will be used during the plant operating periods only and the heating during the weekends will be done by electricity purchased as off peak power. Thus the present steam boilers will have sufficient capacity to take care of the heating of the future additions to the mill.

Because so little heating will be required in the mill, the fuel oil burning installation adopted utilizes oil burners approved to burn No. 4 fuel oil.

A schematic diagram of the control system for a typical factory air conditioning unit is shown in Fig. 7. This control system was designed to hold the dry bulb temperature and relative humidity constant the year round, and to control automatically the heating and humidification in winter, the evaporative cooling in spring and fall and the cooling by well water in summer.

Due to delays caused by difficulty in obtaining materials and by strikes both in the construction industry and, particularly, in the textile machinery manufacturing industry, this mill has not yet been put into production. It is, therefore, impossible at this time to give any data regarding its operation. After the mill has been in operation for some time, it is planned to make a survey of the performance of its air conditioning installation similar to surveys now being made by the author in a number of other textile mills and it is expected that the comparative data thus accumulated would form the basis of a subsequent paper.

From Month to Month

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

CONFERENCE OF COMMONWEALTH ENGINEERING INSTITUTIONS

During the month of September a conference unique in the history of engineering societies will be held in London, England. Representatives of engineering organizations from Australia, New Zealand, India, South Africa, Canada and the United Kingdom will gather there to discuss their many common problems and to explore the possibility of increasing their usefulness to the profession and to the public. The president and general secretary will represent the Engineering Institute.

The agenda covers a wide field dealing with joint publication of papers, a common information and abstracting service, and a common classification for publications, abstracts, filing and libraries.

The exchange of membership privileges will also be discussed. This will apply to publications, professional meetings, and all society activities. Uniformity of entrance standards, of training and of professional recognition will also be considered, and the possibility of joint membership will be investigated.

Professional recognition is another important item. What can the organization do to promote it? The possibility of an exchange of personnel such as research workers, teachers and students is also to be dealt with. Naturally collective bargaining will be on the programme.

An examination into the possibilities of the institutions giving encouragement to research, with provision of facilities for exchange of information, and the coordination of research projects, and travelling research fellowships are all to be discussed.

On the non-technical side the programme provides several social events and many visits to industries and to research establishments. The programme opens on September 14th and continues until the 28th.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

This is a new name for a society that has been in existence since 1893, the Society for the Promotion of Engineering Education. The organization and purpose of the original society have been expanded so as to include those of the Engineering College Research Association. The latter organization had been set up in 1942 in order to achieve objectives which could not be logically carried on under the Society for the Promotion of Engineering Education.

The American Society for Engineering Education now embodies the aims of the two former groups: the advancement of education in all that pertains to engineering and allied branches of science and technology, including the processes of teaching and learning, research, extension services, and public relations. The functions of the new Society are described as follows in its constitution: it "shall serve its members as a common agency of stimulation and guidance in: *(a)* the formulation of the general goals and responsibilities of engineering education for the service of individuals and the advancement of general welfare, *(b)* the adjustment of curricula and educational processes to changing conditions; *(c)* the development of effective teachers and administrators; *(d)* the improvement of instructional materials and methods, of personnel practices, and of administrative usages; *(e)* the enhancement of professional ideals and standards; *(f)* the fostering of research as a function collateral to teaching; *(g)* the coordination of institutional aims and programs, both among schools and colleges and in their joint relations with professional, educational, and public bodies; and *(h)* the cultivation of a fraternal spirit among teachers, administrators, investigators, practitioners, and industrialists.

At the regional meeting held at Digby, N.S., early this month, Council approved of the Institute continuing to give the new society the support it had given to its predecessor by retaining its institutional membership therein.

NON-TECHNICAL SUBJECTS ARE PREFERRED

Recently, the Junior Section of the Montreal Branch circularized its membership in order to determine the most popular subjects for meetings and discussion.

A list of about twenty subjects was submitted, including both technical and non-technical. It was a very wide and general list, and gave plenty of choice.

The results indicated emphatically that the members preferred non-technical subjects for their regular meetings. In the preferred list were such things as the following:

1) An outline of business management.
2) Effective speaking.
3) Psychology.
4) Town planning.
5) Canada's resources.
6) Appreciation of music.
7) The exporting business in Canada.
8) Selling psychology.

It is interesting and important to note this trend. Apparently, the young engineers realize the need of widening their knowledge. It is a good sign and it is to be hoped that the committee for the Junior Section will have no difficulty in lining up a series of good meetings along the lines so clearly indicated.

AN APPEAL TO CANADIAN ENGINEERS

Needed—Books, Journals and Equipment

University libraries in many parts of Europe have been partially or completely destroyed during the war years. With the new sessions commencing, these universities are without the necessary reading matter and equipment for their students.

The Association of Polish Engineers in Canada has set up a committee to handle the distribution of donations towards relieving the acute situation in Poland.

Contributions of the following types of material would be greatly appreciated by Polish university teachers and students:

1—Scientific and technical journals, proceedings, transactions and papers from 1925 to date.

2—Textbooks, handbooks, dictionaries, etc., in all branches of science and technology.

3—Drafting room equipment, compasses, triangles, slide rules, measuring instruments, and meter equipment.

All donations and inquiries should be addressed to M. Weinreb, M.E.I.C., Secretary, Committee forAssistance to Universities in Poland, Association of Polish Engineers in Canada, 671 Belmont Street, Montreal, Canada.

Because of its remoteness, not enough people know about the cenotaph recently unveiled by the Governor-General at Chilliwack, B.C.—a cenotaph conceived, designed and built by Canadian sappers in memory of all sappers. The Institute was officially represented at the unveiling by Past-President E. A. Cleveland of Vancouver.

The following account, based on material prepared by the committee, gives a somewhat sketchy outline of the project, sufficient to indicate the versatility and perseverance of the engineer, and his conquest over the perversity of inanimate objects. (Ed.).

* * * *

Cenotaphs to fallen warriors are generally located in prominent and naturally busy parts of a city or town, where the noise of traffic distracts the mind from the respect that such shrines deserve. The Sappers' Cenotaph, located some six miles out of Chilliwack, B.C., is set in such beautiful surroundings that on a fair day even the agnostic would surely feel the quiet sensation that is reverence.

To those privileged to know the history of this fine cenotaph it is not only a memorial to the dead, but a monument to the Corps, past, present, and to come. One must know something of the conception, production, and completion of the Sappers' Cenotaph to understand our pride in it.

At a meeting of the Officers Mess of "A6" Canadian Engineer Training Centre, in September 1944, a resolution was passed calling for a stone plaque to be erected to the memory of all members of "A6" who gave their lives in the service. Subsequently this idea was expanded by Lt.-Col. C. N. Mitchell, V.C., M.C., M.E.I.C., Officer Commanding, to envision a cenotaph to all sappers, designed, made, and erected by sappers.

Gradually the wheels started to turn. Soon after the New Year, Major W. F. Williams submitted his first sketch. On the twenty-fourth of January, an expedition located and decided on the quarry site, the face of a cliff on Harrison Lake, approximately 22 miles from the site selected for the cenotaph. The rock chosen was monzonite, aggregate of plagioclase, feldspar, and hornblende, resembling a grey granite. Under Lt. T. H. E. Copps, an experienced prospector and miner, a party started out to pitch a tent camp on Harrison Lake, and start the quarrying. A Cenotaph Committee was formed of Capt. R. B. Toombs, Capt. J. K. Korvin, Lt. W. G. Leithead, Lt. B. M. Middleton, S/Sgt. E. L. Crowe, Sgt. W. J. Sass, C.Q.M.S. J. Smalley, Sgt. A. E. Goring, Cpl. J. H. Forshaw, Cpl. R. B. Gamelseter, Spr. C. Mears, and Spr. J. F. Taylor, under the chairmanship of Major J. W. Davies. Subscriptions to cover such incidentals as trees, plants, grass seed, tools, etc., were asked for from all sappers in the Chilliwack area, and the response was speedy and gratifying.

The quarry party completed their most difficult job by the end of March 1945, although the weather had been such that a quarryman's comments would not look well in print. Now came the moving of the forty-two ton stone from the quarry to the park where the final cutting and finishing were to be done. It was decided to bring the massive block on a Bailey pontoon raft to Cannor Bay, a point on the Fraser near Chilliwack, and thence by low-loader overland to its destination. An obsolete Valentine tank was converted into a low-loader. The Bridging Wing constructed a five pontoon Bailey raft, while loading ramps were built at the quarry site and Cannor Bay.

Despite a heavy rain, the big stone started on its journey down the Harrison and Fraser rivers on the morning of May 16th, 1945, with Major T. A.V. Tremblay in charge. Within a few miles of the off-loading point, the raft grounded on a gravel bar in midstream. Using all available power and tricks of the trade, the raft was finally freed, but the force of the current threatened to swamp it. When the stone finally arrived at the off-loading point, some of the pontoons were half full of water.

Lt.-Col. C. N. Mitchell, V.C., M.E.I.C., Officer Commanding, "A6" C.E. Training Centre, Chilliwack, B.C. From a painting by Major J. W. Davies, 2nd i/c R.C.S.M.E., Chilliwack, B.C.

The big stone was unloaded in the centre of the Memorial Park on the 18th of May, 1945. By scrounging, improvising, and borrowing, a minimum of tools and equipment was assembled to start the stone cutting. S/Sgt. E. L. Crowe, Cpl. A. C. Bloomfield, Cpl. L. Thatcher, and Spr. J. P. Forster, all experienced stone masons, assumed the responsibility of carving the cenotaph. For the best part of a year, in fair weather and foul, they worked until the job was completed. All of these men could have claimed their discharge from the army long before the completion of their work, but the finishing of the cenotaph was a matter of personal pride to them. Twice the design had to be changed owing to faults in the stone. When it was found impossible to carry out the twelve-sided design of Major Williams, Capt. I. R. Morrison revised it to an eight-sided shaft. Again, further faults in the rock necessitated alterations, and Capt. W. G. Leithead, the last architect left in the unit, took on the job, and revised the design to the present cenotaph. Although the height of the shaft was not changed to any degree, the base was considerably reduced. By the end of February 1946, the steps were in place, the base stone and cap stone completed, and the main shaft approaching the final phase.

There still remained the modelling of the swords and grenades, the lettering, and the all-important job of raising the main shaft into position. Sgt. John Gastoski, a master craftsman in woodwork, carved a wooden sword model which was later cast in bronze and placed on the four cardinal faces of the cenotaph. Mrs. J. H. D. Barrett, widow of Major Barrett, R.C.E., who was killed in action soon after "D" day, modelled the grenade. The result was beyond expectations, carried out with strength and formality, yet with life in the waving flames. From the clay model, plaster casts had to be made for the bronze foundry. Major Davies, himself an artist but with little experience in modelling, took charge with Colonel Mitchell, Sgt. Gastoski and Spr. Rich assisting. Decked up in overalls and bespattered in clay and plaster, the workers looked like group "C" tradesmen.

On the four cardinal faces, inscriptions were cut and are as follows:

On the East Face—	In memory of the Officers and Men of the Royal Canadian Engineers who gave their lives in the War 1939-1945.
The South Face—	In memory of all Sappers of the Empire who have given their lives in the service of the Empire.
The West Face—	In memory of the Officers and Men of the Canadian Engineers who gave their lives in the War 1914-1918.
The North Face—	In memory of Canadian Sappers who gave their lives while serving with other Corps.

After careful calculation and consideration of all factors, an expert crew of riggers prepared the ground for the long anticipated event of erecting. On the 13th of April, 1946, the cenotaph was ready to be placed in its final position, a delicate operation indeed. By means of rollers, sheer legs, chain blocks, jacks, and block and tackle, the shaft was finally put in place, much to the relief of the whole organization. There remained only the completion of the paths and park, in which the engineers were aided greatly by the father of one of the sappers, a Mr. Booth, himself a well qualified landscape gardener. A park of two acres area surrounds the cenotaph.

* * * *

Thus was completed a unique enterprise which brings much credit to the small group that conceived it and built it. The *Journal* hopes that engineers all over the world will learn about it, and will share with the Canadians in the gratification that comes from knowing that a fitting memorial has been erected to the "members of their calling" who made the great sacrifice.

FACULTY CHANGES AT ALBERTA

R. S. L. Wilson, a former vice-president of the Institute, has just retired from the deanship of the Faculty of Applied Science at the University of Alberta, a position which he had occupied with distinction since 1929. He is succeeded by R. M. Hardy, who has been promoted from the status of Associate Professor of Civil Engineering to that of Professor of Civil Engineering and Acting Dean of the Faculty of Applied Science.

Dean Wilson was born in Lunenberg, N.S., in 1885 where he attended public and high schools. In 1902 he entered McGill University and graduated in 1911 after a five year interruption between freshman and sophomore years. During these five years and later summer vacations he was engaged in a variety of junior positions with the C.P.R. as clerk with the auditor of passenger receipts and various positions as surveyor's assistant on the construction of Angus Shops; maintenance of way, eastern division; construction of the Toronto Sudbury Branch; location of an electric railway in southern Ontario; construction of the Temiskaming and Northern Ontario railway; location surveys, Manitoulin and North Shore railway; and Grand Trunk Pacific branch lines.

After graduation he was engaged for a time with the Shawinigan Light Heat and Power Company on electrical transmission line construction and for one session as lecturer in mathematics and demonstrator in civil engineering at McGill University. This was followed by 3½ years on general construction work in Montreal and Saskatchewan. From 1915 to 1919 he was again lecturer and demonstrator at McGill University with summer periods at the Welland Ship Canal and as engineer with a construction company in Montreal.

In September 1919 he was appointed to the chair of civil and municipal engineering at the University of Alberta. In 1929 he was appointed dean of the Faculty of Applied Science.

While at the University of Alberta he was named as the

R. S. L. Wilson, M.E.I.C.

University representative among the incorporators of the Association of Professional Engineers of Alberta and served in an honorary capacity as registrar and secretary of the Association for some four or five years. Later he held the office of vice-president and president in successive years. He served two periods on the Council of The Engineering Institute of Canada: as councillor representing the Edmonton Branch from 1922-1924, and as vice-president of Zone A in 1933-34.

During his seventeen years service as Dean of Applied Science at the University of Alberta the registration in engineering more than tripled. During this period an extraordinarily large number of engineering students at Alberta came to regard him as a personal friend. His long experience and sympathetic personal characteristics were a great asset in dealing with the variety of special problems arising from the large number of returned men now proceeding through University courses in engineering. His retirement will be considered a real personal loss to many such men at the University of Alberta who have come to regard him as a friend and confidant.

The new head of the Faculty, Dean R. M. Hardy, was born at Winnipeg in 1906. He graduated as 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. Later he was 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.

R. M. Hardy, M.E.I.C.

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.

Dean Hardy has been a frequent contributor to The Engineering Journal and to other technical publications. He is president of the Alberta Land Surveyors Association and is a member of Council of the Association of Professional Engineers of Alberta. He has been active in the affairs of the Edmonton Branch of the Institute, having served at one time as secretary-treasurer.

The best wishes of the Institute go to Dean Wilson that he may long enjoy a well-earned period of retirement and to Dean Hardy that success may attend all his endeavours.

THE 1946 PROFESSIONAL MEETING AT DIGBY

An adequate account of the Maritime Professional Meeting held at Digby, N.S., September 5-6-7, would require a lot more space than the present paper supply situation will allow. The notes which follow should, however, be sufficient to convey to those who were not present the assurance that they have missed something, and to others they may bring back memories of a most pleasant time.

In the minds of the organizers, the Digby meeting was to be a continuation of the meeting held at Pictou, N.S., in 1939, and which had been interrupted suddenly at the half-way mark by the news of the invasion of Poland on September 1st. The delightful setting of the Pines Hotel, perfect summer weather, a programme where moments of relaxation alternated happily with the technical functions, those are so many factors that combined to make the 1946 Maritime Meeting a fitting celebration after seven years of hard work and restraint. Organized as a joint undertaking, this was the first maritime professional meeting since the Institute has entered into cooperative agreements with the Associations of Professional Engineers of Nova Scotia and New Brunswick. The results achieved are a good illustration of effective cooperation.

Officers of the three societies present were: President J. B. Hayes of the Institute and Mrs. Hayes, President J. L. Cavanagh of the Nova Scotia Association and Mrs. Cavanagh, R. M. Richardson, councillor of the New Brunswick Association representing President G. M. Brown, and Mrs. Richardson. In addition, there were several councillors and past officers of the three organizations, among whom should be mentioned: Past-presidents of the Institute A. J. Grant of St. Catharines, Ont., and H. W. McKiel of Sackville, N.B., both accompanied by their wives. The registration figure which was well over 300 includes mostly engineers from the Maritimes and their wives, but special mention should be made of the presence of members of the Institute such as W. H. Powell of Vancouver, B.C., who was accompanied by his daughter; Mr. and Mrs. R. F. P. Bowman from Brandon, Man.; Mr. and Mrs. E. A. Fulton of St. Louis, Missouri, and Miss Fulton. There were also several members and their wives from Ontario and Quebec.

Council Meeting

On September 4th, a regional meeting of the Council of the Institute was held in the afternoon, under the chairmanship of President Hayes. As it the custom at such meetings, past officers of the Institute in the Maritimes had been invited to attend as well as members of the branch executives. Officers of the provincial associations were also special guests and participated in the deliberations which lasted until shortly after 10 o'clock in the evening.

A large number of persons having already registered, the meeting was unofficially inaugurated that evening in the form of a get-together in the Maritime Professional Engineers club room. Under the inspiration of music provided by a talented accordionist, the ice was duly broken and, right from the start, a spirit of camaraderie was established which pervaded the entire meeting.

On Thursday morning the proceedings were launched at breakfast with what a writer of advertising copy would term an "eye-opener"; this was a bathing beauty contest "for men only" . . . to participate in. The event which terminated by a victory for "Arabella" MacNab set the note for the rest of the meeting.

President J. B. Hayes welcomes members at Digby. On his right, Chairman L. E. Mitchell, and on his left, Deputy Mayor Cardoza and Professor A. E. Flynn.

The Papers

At the first technical session, on Thursday, Dean H. W. McKiel of Mount Allison University presented a paper on Engineering Education in which he dealt with admission standards, selection of students and the need for broadening the scope of engineering courses. A lively discussion followed which indicated a great interest in the subject.

The second paper was by Dr. D. J. MacNeil, consulting geologist, of Antigonish, N.S., who told of the systematic search being currently made in the Maritimes to find oil in commercial quantities. He expressed the hope that those efforts would not be lessened and that sponsors of the survey would receive sufficient encouragement to spur them on to a successful conclusion

On Friday morning, Dr. Norman A. Parlee, director of research and development, Dominion Steel and Coal Corporation, Sydney, N.S., discussed the possible uses, for engineering and agricultural purposes, of the several hundred thousand tons of blast furnace and open hearth slag produced annually at Sydney.

The second speaker, that morning, was T. J. Halme of Canadian General Electric Company, Toronto. Mr. Halme, who spoke on Electronics in Industry, pointed out that electronics must not be expected to revolutionize present methods of operation, but that they will help existing methods, lower costs, improve quality and increase production.

The large attendance at all technical sessions is a tribute

(*Continued on page 548*)

The committee which planned and conducted the Digby meeting under the joint chairmanship of L. E. Mitchell and Mrs. G. J. Currie.

At the head table at the Friday dinner. Right to left, L. E. Mitchell, chairman, meeting committee; Past-President A. J. Grant; Premier Angus L. Macdonald; J. B. Stirling of Montreal, chairman at the dinner.

W. H. Noonan, Halifax; Charles Fowler, Halifax; J. B. Stirling, Montreal; A. A. Turnbull, Saint John.

Ira P. Macnab, Halifax; A. E. Cameron, Halifax; W. S. Wilson, Sydney.

Mrs. Gordon Naish, Mrs. E. C. O'Leary, Halifax, and S. Gordon Naish, secretary of the Cape Breton Branch.

J. H. Fraser of Sydney chats with W. H. Powell of Vancouver.

J. M. M. Lamb and Mrs. Lamb of Saint John, with Past-President A. J. Grant.

Lorne O. Cass, chairman of the Saint John Branch; Colonel J. A. Macdonald of Sydney, chairman of the Cape Breton Branch; J. L. Cavanagh, president of the Nova Scotia Association.

RULES GOVERNING AWARD OF INSTITUTE PRIZES

THE SIR JOHN KENNEDY MEDAL

A medal, called the "Sir John Kennedy Medal," was established in 1927, to be awarded under the following rules 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 Engineering Institute of Canada.

(1) The medal shall be awarded by the council of the Institute, at intervals of not less than two years, but only when the occasion warrants, 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.

(2) As a guide in making the award, the council of the Institute shall take into consideration the life, activities and standing in the community and profession of the late Sir John Kennedy.

(3) Awards shall be limited to corporate members.

(4) At the beginning of the year of award, all members of Council shall be asked for their recommendations, supported by reasons, for the award of the medal, which must be submitted to council not later than May first. The council of the Institute shall then give consideration to the recommendations, but will not necessarily adopt any of them. If, in the opinion of the council, no corporate member of the Institute thus recommended is of sufficient merit or distinction, no award shall be made.

(5) The award shall be decided by letter ballot of the council in a form to be prescribed by the council. The ballot shall be mailed to each member of the council and shall state the date of the council meeting at which it is proposed to canvass the ballot, which shall not be less than twenty days after the issue of the ballot. Unless at least twenty-five votes are cast there shall be no award. There shall be no award if more than two negative votes are cast.

(6) Announcement of an award shall be made in *The Engineering Journal* and at the annual meeting, and, if possible, the presentation shall take place at that meeting.

THE JULIAN C. SMITH MEDAL

This medal was founded in 1939 by a group of senior members to perpetuate the name of the late past-president of the Institute. It is awarded for "achievement in the development of Canada." The inaugural awards—eleven in number—were made in 1940 and 1941, but subsequent awards are limited to not more than two each year.

The general secretary shall ask each past-president and each vice-president of the Institute for nominations, which shall be submitted to a committee of three consisting of the president and two members of Council appointed by him. This committee may select not more than two names from the nominations, which name or names shall be submitted by open letter ballot to all councillors not later than October first of each year. At least twenty days shall elapse before the ballot is closed. Unless at least twenty-five votes are cast there shall be no award. There shall be no award if more than two negative votes are cast.

It is possible that some special occasion—a centenary celebration or the like—may arise when it would evidently be desirable to award more than two Julian C. Smith medals. In such a case departure from the prescribed limit may be permitted, but only if authorized by a formal resolution of Council, stating the special reasons for the action.

DUGGAN MEDAL AND PRIZE

A prize of a medal and cash to a combined value of approximately one hundred dollars was established in 1935, to be given each year from the proceeds of a donation by Past-President G. H. Duggan, D.SC., LL.D., M.E.I.C., for the purpose of encouraging the development of the branches of engineering in which he practised.

The prize will be awarded for the best paper presented to the Institute in accordance with the following rules:

(1) Competition shall be open to all members of the Institute.

(2) The papers shall be presented to the Institute either at the regular meeting of a branch or at a professional meeting of the Institute, or directly to Headquarters. They shall not have been presented previously to any other body or meeting.

(3) Papers to be eligible for this competition shall deal with subjects concerning the use of metals for structural or mechanical purposes. Without limiting the generality of the foregoing, it is suggested that the following topics come within this category, viz.: the economic and theoretical elements of design, fabrication, machinery, transporting, erecting, the investigation of problems or failures, methods of overcoming difficulties, new methods of design or manufacturing, the recording of tests, and other features that add to engineering knowledge.

(4) Papers shall be the bona fide production of the author and proper credit shall be given for any assistance received from other parties, partners or reports. The relation of the author to the work shall be clearly stated. Papers shall be compiled and arranged with proper regard to literary value and shall constitute worthy contributions to the records of the engineering profession.

In judging the competition consideration will be given to the personal knowledge and appreciation of the problems and processes involved and the joint application of theoretical and practical considerations to the execution of the subject which are displayed on the part of the author.

(5) The papers shall be judged by a committee of three corporate members, eminent in the corresponding branch of the profession, appointed for the purpose by council as required.

(6) The award shall be made only when a paper of sufficient merit is presented. The prize year shall be from July 1st to June 30th and papers must be presented to Headquarters of the Institute by the 30th day of June.

(7) The prize shall be awarded at the annual meeting.

THE GZOWSKI MEDAL

A gold medal, called "The Gzowski Medal," is provided from the fund established in 1889 by Col. Sir Casimir Gzowski, A.D.C., K.C.M.G., late past-president of the Institute, and will be awarded according to the following rules for papers presented to the Institute:

(1) Competition for the medal shall be open only to those who belong to the Institute.

(2) The award of medals shall not be made oftener than once a year, the medal year shall be the year ended June last previous to the annual meeting at which the award is to be made.

(3) The papers entered for competition shall be judged by a committee of five, to be called the Gzowski Medal Committee, which shall be appointed by the council as soon after the annual meeting of the Institute as practicable. Members and Honorary Members only shall be eligible to act on this committee.

(4) Papers to be eligible for competition must be the bona fide production of those who contribute them, and must not have been previously made public, nor contributed to any other society in whole or in part.

(5) The medal shall be awarded for the best paper of the medal year, provided such paper shall be adjudged of sufficient merit as *a contribution to the literature of the profession* but not otherwise.

(6) In the event of the committee not considering a paper in any one year of sufficient merit, no award shall be made; but in the following year or years, it shall be in the power of the committee to award the accumulated medals to the authors of different papers which may be deemed of sufficient merit.

(7) The medal shall be suitably engraved by the Institute, and shall be handed to the successful authors at the annual meeting, or be given to them as soon afterwards as possible.

THE LEONARD MEDAL

A gold medal, called "The Leonard Medal," is provided from the annual proceeds of a fund established in 1917 by the late Lieut.-Col. R. W. Leonard, and will be awarded in accordance with the following rules for *papers on mining subjects* presented either to The Canadian Institute of Mining and Metallurgy or to The Engineering Institute of Canada.

(1) Competition for the medal shall be open to those who belong to The Canadian Institute of Mining and Metallurgy or to The Engineering Institute of Canada.

(2) Award shall be made not oftener than once a year, and the medal year shall be the year ended June last previous to the year in which the award is made.

(3) The medal shall be presented at annual meetings of The Engineering Institute of Canada.

(4) A committee of five shall judge the papers entered for competition, all of whom shall be members both of The Canadian Institute of Mining and Metallurgy and The Engineering Institute of Canada, this committee to be appointed by the council of The Engineering Institute of Canada.

(5) All papers presented shall be the work of the author or authors and must not have been previously made public, except as part of the literature of The Canadian Institute of Mining and Metallurgy or The Engineering Institute of Canada.

(6) Should the committee not consider the papers presented in any one year of sufficient merit, no award shall be made, but in the following year, or years, the committee shall have power to award the accumulated medals or to award a second prize in the nature of a silver medal, or a third prize of books to be selected by the committee.

(7) The medal shall be suitably engraved, containing the name of The Engineering Institute of Canada, and the words, "The Leonard Medal" together with the adopted design, and on the reverse side the name of the recipient, the date and any other inscription that may be decided upon by the committee.

THE PLUMMER MEDAL

A gold medal, called "The Plummer Medal," is provided from the annual proceeds of a fund established in 1917 by J. H Plummer, D.C.L., and will be awarded according to the following rules for *papers on chemical and metallurgical subjects* presented to the Institute.

(1) Competition for the medal shall be open to those who belong to The Engineering Institute of Canada, and to non-members if their papers have been contributed to the Institute and presented at an Institute or Branch meeting.

(2) Award shall be made not oftener than once a year, and the medal year shall be the year ended June last previous to the year in which the award is made.

(3) The medal shall be presented at annual meetings of The Engineering Institute of Canada.

(4) A committee of five shall judge the papers entered for competition, all of whom shall be members of The Engineering Institute of Canada, and shall be appointed by the council of the Institute.

(5) All papers presented shall be the work of the author or authors and must not have previously been made public, except as part of the literature of The Engineering Institute of Canada.

(6) Should the committee not consider the papers presented in any one year of sufficient merit, no award shall be made, but in the following year, or years, the committee shall have the power to award the accumulated medals or to award a second prize in the nature of a silver medal, or a third prize of books to be selected by the committee.

(7) The medal shall be suitably engraved, containing the name of The Engineering Institute of Canada, and the words, "The Plummer Medal," together with the adopted design, and on the reverse side the name of the recipient, the date and any other inscription that may be decided upon by the committee.

THE T. C. KEEFER MEDAL

This medal was established by Council in 1942 to perpetuate the name of the first president of the Institute.

It is awarded for papers presented to the Institute during the year on *civil engineering subjects*, "civil" being used in the limited sense to indicate structural, surveying and construction work generally.

THE R. A. ROSS MEDAL

This medal was established by Council in 1942 to perpetuate the name of a past president of the Institute distinguished for work in the electrical branch of engineering.

It is awarded for papers presented to the Institute during the year on *electrical engineering subjects.*

THE CANADIAN LUMBERMEN'S ASSOCIATION PRIZE

A prize of $100.00 will be awarded by the Canadian Lumbermen's Association for the best paper presented in any year on the use of lumber or timber in construction; or on the use of wood, including wood waste, in the manufacture of useful products; or on the development of methods of treating wood to make it more resistive to destruction from decay, insects, marine organisms or fire; or in such other related subjects in wood utilization as may later be designed.

The following rules shall govern in the competition:

(1) The competition shall be open to all members of the Institute and to any bona fide resident of Canada.

(2) An award shall be made only if, in the opinion of the examiners, a paper has been presented for publication in the *Journal* of the Engineering Institute of Canada and/or in *Timber of Canada* of sufficient merit to justify the award.

(3) The award shall not be made oftener than once a year, and the prize year shall be from July 1st to June 30th.

(4) The award shall be made at the Annual Meeting of the Engineering Institute of Canada.

(5) A committee of five shall judge the papers entered for competition, all of whom shall be members of the Engineering Institute of Canada.

(6) All papers presented shall be the work of the author or authors and must not have been previously made public except as part of the literature of the Engineering Institute of Canada, or of the Canadian Lumbermen's Association. Proper credit shall be given in the papers for any assistance obtained from other parties or from other reports.

(7) Should the Committee not consider the papers presented in any one year of sufficient merit to justify a prize, no award shall be made, but in the following year or years the Committee shall have power to award accumulated prizes if papers of sufficient merit to justify prizes are presented.

(8) In the case of two or more authors presenting a paper, the amount of the prize shall be divided equally among such authors.

(9) For the first year the award shall be made for the best paper on the structural application of timber and/or plywood as for example—

(1) Laminated structural wood members.

(2) Composite wood and plywood structural members.

(3) New ideas in the design of structural timber units.

Special consideration will be given to papers dealing with the application of low grade material to structural uses. (Approved by E.I.C. Council, June, 1944.)

PRIZES TO STUDENTS AND JUNIORS

(1) Five prizes may be awarded annually for the best papers presented by Students or Juniors of the Institute in the vice-presidential zones of the Institute, as follows:—

The H. N. Ruttan Prize,—
in Zone A—The four western provinces.

The John Galbraith Prize,—
in Zone B—The Province of Ontario.

The Phelps Johnson Prize,—
for an English Student or Junior in Zone C—The province of Quebec.

The Ernest Marceau Prize,—
for a French Student or Junior in Zone C—The province of Quebec.

The Martin Murphy Prize,—
in Zone D—The Maritime provinces.

(2) Awards shall only be made if, in the opinion of the examiners for a zone, a paper of sufficient merit has been presented to a branch in that particular zone.

(3) The winner of a prize shall be required to specify such technical books or instruments as he may desire to the total value of approximately twenty-five dollars when suitably bound and printed or engraved, as the case may be.

(4) The award of prizes shall be for the year ending June thirtieth. On that date, each branch secretary shall forward to the examiners for his particular zone all papers presented to his branch by Students and Juniors during the prize year, regardless of whether they have been read before the branch or not.

(5) The prizes shall be awarded only to those who are in good standing as Students or Juniors of the Institute of June thirtieth following the presentation of the paper.

(6) The papers must be the bona fide production of those contributing them and must not have been previously made public or contributed to any other society in whole or in part. It is to be understood, however, that a paper which has won or been considered for a branch prize is nevertheless eligible for the Institute Prize. No paper shall be considered for more than one of the five prizes.

(7) The examiners for each zone shall consist of the vice-president of that zone and two councillors resident in the zone, appointed by council. In the case of Zone C, two groups of examiners shall be appointed under the two vice-presidents, one for the English award and one for the French award. The awards shall be reported to the annual meeting of the Institute next following the prize year, and the prizes presented as soon thereafter as is reasonably possible.

PRIZES TO UNIVERSITY STUDENTS

In 1930 Council established eleven cash prizes of twenty-five dollars each for competition among students of Canadian engineering schools, in the year prior to the graduating year. Awards are now made annually to the following institutions:

University of Alberta
University of British Columbia
Ecole Polytechnique, Montreal
Laval University, Quebec
University of Manitoba
McGill University
University of New Brunswick
Nova Scotia Technical College
Queen's University
Royal Military College
University of Saskatchewan
University of Toronto.

It is the desire of council that the method of their award shall be determined by the appropriate authority in each school or university, so that a prize may be given to the student in any department of engineering who has proved himself most deserving, not only in connection with his college work, but also as judged by his activities in the student engineering organization, if any, or in the local branch of a recognized engineering society.

It is not necessary for the recipient to belong to the Institute, and in this respect the prizes are quite distinct from those offered to Students and Juniors of the Institute, or from the prizes which are offered by a number of our branches to the Students attached to them.

It is felt that the establishment of these prizes not only aids deserving students, but assists in developing their interest in engineering societies' work, and in the resulting acquirement and interchange of professional knowledge.

Personals

News of the Personal Activities of members of the Institute

Dr. R. D. Bennett, M.E.I.C., is the newly elected chairman of the Kingston Branch of the Institute. He was born in Montreal, and attended McGill University, receiving B.Eng. and M.Sc. degrees in 1932 and 1933. While serving as head demonstrator and graduate assistant in the chemical engineering department he obtained his Ph.D. at McGill in 1935, and that year joined the Canadian Industrial Alcohol Company Limited in Montreal as chief chemist. In 1937, he went to J. T. Donald and Company Limited, Montreal, as head of the organic department and the next year became connected with Canadian Industries Limited. With that firm he was located at Beloeil and Shawinigan Falls, Que., and was transferred in 1943 to Kingston, Ont. He is development superintendent in C.I.L.'s Nylon Division in that city.

J. E. Thom, M.E.I.C., the newly elected secretary-treasurer of the Kingston Branch of the Institute, is from Regina, Sask.

He attended the University of Toronto, graduating in 1932 with a B.A.Sc. He was then employed for six years by Imperial Oil Limited at the Regina Refinery, and in 1941 transferred to Defence Industries Limited. In the plant engineering department at Verdun, Que., he was successively engineer, supervisor, and superintendent. In 1945 he accepted his present position as resident engineer at the Kingston Works of Canadian Industries Limited.

R. H. Parsons, M.E.I.C., has recently retired as city engineer for Peterborough, Ont., after thirty-three years service in that office. The city council and fellow civic employees tendered a dinner in his honour and presented him with an engraved silver tray and an illuminated address citing his contributions to city improvement. Mr. Parsons studied engineering at the University of Michigan, and commenced his career with railroad work in the United States. He became engaged in municipal engineering work in Ottawa, Ont., where he was assistant to the city engineer from 1901 to 1913, with a two year interval in 1905 and 1906 as superintendent of the Warren Bituminous Paving Company at Toronto, Ottawa and Regina. He received his appointment in Peterborough in 1913. Mr. Parsons is a past president of the Canadian Institute on Sewage and Sanitation.

W. T. Dempsey, M.E.I.C., took office on September 1st as city engineer for Oshawa, Ont. He is from Griswold, Man., and graduated in civil engineering at the University of Saskatchewan in 1934. He has been employed in oil field development in South America and in construction engineering in Canada. In 1941 he was with the Chemical Construction Corporation at Niagara Falls, Ont. He served with the R.C.E. in the last war with the rank of lieutenant.

Captain (L) E. G. Cullwick, M.E.I.C., who was head of the department of electrical engineering at the University of Alberta and was granted leave of absence in 1942 to serve with the navy, has resigned from the university. He is located at Ottawa, Ont., at Naval Service Headquarters as director of electrical engineering.

E. D. Gray-Donald, M.E.I.C., chief engineer of the Quebec Power Company, has been promoted in the reserve army to the rank of lieutenant-colonel and appointed commander of the 4th Division, R.C.E.M.E.

George Bromley, M.E.I.C., consulting engineer of Montreal, Que., has become associated with J. A. Kearns, M.E.I.C., and the new firm will be known as Kearns and Bromley, Associate Consulting Engineers, Montreal.

D. E. Perriton, M.E.I.C., who has recently been appointed engineer in charge of mechanical sales for the eastern division of the Dominion Bridge Company Limited, Lachine, Que., has been with the company since 1922 following his graduation from McGill University in that year. He had occupied various positions in the engineering and contracting departments, before being transferred to the Ontario Division in 1930 where he assumed the managership of the McGregor McIntyre Iron Works Limited, a subsidiary of Dominion Bridge Company. In 1940 he became manager of the company's cartridge case plant at Toronto and continued in this position until his present appointment.

Brig. Gen. Sir Godfrey Rhodes, M.E.I.C., is in Crowborough, Sussex, England, where he has opened an office in collaboration with the firm of consulting engineers, Sir Alexander Gibb and Partners. He will be responsible for railway affairs for the firm. He had been in British East Africa for many years, connected with the Kenya and Uganda Railways and Harbours, at Nairobi, Kenya Colony, serving as chief engineer, as deputy general and chief engineer, and as general manager.

N. C. Sherman, M.E.I.C., who retired recently from the army with the rank of colonel, after thirty-five years service, is now established in Vancouver as an industrial consulting engineer. For the last few months, he was connected with the John Inglis Company as resident engineer at Vancouver.

E. R. Evans, M.E.I.C.
Photo by W. B. McAdams

E. R. Evans, M.E.I.C., has been elected chairman of the Moncton Branch of the Institute. Born at Hampton, N.B., he commenced his professional career in 1909 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 at Richibucto, N.B., and West Point, P.E.I., and later as engineer in charge of railway surveys for the Moncton-Buctouche Railway to Loggieville, N.B. He was commissioned a lieutenant in the Royal Canadian Artillery in 1915, won a captaincy and was awarded the Military Cross. After demobilization in 1919, he joined the Canadian National Railways and has been resident engineer on the construction of the transit sheds and new hotel and station at Halifax, the bridge across the St. John river at Fredericton, and the new locomotive shops at Moncton, N.B. He is at present assistant engineer at Moncton for C.N.R.

Norman Bell, M.E.I.C., formerly assistant superintendent of the Bayer Ore plant of the Aluminum Company of Canada at Arvida, Que., has gone to Pittsburgh, Pa. He is on the teaching staff of the chemical engineering department of the University of Pittsburgh.

C. A. Leighton, M.E.I.C., who has for many years been located in the United States in engineering work in Enfield and Boston, Mass., and New York, N.Y., and at Bermuda, B.W.I., and Caracas, Venezuela, has returned to Canada. He is associated with Marine Industries Limited, Montreal.

O. B. Mason, M.E.I.C., formerly of Chillicothe, Ohio, has accepted an appointment as assistant to the general manager of the Escanaba Paper Company of Escanaba, Mich.

G. H. W. McKee, M.E.I.C., who has been instructing in business administration at the University of Western Ontario, London, Ont., has become connected with Kelco Engineering Limited of that city as assistant to the president.

R. J. Merritt, M.E.I.C., is now manager of the Electric Steam Radiator Company of Canada Limited, Windsor, Ont. He was previously in the technical department of Defence Industries Limited and was located at the Cherrier Works at Montreal.

C. G. Mills, M.E.I.C., has taken a position with the engineering division of the B.C. Electric Railway Company at Vancouver, B.C. He was previously employed as an electrical engineer with the West Kootenay Power and Light Company at Trail, B.C.

L. Sterns, M.E.I.C., who was since 1944 in charge of construction for the Canadian International Paper Company, Gatineau, Que., has gone to the E. B. Eddy Company of Hull, Que., where he is construction engineer.

ERRATUM

In the Personals column of the August Journal, **Guy A. Lindsay,** M.E.I.C., was reported as being "employed as design engineer with the industrial electronics division of the Westinghouse Electric Company at Baltimore, Md." The item was meant to refer to **G. A. Lindsay,** M.E.I.C., who was formerly with the Northern Electric Company Limited, Montreal, as consulting engineer. Mr. Guy A. Lindsay of Ottawa is still in his position as engineer in charge of the general engineering branch of the Department of Transport and he is the one who, in 1940, was active on a committee appointed to represent Canada in the investigations for the early development of power resources in the international section of the St. Lawrence River.

We apologize to the gentlemen involved and to our readers.

W. I. Fisher, M.E.I.C., who served overseas with 2nd Battalion R.C.E., has returned to his former position with the Nova Scotia Department of Highways and Public Works.

J. S. Fowler, M.E.I.C., has been released from the R.C.N.V.R., and has returned to civil life and is now with the University of Saskatchewan.

John H. Fox, M.E.I.C., who served overseas in the R.C.E.M.E., with the rank of lieutenant colonel, has returned to his pre-war position with Minneapolis Honeywell Regulator Company Limited in Toronto.

F. F. Fulton, M.E.I.C., who was senior technical staff officer at Canadian Military Headquarters overseas, has returned to his pre-war appointment with the Northern Electric Company Limited, Montreal.

H. H. Minshall, M.E.I.C., who served overseas in the R.C.E., for several years, has returned to his pre-war position with Dominion Bridge Company in Vancouver.

W. J. Murray, M.E.I.C., who was on works services with the R.C.A., has rejoined the Hydro-Electric Power Commission of Ontario in Toronto.

Ralph R. Willis, M.E.I.C., who served overseas with the R.C.E., on works services, has returned to his pre-war position with the Ross Engineering Company of Canada Limited in Montreal.

F. C. Woods, M.E.I.C., who was overseas for over four years with the R.C.E., has returned to his former position with the City of Westmount, Que.

John A. Webster, M.E.I.C., who served in the Royal Canadian Signals, is now with the Shawinigan Water and Power Company in Montreal.

E. G. Woolsey, M.E.I.C., who was overseas with the R.C.E., has accepted a position with the Dominion Observatory, Ottawa, Ont.

J. H. Ferguson, Jr.E.I.C., who joined the R.C.A.F. in 1929, is remaining with them in the post war period.

R. A. Forrester, Jr.E.I.C., who was overseas for three years with the R.C.E., has accepted a position with the Hydro-Electric Power Commission of Ontario, in Toronto.

J. S. Francis, Jr.E.I.C., who served in both army and navy, is now employed with the Northern Electric Company Limited in Montreal.

C. Fraser, Jr.E.I.C., who served overseas for five years in the R.C.E., has returned to his former position with the Ontario Department of Highways at Port Arthur.

W. M. Fraser, Jr.E.I.C., has been released from the navy and is now connected with Fraser Airborne Products Limited.

R. H. Garrett, Jr.E.I.C., who served in Canada and overseas with the R.C.A.F., is now partner in Essex and Company in Vancouver, B.C.

L. W. Geake, Jr.E.I.C., who served overseas in the R.C.E.M.E., has accepted employment with Price Brothers and Company Limited, Kenogami, Que.

H. E. Gove, Jr.E.I.C., who was in the R.C.N.V.R., is now employed with the National Research Council at Chalk River, Ont.

E. R. Mitchell, Jr.E.I.C., who was in the R.C.E.M.E., is now with the Bailey Meter Company Limited in Montreal.

G. A. Morison, Jr.E.I.C., who served with the R.C.E., has accepted a position with the Canadian Pacific Railway in Montreal.

C. E. Morse, Jr.E.I.C., who served overseas in the R.C.A.F., is now with Dominion Glass Company Limited in Montreal.

W. Herbert C. Wallis, Jr.E.I.C., who served in the R.C.A.F., has accepted a position with Canadair Limited in Montreal.

Ronald S. Wilson, Jr.E.I.C., who was overseas with the R.C.N.V.R., is now with the National Harbours Board in Montreal.

W. C. Weir, Jr.E.I.C., who served in Canada and overseas with the R.C.A.F., has accepted a position with the Veterans Land Act administration and is in Ottawa, Ont.

R. C. Weller, Jr.E.I.C., who was in the R.C.E., is now employed with the Department of Mines and Resources at Ottawa, Ont.

John R. Wellington, Jr.E.I.C., who served overseas with the R.C.A., has now accepted employment with the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C.

J. P. Woods, Jr.E.I.C., who was overseas in the navy, is now with the Consolidated Paper Corporation at Grand'Mère, Que.

R. B. Wotherspoon, Jr.E.I.C., who served in the Royal Engineers for six years, has returned to his pre-war position with the Steel Company of Canada at Gananoque, Ont.

R. R. Snyder, Jr.E.I.C., has been discharged from the R.C.N.V.R. and is employed with Pacific Mills at Ocean Falls, B.C.

W. J. Milhausen, Jr.E.I.C., who served overseas in the R.C.E., is now with the Manitoba Department of Public Works in Winnipeg.

L. E. Gads, Jr.E.I.C., who was discharged in 1945 from the R.C.A.F., has returned to the department of civil engineering of the University of Alberta. He has been appointed assistant professor of civil engineering.

R. E. McClary, S.E.I.C., who received his B.Sc., (electrical) from the University of Alberta this year, is demonstrating in electrical engineering at the University.

G. Proudfoot, S.E.I.C., a B.Sc. in electrical engineering of the class of 1946 at the University of Alberta, is with the electrical engineering department of the University as a demonstrator.

A. D. Flay, S.E.I.C., who served overseas in the R.C.E.M.E., has returned to Queen's University to continue his studies in Arts.

J. E. Freeman, S.E.I.C., who served in the R.C.N.V.R., has accepted a position with New Brunswick International Paper Company Limited, Dalhousie, N.B.

V. A. Graham, S.E.I.C., who served in the R.C.N.V.R., is now with the Dominion Bridge Company at Lachine, Que.

A. H. Gerrish, S.E.I.C., who was in training for the army is now employed with the Montreal Engineering Company.

G. A. Verge, S.E.I.C., who served overseas with the Royal Canadian Signals, is now resident engineer, Department of Mines, Quebec.

Thomas E. Weber, S.E.I.C., who was in training for the Canadian Infantry Corps, has been released from the army and has taken employment with Mr. M. G. Smerchanski at Portage La Prairie, Man.

PROFESSIONAL MEETING AT DIGBY

(*Continued from page 543*)

to the authors and must have been very gratifying to the members of the committee who had arranged a well-balanced programme of papers combining local and general interest.

The Luncheons, Dance and Banquet

At the first luncheon, on Thursday, September 5th, under the chairmanship of L. E. Mitchell of Halifax, the official welcome from the town of Digby was extended by Deputy Mayor Victor G. Cardoza. After this, the president of the Institute, J. B. Hayes of Halifax, expressed his pleasure at presiding over a maritime meeting and made everyone feel quite at home.

The opening ball, which was held that evening provided a pleasant diversion. Long after the music had ceased, echoes were still ringing about the place and are said to have originated with serenaders going from one cottage to another.

The Friday luncheon was under the chairmanship of R. M. Richardson of the New Brunswick Association and was addressed by Dr. L. Austin Wright, general secretary, who described briefly the many services provided by the Institute for its members.

The banquet on Friday night was the closing function. Under the chairmanship of J. B. Stirling, a councillor of the Institute and a member of the New Brunswick Association, the meeting was honoured by the presence of Premier Angus L. Macdonald who spoke briefly. Thomas H. Raddall, the Canadian author who has so vividly described the strong characteristics of the Maritime people, was the guest speaker. Under the title "Nova Scotia Humour," his address was a collection of delightful anecdotes.

At the conclusion of the banquet, a show was given, in cabaret style, by a troupe of performers brought to Digby for the occasion.

Thanks are due to L. E. Mitchell and Mrs. G. J. Currie under whose joint chairmanship such a well-balanced programme was arranged, which, with the proverbial maritime hospitality, has resulted in one of the most successful meetings in the annals of the Institute. It was the wish of everyone present that it would not be necessary to wait another seven years before the next Maritime Professional Meeting.

Obituaries

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

John Preston Forde, M.E.I.C., a life member of the Institute since 1938, died at his home in Victoria, B.C., on February 27, 1946.

He was born in Holywood, Ireland, in 1873, followed an engineering course at Dublin University, and came to Canada in 1891, establishing himself in British Columbia. He was first employed in field work and draughting for Burnet and Hope at Vancouver and in 1897 engaged in hydraulic and mining engineering in Lillooet, B.C. He entered railway work in 1901 as engineer in charge of the Kettle Valley Lines, Grand Forks, B.C., going the next year to the State of Washington as assistant engineer for the Great Northern Railway at Spokane. In 1904 he became district engineer for the Canadian Pacific Railway at Revelstoke, B.C., where he remained for seven years.

Mr. Forde then joined the staff of the Federal Department of Public Works and was successively located at Nelson, Victoria and New Westminster, B.C. He became engineer in charge of all Dominion works projects in British Columbia and the Yukon, including the Esquimalt drydock. He retired in 1938.

He had been a Member of the Institute since 1905.

Reginald March Calvin, M.E.I.C., sales manager of Canadian Vickers Limited, Montreal, died suddenly on August 12th, 1946, at Metis Beach, Que.

Born at Garden Island, Ont., in 1889, he was educated at Kingston schools and at Queen's University where he received a B.A. in 1911 and a B.Sc. in civil engineering in 1914. Following graduation he was on the engineering staff of Canadian Stewart Company on Toronto harbour improvements for some months, resigning to enlist in the Queen's University Engineers as a sapper, and was commissioned before going overseas in 1915. On his discharge in 1919 with the rank of major, he entered the Department of the Interior, employed on power investigation in the Dominion Water Power Branch at Ottawa. During the years 1921 to 1927 he was connected with the H. S. Taylor Company in Montreal and with Hanover Converters Limited at Hanover, Ont. In 1927 he joined the industrial engineering department of Canadian Vickers Limited, Montreal, and the firm appointed him sales manager in 1934.

Mr. Calvin joined the Institute in 1914 as a Student, becoming an Associate Member in 1919 and a Member in 1940. He served in recent years as a member of the Finance Committee.

James Anderson, M.E.I.C., of Malagash, N.S., died accidentally on May 8th, 1946.

He was born in 1904 in Motherwell, Scotland, was educated at Dalziel and Airdrie and served his apprenticeship as a mining engineer in Glasgow, Scotland, with the firm of William Dixon. He received a mining surveyor's certificate in 1926, and a mine manager's certificate three years later. In preparation for the latter he spent two years as assistant superintendent and engineer at the Cadzon Colliery, Hamilton, Scotland.

He came to Canada in 1930 and was employed as a surveyor in the Land Titles Office at Calgary, Alta., after which he was employed for two years by the Granby Consolidated Mining and Smelting Company at Anyox, B.C. He next proceeded to Ontario to mining engineering work at the Frood Mine, Sudbury, and at the Falconbridge Nickel Mine. In 1936 he entered the Malagash Salt Company in Nova Scotia, and was later appointed its manager, being actively engaged for the company at the time of his death. He joined the Institute as a Member in 1940.

Library Notes

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

BOOK REVIEW

AIRPORT PLANNING

Charles Froesch and Walther Prokosch. New York, Wiley; London. Chapman & Hall, 1946. 250 pp., Illus., 11¼ x 8½ in., cloth, $7.00.

Reviewed by J. A. Wilson, M.E.I.C.*

Adequate airports are as essential today to Air Transportation as are good roads to the modern automobile industry. Since the financial expenditures involved in providing such facilities are now so considerable and are constantly increasing, no airport project should be undertaken except after the most careful study and scrutiny to ascertain that all factors have been carefully weighed and that the expense can be justified from all angles. In this volume, the work of two experts, each with long experience in his own field, airport problems are clearly and concisely analysed from a fundamental and functional viewpoint.

The purposes of the book are: 1. To indicate the proper relationship of landing facilities to communities or regions they are to serve; 2. To analyse the characteristics of aircraft which affect the planning and design of those facilities; and, 3. To effect a proper balance between the airfield and buildings. Practical and detailed consideration is also given to airfield construction and lighting, building design, hangar design, and the establishment and operation of special services.

Each section is an admirable summary of up-to-date knowledge and practice which should be invaluable, not only to those in the aviation industry but to the constantly increasing number of executives, engineers, architects and contractors whose interest and attention will undoubtedly be attracted by the ever widening scope of modern aviation. The book is admirably illustrated by pictures, diagrams, maps and sketches throughout and each section contains a bibliography of reference works on its particular subject.

Stress is properly laid on the importance of planning ahead and allowing for expansion in planning. What may be adequate for today may be totally inadequate to take care of the traffic requirements a few years hence. This may result in the forced abandonment of expensive facilities created without sufficient vision to provide for future expansion. The expense involved in the creation of modern airport facilities is so great that no effort must be spared to plan for future expansion to take care of all anticipated growth. The authors show admirably how much error may be avoided and how sites, if properly planned, may be developed gradually, step by step, thus avoiding unnecessary preliminary expense while providing in the plan ample room for expansion, which may be required in future to meet increased traffic or to accomodate larger types of aircraft.

A word of warning is necessary, however. No amount of planning will provide a suitable airport site in some localities. The site must exist before it can be planned. Some localities are fortunate in having a choice of possible sites for development, others are fortunate if there are one or two possible airport sites available. In the case of at least one important Canadian city, no site which could be improved at reasonable cost has been found within a distance of twenty miles after twenty years of exhausted search! In another, the only possible site, and it is a fine one, is useless because it is blanketed by fog at many seasons of the year.

In Canada, the Civil Aviation staff has had the foresight to plan for expansion and few existing sites will have to be abandoned because of lack of vision in their planning. Many sites call urgently today for necessary expansion to meet new conditions, however. If Canada is to hold the great position she has made for herself in the aviation world, a great expansion of our airport programme is still necessary in all parts of the Dominion and no better guide to planning that expansion could be desired than this valuable work.

Formerly Director of Air Services, Department of Transport, Ottawa, Canada.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Atomic Energy in Cosmic and Human Life; Fifty Years of Radio-activity:

George Gamow. Cambridge, University Pr.; N.Y., Toronto, Macmillan, 1946. 161 pp., illus., cloth, $3.25 (in Canada).

Beams on Elastic Foundation; Theory with Applications in the Fields of Civil and Mechanical Engineering:

M. Hetényi. Ann Arbor, University of Michigan Pr.; London, Geoffrey Cumberlege, Oxford University Pr., 1946. 255 pp., illus., cloth, $4.50.

Civil Code of Lower Canada; with the Amendments Effected by Imperial Federal and Provincial Legislation, up to and including the First Session of the Twenty-Second Legislature of the Province of Quebec, 9 George VI, 1945; and also the Federal Bills of Exchange Act as Amended to Date:

E. Howard Cliff. Montreal, Wilson & Lafleur, 1945. 857 pp., fabrikoid, $7.00.

Le Cobalt:

Robert Perrault. Paris, Dunod, 1946. 151 pp., illus., paper, 390 Fr.

Design and Construction of Concrete Roads; 2d ed:

R. A. B. Smith and T. R. Grigson. London, Concrete Publications Ltd., c1946. 162 pp., illus., cloth, 8/6.

English-French and French-English Technical Dictionary; Metallurgy, Mining, Electricity, Chemistry, Mechanics, Sciences:

Francis Cusset. Brooklyn, N.Y., Chemical Publishing Co., Toronto, General Publishing Co., 1946. 590 pp., $7.00 (in Canada).

Modern Organic Finishes; Their Application to Industrial Products:

Rollin H. Wampler. Brooklyn, N.Y., Chemical Publishing Co., Toronto, General Publishing Co., 1946. 452 pp., illus., cloth, $11.90 (in Canada).

Simplified Punch and Diemaking:

James Walker and Carl C. Taylor. N.Y., London, Toronto, Macmillan, 1946. 235 pp., illus., cloth $5.50 (in Canada).

Statistically Indeterminate Structures:

L. C. Maugh. N.Y., Wiley; London, Chapman & Hall, c1946. 338 pp., illus., cloth, $5.00.

Steel Castings:

Eric. N. Simons. London, Paul Elek (Publishers), c1946. 208 pp., illus., cloth, 13/-.

Vertical Curves for Roads; a Textbook for Highway Engineers and Students:

F. G. Royal-Dawson. London, E. & F. N. Spon, 1946. 141 pp., illus., 15/-.

PROCEEDINGS, TRANSACTIONS, ETC.

American Society for Testing Materials:

Proceedings, Vol. 45, 1945. (Committee Reports and Technical Papers).

American Standards Association:

Year Book, 1945-46.

Canadian Trade Index; Annual Issue of 1946:

Toronto, Canadian Manufacturers' Association, 1946.

Engineering Index, 1945:

N.Y., Engineering Index, c 1946.

Institution of Mining and Metallurgy:

Transactions of the Fifty-Third Session—1943-1944. Vol. 53, 1944.

Society for Experimental Stress Analysis:

Proceedings, Vol. 3 n 2, c1946. Cambridge, Mass., Addison-Wesley Pr., 1946.

Svenska Forskningsinstitutet för Cement och Betong vid Kungl. Tekniska Högskolan I Stockholm. (Swedish Cement and Concrete Research Institute at the Royal Technical University, Stockholm):

Handlingar (Proceedings) N:r 6—Förestandarens redogorelse for verksamheten under tiden 1 juli 1944—30 juni 1945 (Report of the Director on the Work of the Institute).

TECHNICAL BULLETINS, REPORTS, ETC.

American Welding Society:

Standard Code for Arc and Gas Welding in Building Construction; D1.0-46. (Supersedes "Code for Fusion Welding and Gas Cutting in Building Construction, Part A—Structural Steel", 1937 and "Code for Arc and Gas Welding in Building Construction, Tentative—1941.")

British Standards Institution:

British Standard Specification BS 229: 1946—Flameproof Enclosure of Electrical Apparatus.—BS 1306: Part 1: 1946—Non-Ferrous Pipes and Piping Installations for and in Connection with Land Boilers.

Canada. Dominion Water and Power Bureau. Water Resources Paper No. 89:

Surface Water Supply of Canada; St. Lawrence and Southern Hudson Bay Drainage, Ontario and Quebec; Climatic Years 1939-40 and 1940-41.

Codes of Practice Committee. British Standard Code of Practice:

CP(B) 565—Structural use of Steel in Buildings.—CP(B) 566—Structural use of Normal Reinforced Concrete in Buildings.—CP(B) 586—Roof Tiling.—CP(B) 587—Sewers and Drains.—CP(B) 588—Concreting of Sewers and Drains.—CP(B) 589—Sewer Connections.—CP(B) 590—Installations of Vapour Compression Domestic Electric Refrigerators.—

Electrochemical Society. Preprints:

90-1—Distribution of Current Along a Cylindrical Anode Inside of a Concentric Tube, by Arnold Weisselberg and Staff.—
. . . 90-2—Routine Control of Brass Plating Processes; Polarographic, Electrochemical, and Chemical Analysis of Plating Solutions and Deposits, by H. E. Zentler Gordon and Eric R. Roberts.

Gr. Britain. Dept. of Scientific & Industrial Research. Building Research Board.

Heating and Ventilating of Dwellings, by Heating and Ventilating (Reconstruction) Committee. (Post-War Building Studies, No. 19).

Harvard University. Graduate School of Engineering, Publications:

No. 419—Stability and Stiffness of Cellular Cofferdams, by Karl Terzaghi. Discussions. (Reprinted from American Society of Civil Engineers, Transaction v. 110, 1945—Paper No. 2253.)—No. 421—Shunt and Series Sections of Transmission Line for Impedance Matching, by C. T. Tai. (Reprinted from Journal of Applied Physics, v. 17, 1946.)—No. 422—Calculation of the Output from Non-Linear Mixers, by Harry Stockman. (Reprinted from Journal of Applied Physics, v. 17, 1946).

Illinois Institute of Technology. Research Publications:

Vol 4 n. 1, April 1946—Catalysis.

Illinois. University. Engineering Experiment Station. Bulletin:

No. 360—Investigation of the Strength of Riveted Joints in Copper Sheets, by Wilbur M. Wilson and Ahmet Munci Ozelsel.—No. 361—Residual Stresses. in Welded Structures, by Wilbur M. Wilson and Chao-Chien Hao—No. 362—Bonding Action of Clays—Part II—Clays in Dry Molding Sands, by Ralph E. Grim and F. Leicester Cuthbert.—No. 363—Studies of Slab and Beam Highway Bridges—Part I—Tests of Simple-Span Right I-Beam Bridges, by Nathan M. Newmark, Chester P. Siess and Robert R. Penman.

North Dakota Research Foundation:

Bibliography of the Geology and Natural Resources of North Dakota, 1814-1944, Chrissie E. Budge. (Bulletin No. 1)

Ohio State University. Engineering Experiment Station:

Bulletin No. 125—Lead Replacements in Dinnerware Glazes, by H. J. Orlowski and John Marquis.

Princeton University. Industrial Relations Section. Selected References No. 10, July 1946:

Channels of Communication in Industrial Organization.

Training Within Industry Foundation. Bulletin Series:

No. 1, July 1, 1946—Cost Reduction.—No. 2, July 15, 1946—Training Techniques.—No. 3, August 1, 1946—Executive Decisions.—No. 4, August 15, 1946—Experienced Employees.

U.S. Geological Survey. Bulletins:

943-C—Nickel-Copper Prospects Near Spirit Mountain, Copper River Region, Alaska.—945-E—Chromite-Bearing Sands of the Southern Part of the Coast of Oregon.—946-B—Quicksilver-Antimony Deposits of Huitzuce, Guerrero, Mexico.—946-C—Scheelite Deposits in the Northern Part of the Sierra de Juarez Northern Territory, Lower California, Mexico.—946-D—Tungsten Deposits of the Southern Part of Sonora, Mexico.—946-E—San José Antimony Mines near Wadley, State of San Luis Potosi, México.—947-A—Mineral Investigations of the Geological Survey in Alaska in 1943 and 1944.—949—Bibliography of North American Geology, 1942 and 1943.

U.S. Geological Survey. Professional Paper:

205-B—Minerals of the Montmorillonite Group; Their Origin and Relation to Soils and Clays.

U.S. Geological Survey. Water-Supply Papers:

889-F—Ground Water in the High Plains of Texas.—967-A—Notable Local Floods of 1939—Part 1—Floods of September 1939 in Colorado River Basin Below Boulder Dam.—967-B—op. cit.—Part 2—Flood of July 5, 1939 in Eastern Kentucky.—967-C—op. cit.—Part 3—Flood of August 21, 1939 in Town of Baldwin, Maine.—970—Quality of Surface Waters of the United States, 1943.—971—Surface Water Supply of the United States, 1943—Part 1—North Atlantic Slope Basins.—972—op. cit.—Part 2—South Atlantic Slope and Eastern Gulf of Mexico Basins.—973—op. cit.—Part 3—Ohio River Basin.—975—op. cit.—Part 5—Hudson Bay and Upper Mississippi River Basins.—982—op. cit.—Part 12—Pacific Slope Basins in Washington and Upper Columbia River Basin.—990—Water Levels and Artesian Pressure in Observation Wells in the United States in 1943—Part 5—Northwestern States.—991—op. cit.—Part 6—Southwestern States and Territory of Hawaii.—1004—Surface Water Supply of the United States, 1944—Part 4—St. Lawrence River Basin.—1007—op. cit.—Part 7—Lower Mississippi River Basin.—1009—op. cit.—Part 9—Colorado River Basin.—1010—op. cit.—Part 10—The Great Basin.—1011—op. cit.—Par 11—Pacific Slope Basins in California.—1014—op. cit.—Part 14—Pacific Slope Basins in Oregon and Lower Columbia River Basin.

PAMPHLETS, ETC.

Community Planning, Why? When? and How?

C. A. Meadows. Toronto, Meadows, Critoph & Co.

Flexibility in Small Lot Production Broaching:

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

Gr. Britain. Ministry of Towns and Country Planning:

Interim Report of the New Towns Committee, March 1946. Cmd. 6759.

. . . Second Interim Report of the New Towns Committee, April 1946. Cmd. 6794.

. . . New Towns Bill; Memorandum by the Minister of Town and Country Planning showing Application and Modification of Provisions of the Town and Country Planning Act, 1944. April 1946. Cmd. 6801.

. . . New Towns Bill; Memorandum by Secretary of State for Scotland, April 1946. Cmd. 6804.

Improving the Distribution of Water to Farmers by use of the Parshall Measuring Flume:

Ralph L. Parshall. U.S. Dept. of Agriculture. Soil Conservation Service. Bulletin 488, May 1945.

Reappraising the Quality Function:

J. M. Juran. N.Y., Wallace Clark & Co. (Reprinted from American Management Association. Production Series No. 164)

Research by the Aluminium Industry in Canada:

R. H. Rimmer. Kingston, Aluminium Laboratories Limited, 1946. (Lecture No. 18-46).

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.

BASIS OF SHEET METAL DRAFTING:

W. H. Hedley. London, New York, Toronto; Longmans, Green, 1945. 118 pp., illus., 8¾ x 5¾ in., cloth, $1.80 (in Canada).

The purpose of this book is to give a firm foundation in the setting out of patterns which forms an important part in the technical education of those connected with sheet metal work. It is written primarily for the student who should find the application of calculations to the development of patterns interesting and valuable, even if only one or two calculations are made to serve as a check to patterns developed graphically. The book also covers a good deal of the work required for teaching plane and solid geometry in Junior Technical Schools.

BRITISH STANDARD SPECIFICATION FOR FLAMEPROOF ENCLOSURE OF ELECTRICAL APPARATUS FOR POWER AND LIGHTING PLANT; B. S. 229:1946:

London, British Standards Institution, 1946. 3/6.

This new illustrated edition of B. S. 229 defines the performance required and prescribes those features of design and construction considered to be essential to secure reliability in service.

It specifies the maximum permissible gap dimensions for a number of inflammable gases and vapours likely to introduce an explosion hazard if met in any industry.

The specification contains a tabulated summary classifying the gases and vapours covered into four groups:—1—Mining.—2—General industrial processes.—3—Gasworks and coke oven plants.—4—Excluded gases and vapours, acetylene, carbon-disulphide and hydrogen, for which the maximum experimental safe-gap is too small to admit any permissible gap for the class of apparatus to which flameproof enclosure is commonly applied.

BRITISH STANDARD SPECIFICATION FOR 'READY-TO-FIT' THERMAL INSULATING MATERIALS; B. S. 1304:

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

The first of a series of specifications for thermal insulating materials, embracing pre-formed, plastic, granular, and loose-filled types, B. S. 1304 covers thermal insulating materials for hot and cold water supply and central heating installations for dwellings with a water heater rated at not greater than 40,000 B.Th.U. per hour. It is intended for use in connection with small dwellings.

The fuel saving to be achieved by the installation of thermal insulation in such dwellings, is emphasized in an appendix. A list of suitable materials with information concerning thermal conductivity is also given.

CSA LIST OF APPROVED ELECTRICAL EQUIPMENT:

Ottawa, Canadian Standards Association, 1946.

CSA Approvals Division is renewing the periodic publication of its *List of Approved Electrical Equipment.* The completed List (January 1946) and the first Supplement (May 1946) have been issued. Supplements showing additions, revision, and cancellations will be issued every four months, and the complete List will be reprinted in January, 1948.

STANDARD CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION.

New York, American Welding Society, 1946. 68 pp, $0.50.

This new edition, which replaces the 1941 (tentative) edition, embodies revisions based on experience in the recent applications of welding to structural fabrication and on further research investigation.

The section on design now provides for increased allowable weld unit stresses equal to those allowed for the steel being welded. Other sections on filler metal, workmanship, inspection and qualification of welding operators and procedures have also been revised.

TIRE WEAR AND COST ON SELECTED ROADWAY SURFACES:

R. A. Moyer and Glen L. Tesdall. Ames, Iowa Engineering Experiment Station, 1945. 127 pp., illus., 9 x 6 in., paper, request. (Bulletin 161).

The authors present the results of an extensive research study of the factors which determine tire wear and cost, and show the means by which tire life can be extended through proper tire care and maintenance. The results have been determined from 450,000 miles of carefully controlled driving on gravel, bituminous surfaces, and concrete pavements in Iowa, Kansas, Missouri and Wyoming.

WHAT PRICE SUPERVISION; How Management Can Build a Stronger Supervisory Force:

R. D. Bundy. New York, Deep River, Conn., Chicago, National Foremen's Institute, c1946. 46 pp., 6½ x 9½ in., fabrikoid, spiral-bound, $2.00.

In this book the author offers a definite programme, and presents specific suggestions for attaining the type of supervision necessary for the era ahead. Section I presents the various aspects of the supervisory problem: Pattern of management-foremen relations, Views on supervision, Outworn policy, Measure of leadership, Two problems—secure and develop, Philosophy of long standing, Case histories, Factual data on foremen's education, Education vs experience. In Section II the author offers a definite solution and covers: What is supervision, Well-balanced supervision, and The foreman who gets things done.

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.

ELECTRONICS in INDUSTRY:

By G. M. Chuto. McGraw-Hill Book Co., New York and London; Embassy, Toronto, 1946. 461 pp., illus., diagrs. charts, tables, 8½ x 5¼ in., cloth, $5.00.

To give a broad introduction to the use of electronic circuits and equipment is the purpose of this book. It outlines the industrial uses of tube circuits and gives detailed explanation of a large number of electronic equipments now serving in industrial plants. No previous knowledge of tubes is assumed, the early chapters being devoted to the necessary fundamentals, and since the book is intended for users of equipment already available, no design information is presented.

HEATING and VENTILATION of DWELLINGS (Post-War Building Studies No. 19):

By the Heating and Ventilation (Reconstruction) Committee of the Building Research Board of the Department of Scientific & Industrial Research, published for the Ministry of Works by His Majesty's Stationery Office, London, 1945. 228 pp., diagrs., maps, tables, 9½ x 6 in., paper, 2s.6d. (obtainable from British Information Services, 30 Rockefeller Plaza, New York, $0.75).

The major purposes of this report are as follows: to determine the average conditions of warmth and ventilation which are desirable, and the minimum provision for hot-water supply and cooking; to find the amount of heat theoretically needed in an average house to provide these basic facilities and show how this amount is affected by the construction of the house, etc., and to discuss the various factors relating to the choice of methods of heating. Special topics dealt with separately are: ventilation methods; clothes washing; the development, installation and operation of heating appliances; testing and standardization of appliances; and the use and distribution of fuel.

MOTEURS d'AVIONS, 2 Vols., Text and Planches:

By R. Marchal, preface by P. Dumanois. Dunod, Paris, 1946. Text, 643 pp., illus., diagrs., charts, tables, 11 x 7½ in., paper, (3200 frs., 2 vols.)

This comprehensive work on airplane engines first defines and identifies important parts and engine characteristics, and gives a brief historical sketch. A considerable part of the book is devoted to the thermodynamics of fluids and of engines and compressors. Another group of chapters covers the strength of materials and the kinematics of engine parts. Carburetion, ignition and lubrication are dealt with separately. Manufacturing practice and testing procedures are considered, and a chapter is devoted to unusual types of engines. Over a hundred plates and diagrams are contained in a supplementary volume.

TRAINS, TRACKS and TRAVEL:

By T. W. Van Metre. 7th ed. Simmons-Boardman Publishing Corp., New York, 1946. 423 pp., illus., diagrs., 9¼ x 6 in., cloth, $3.50.

This popular treatise, now in its seventh edition and twentieth year, has again been revised to keep abreast of the continuing developments in the railroad field. Intended originally for boys, the book has become broad enough in scope and thorough enough in treatment to be of general interest to all amateurs of railroading. Extensively illustrated, the pictures and text cover the historical, mechanical and operational phases of one of our greatest industries.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

September 15th, 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 October 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 our 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

HOOD—JAMES R., 110 Marion St., Toronto 3, Ont. Born at Galt, Ont., Nov. 23rd, 1919. Educ.: B.Sc. (Chem.Engrg.), Queen's, 1942; R.P.E., Ontario. 1942-1945, meteorologist, British Commonwealth Air Training Plan; with Canada Packers Limited, Toronto, as follows: 1945-46 (13 mos.), routine analysis, chemical engrg. problems, preliminary layout new glue lab., design pilot plant for extraction of cholesterol, and at present, chemical engr. in mech. supvr.'s office on factory layout designs, designs and drawing of mech. and chem. equipt., mtce. engrg.

References: D. S. Ellis, A. Jackson, L. T. Rutledge, H. W. Harkness, R. A. Low.

MacLEOD—ROBERT GORDON, 80 St. Clair Ave. W., Toronto 5, Ont. Born at Winnipeg, Man., Nov. 11th, 1915. Educ.: B.Sc. (Elect.), Manitoba, 1936; Assoc. Fellow, Royal Aero. Society; 1935-37, salesman, illumination surveys, Dickson Elect. Co., Winnipeg; 1937 (4 mos.), shop asst., assembly of wooden aircraft, De Haviland Aircraft of Can., Toronto; 1941-45, Engr. Officer, R.A.F., Engr. Staff Officer, H.Q. Fighter Command, Eng., investigation of defects, development, inspn., mtce., modification, publications, tools, test app., range and scale of spare parts related to aircraft instruments, de-icing equipt., etc. (mentioned in despatches), R.A.F. St. Engr. Officer, finally Squadron Leader; 1945-46, research engr., De Haviland Engine Co., England, methods of improving comb. in gas turbine engines, design of comb. chamber heads, design and test of models related, recommendations; recently repatriated.

References: E. P. Fetherstonhaugh, A. E. Macdonald, N. M. Hall, G. H. Herriott, W. F. Riddell, A. C. Davidson, R. D. Hiscocks.

MILNE—HARRISON SCOTT, of Deep River, Ont. Born at Delisle, Sask., Jan. 2nd, 1913. Educ.: B.Sc., Sask., 1933; completed 3rd yr. mech. engrg; with D.I.L., as follows: 1940-41, dftsman., design and equipt. layout for Pickering Shell Filling and Wpg. Cordite plants, 1941 (4 mos.), prod. foreman, Verdun, Que., 1941-42 (4 mos.), dftsman, design and equipt., on loan to C.I.L., Kingston Nylon project, 1942 (4 mos.), prod. foreman, Verdun, Que., 1942-43 (18 mos.), supervisor., bldg. services, mtce. section, plant engrg., Verdun, 1943-45, sr. supervisor, mech. section, plant engrg., Verdun, 1945 (5 mos.), supt. plant engrg., Verdun, 1945 to date, resident engr., special projects divn., N.R.X. project, Chalk River, Ont.

References: C. J. Mackenzie, H. B. Hanna, C. H. Jackson, A. B. McEwen, F. H. Barnes.

NICKERSON—HAROLD WAITE, of Cornwall, Ont. Born at Orrington, Maine, July 31st, 1907. Educ.: B.Sc. (Elect.); B.Sc. (Civil), N.B., 1929 and 1933, respectively; R.P.E., Ontario; with Canadian Cottons Ltd., as follows: 1934-35, timekeeper and supply clerk, during constrn. of reinforced concrete dam, St. Croix Mill, Milltown, N.B., 1935-39, supply and cost analysis clerk, dftsman., engrg. dept., Marysville, N.B., during this period (summer, 1937), with Milton Hersey Co., inspecn. asphalt paving of several N.B. highways; 1939-43, asst. plant engr., Marysville, mtce. machinery, bldgs., design, instln. new equipt. and constrn., etc., 1943 to date, plant engr., mech., elect. and architectural engrg., Cornwall, Ont.

References: D. Ross-Ross, H. E. Meadd, B. de Hueck, D. Giles, T. R. Durley, D. N. McCormick.

RANEY—FREDERICK EVERETT, of Washington, D.C. Born at Lachute, Que., Aug. 25th, 1902. Educ.: B.Sc. (Elect.), Queen's, 1937; with Royal Canadian Signals, as follows: 1938-39 (7 mos.), Instructor, Radio Course, Canadian Signals Centre, 1939-40, Asst. to Officer I/C Instalns., Saint John, N.B., 1940-41 (7 mos.), Asst. to Director of Tech. Research (Signals), M.G.O. Branch, N.D.H.Q., 1941-43, Asst. to Director of Signals, Design Dept., Munitions & Supply, Ottawa, 1943-44, Asst. to Director of Elect. Design, N.D.H.Q., and at present, Signals Liaison Officer, with the rank of Lieut. Colonel, Canadian Army Staff, Washington, D.C.

References: H. F. G. Letson, J. Blair, K. R. Swinton, R. A. Low, R. E. Jamieson, D. M. Jemmett.

STANLEY—ROSS MEREDITH, of Lethbridge, Alta. Born at Calgary, Alta., Sept. 30th, 1914. Educ.: B.Sc. (Arch.), Alberta, 1938; 1938-40, dftsman, engrg. office, design of bldgs. (structl. and arch.), Valley Pipe Line Co., Turner Valley, Alta.; 1940-44, sr. dftsman, i/c dfting. office and all plans made in district, Dept. Transport, Air Service Branch, Lethbridge, Alta.; 1944-46, Asst. Ordnance Works Officer, i/c all design for constrn. of all Naval amm. and armament depots in Canada and Nfld., reinforced concrete fireproof constrn., N.D.H.Q., Ottawa; and at present, designer, responsible for design and constrn. supervision of commercial and civic bldgs., Meech, Mitchell & Meech, architects and engrs., Lethbridge, Alta.

References: A. L. H. Somerville, T. H. Miard, T. O. Neumann, R. G. Laird, R. C. Bell, P. E. Kirkpatrick.

FOR TRANSFER FROM JUNIOR

JORDAN—JACK McLEAN, of Cobourg, Ont. Born at Fenelon Falls, Ont., Oct. 10th, 1910. Educ.: B.A.Sc., Toronto, 1934; R.P.E., Ontario; 1934-35, rodman, instrument work, surveys, constrn., Dept. Highways; 1935-36, engr. and foreman, airfield constrn., Dept. National Defence; 1936-38, engr. and br. office mgr., Curran & Briggs Ltd., constrn. and paving contracts; 1938-41, genl. underground work leading to level boss in 1940, i/c mining operations on one level; 1942-44, R.C.E., Field Engr.; 1944-46, Works Officer, Toronto area, i/c mtce. of army bldgs.; at present, counties engr. and road supt., Northumberland and Durham, Cobourg, Ont. (Jr. 1938.)

References: J. A. P. Marshall, H. B. Stuart, G. J. Cote, W. L. Saunders, R. A. Rule, G. E. Humphries, E. L. Zealand, C. R. Young.

POWELL—ROBERT MONTAGU, of Montreal, Que. Born at Ottawa, April 8th, 1914. Educ.: Graduate, R.M.C., 1935; B.A.Sc. (Chem.), 1937; 1938-39, foreman, hydrogen peroxide plant, C.I.L., Shawinigan Falls, Que.; 1939-45, Lieut., R.C.N., subsequently Lieut. Cmdr., R.C.N.V.R.; 1945 to date, tech. asst., sales dept., organic chem. divn., Canadian Industries Limited, Montreal, Que. (Jr. 1946.)

References: L. F. Grant, H. H. Lawson, R. R. McLaughlin, W. L. L. Cassels, G. R. Stephen, C. E. Miles, H. R. Little.

SEYBOLD—HUGH G., 12 Parkman Place, Westmount, Que. Born at Montreal, Que., June 21st, 1910. Educ.: B.Eng. (Elect.), McGill, 1933; 1933-37, Hudson's Bay Co., transportation, N.W.T.; 1937-40, Drummond McCall & Co. Ltd., Montreal; 1941-45, Engineer Officer, R.C.N., and Lieut. Cdr. (E); 1946, mgr., aluminum dept., Drummond McCall & Co. Ltd., Montreal, Que. (Jr. 1946.)

References: C. V. Christie, A. Hutchison, B. R. Spencer, H. Cunningham, R. F. Legget, H. Lea.

YOUNG—HUME BLAKE, of Vancouver, B.C. Born at Winnipeg, Man., May 30th, 1919. Educ.: B.Sc. (Civil), Manitoba, 1941; 1938-39-40 (summers), storekeeper, Manitoba Bridge & Iron Works; National Testing Labs., Winnipeg; inspector, airport runway constrn., Regina and Winnipeg; timekeeper and foreman, Nelson River Constrn.; 1941-42, pur. agt., Demerara Bauxite Co., Ltd., British Guiana; 1942-45, Aero. Engrg. Officer, R.C.A.F.; 1946 to date, instrumentman, City of Vancouver, B.C. (Jr. 1946.)

References: E. P. Fetherstonhaugh, G. H. Herriot, F. S. Fowler.

FOR TRANSFER FROM STUDENT

MEUSER—HENRY LLOYD, of Ottawa, Ont. Born at Regina, Sask., Jan. 6th, 1913. Educ.: Graduate, R.M.C., 1934; B.Sc. (Civil), Queen's, 1935; with R.C.E., as follows: 1935-37, Lieut., i/c survey parties, Geographical Section, General Staff, 1937-38, Barracks constrn. and Mtce., Works Officer, M.D. No. 6, Capt., 2 I.C 1st Field Coy. (Overseas), 1940-41, Major, O/C 1st Field Coy. (Overseas), 1941-43, Lt. Col., Asst. Dir. Survey, 1 Cdn. Corps (Overseas), 1943-45, Colonel, Deputy Director Survey, 1st Cdn. Army (Overseas), 1945-46, Deputy Chief Engr. Works and Acting Chief Engr. Cdn. Forces in Netherlands; and at present, Dir. of Engrs., N.D.H.Q., Ottawa, Ont.

References: H. Kennedy, J. P. MacKenzie, J. L. Melville, G. Walsh, J. P. Carriere.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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, Ph.D. or M.Sc. Specialized in physical chemistry, required by industrial organization in Montreal area as member of organic research team. Salary open. Apply to File No. 3596-V.

CHEMICAL ENGINEERS, recent graduates up, required as shift supervisors by an industrial chemical plant in the Montreal area. Salary from $200. Apply to File No. 3605-V.

CHEMICAL ENGINEER, under 30, required for the patent department of a large industrial organization in Montreal. Salary from $200. Apply to File No. 3609-V.

CIVIL

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.

ELECTRICAL

ELECTRICAL ENGINEERS, preferably with experience in line communications, required by a communications company in the Montreal area. Salary according to experience. Apply to File No. 3601-V.

ELECTRICAL ENGINEER DRAUGHTSMEN, preferably with pulp and paper experience, required by a paper company in Montreal. Salary open. Apply to File No. 3610-V.

ELECTRICAL ENGINEER with construction experience wanted as assistant to sales manager in a Montreal electrical supply and service company. Salary according to experience. Apply to File No. 3611-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.

MECHANICAL

MECHANICAL ENGINEER, preferably with mining experience, age 25-35, required by a manufacturer in Montreal to do estimating or design work on mining equipment and assist in sales. Salary according to experience. Apply to File No. 3589-V.

MECHANICAL ENGINEER as production engineer for a sea food canning company in Eastern Canada. Duties would include plant design, production improvement and plant maintenance. Bilingual and experienced man preferred. Salary from $200-$300. according to qualifications. Apply to File No. 3592-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.

MECHANICAL ENGINEER with pulp and paper or construction experience required as resident engineer for a paper mill in Western Ontario. Salary open. Apply to File No. 3598-V.

MECHANICAL ENGINEER with five to ten years' industrial experience and familiar with the layout and construction of chemical plants, required by a manufacturer in the Montreal area for plant design and construction. Salary from $300. Apply to File No. 3605-V.

MECHANICAL ENGINEER with experience in the automotive business and the maintenance of all types of internal combustion engines required by an oil company in the Montreal area. Salary open. Apply to File No. 3608-V.

MECHANICAL ENGINEER with at least five years industrial experience required by a textile firm with headquarters in Montreal. Salary open. Apply to File No. 3615-V.

COMBUSTION ENGINEER, MECHANICAL, preferably with five years industrial experience, required by a textile firm with headquarters in Montreal. Salary from $300. Apply to File No. 3615-V.

MECHANICAL ENGINEER with at least five years' experience of aluminum processing, plant design and operation, etc., required for Aluminum production organization in Australia. Limited contract. Salary open. Apply to File No. 3620-V.

MISCELLANEOUS

ENGINEERING DRAUGHTSMAN with pulp and paper or construction experience required for a paper mill in Western Ontario. Salary open. Apply to File No. 3598-V.

ELECTRICAL, MECHANICAL OR COMBUSTION ENGINEER required by an industrial firm in Montreal for estimating and supervising the installation of heating plants. Age over 35. Salary from $300 according to experience. Apply to File No. 3602-V.

DESIGN ENGINEER, capable of assuming responsibilities of designing structures and equipment layouts of steam plants, hydro-electric developments, etc., required by an industrial corporation in Montreal. Salary from $350 according to experience. Apply to File No. 3603-V.

HYDRAULIC ENGINEER, familiar with hydraulic machinery design, installation, stream functions and runoff computations, etc., required by an industrial corporation in Montreal. Salary from $300 according to experience. Apply to File No. 3603-V.

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.

RESIDENT ENGINEER with considerable construction experience, preferably bilingual, to take charge of the construction of a dam on the Upper Ottawa River. Salary from $300. Apply to File No. 3613-V.

CHIEF DRAUGHTSMAN with experience in design and controlling a design staff required for both structural and equipment work by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-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.

MACHINE DESIGNER with considerable experience required by a company in Southern Ontario. Experience on the designing of steel mill equipment or heavy machinery desirable but not essential. Salary according to qualifications. Apply to File No. 3617-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER, with transmission line experience, required for the engineering department of an industrial firm in Montreal. Salary from $225. Apply to File No. 3618-V.

ASSISTANT CHIEF DRAUGHTSMAN AND STRUCTURAL AND MECHANICAL DRAUGHTSMEN with experience, required for the engineering department of an industrial firm in Montreal. Salaries open. Apply to File No. 3618-V.

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

CHEMICAL

CHEMICAL ENGINEER with some pulp and paper experience required for the technical department of a paper mill in Lake St. John area. Apply to File No. 3470-V.

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. Salary open. Apply to File No. 3549-V.

JUNIOR CHEMICAL ENGINEERS OR CHEMISTS, preferably bilingual, for various paper plants in Quebec. Salary from $200 according to experience. Apply to File No. 3555-V.

CHEMICAL ENGINEER required by an industrial organization with headquarters in Montreal as assistant to chief chemist and control supervisor in a pulp and paper plant. Initiative to deal with unexpected problems essential. Salary from $250 according to experience. Apply to File No. 3555-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, recent graduate up, required by a petroleum refining company in Montreal for process and design work. Salary about $200. Apply to File No. 3575-V.

CHEMICAL ENGINEERS, age 22-35, recent graduates up, are required by a Montreal firm for development work, maintenance, design and construction in explosives field. Sales and technical service representation to paper and textile industries. Salaries according to qualifications. Apply to File No. 3588-V.

CIVIL

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to Box No. 3394-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in th Montreal area. Apply to File No. 3446-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 DRAUGHTSMAN, age 25-35, for consulting engineer's office near Toronto. Applicant should have some knowledge of municipal sewerage and waterworks problems. Apply to File No. 3489-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 ENGINEER, recent graduate, required by a firm of consulting engineers in Montreal, to assist Engineer in charge of field work in Ont. Salary $175 up. Apply File No. 3518-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 with experience as structural designers and draughtsmen are required by an engineering firm in Montreal. Salary from $300—$400 according to experience. Apply File No. 3520-V.

CIVIL ENGINEER to take charge of project engineering required by a firm of industrial engineers in Quebec. Should be bilingual and have experience in heavy construction. Salary according to capacity. Apply File No. 3531-V

CIVIL ENGINEER to be superintendent of construction with a contractor in Montreal. Salary according to qualifications. Apply to File No. 3558-V.

CIVIL ENGINEER, recent graduate up, to be assistant to town engineer of a town in the Montreal area. Permanent position. Salary from $175 up. Apply to File No. 3569-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 considerable building experience, as construction superintendent with a firm of building contractors in Central Ontario. Salary open. Apply to File No. 3582-V.

CIVIL ENGINEER with 3 or more years' experience on design of industrial buildings, equipment, supports and foundation work, is required by a Montreal firm for structural design work in steel, timber and reinforced concrete. Salary $200 up. Apply to File No. 3588-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 Box No. 3415-V.

ELECTRICAL ENGINEERS, age 30 to 40. 5 to 10 years experience, for estimating design and general engineering for large public utility in Toronto area. Apply to File No. 3429-V.

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

ELECTRICAL ENGINEERS, preferably experienced for sales and service of motors, transformers, control equipment, etc., with an industrial firm in Montreal. Salary according to qualifications and ability. Apply File No. 3512-V.

ELECTRICAL DRAUGHTSMAN with considerable experience in industrial light, heat and power layouts is required by a consulting engineer in Montreal. Salary from $200 according to experience. Apply File No. 3528-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 ENGINEERS, from recent graduates up, preferably with pulp and paper experience, required by a power and paper corporation in Ontario. Salary open. Apply to File No. 3554-V.

ELECTRICAL ENGINEER with power plant experience, must be bilingual, to take complete charge of power plants and distribution system for a N.B. town. Salary according to experience. Apply to File No. 3561-V.

ELECTRICAL ENGINEER for a junior position in the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-V.

MECHANICAL

MECHANICAL ENGINEER, graduate with 4 or 5 years' experience in heating and ventilating layouts is wanted by a consulting engineer in Montreal. Apply File No. 3243-V.

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 Box No. 3393-V.

JUNIOR MECHANICAL ENGINEER with some experience on mechanical design. Preference to ex-service men. Salary from $200 to $250. Location Quebec City Apply to File No. 3401-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Apply to File No. 3406-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to Box No. 3424-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 qualificatione. Apply to File No. 3471-V.

MECHANICAL ENGINEER with considerable experience in plumbing, heating, ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

MECHANICAL ENGINEER, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

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

MECHANICAL ENGINEER with considerable industrial experience is required for the staff of a firm of consulting engineers in Montreal. Salary about $250. Apply File No. 3525-V.

MECHANICAL ENGINEER, to assume charge of factory maintenance staff and help design new machines and develop new ideas in conjunction with research and methods departments, wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from $250. Apply File No. 3538-V.

MECHANICAL DRAUGHTSMAN with over five years experience in piping layout and similar work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

MECHANICAL ENGINEER, recent graduate, for the engineering staff of a pulp manufacturer in Eastern Quebec. Apply to File No. 3547-V.

MECHANICAL ENGINEERS 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 at least five years' industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary $275-$325. Apply to File No. 3553-V.

MECHANICAL ENGINEER with considerable experience in heating and ventilation, etc., required by a firm of consulting engineers in Montreal. Salary open Apply to File No. 3565-V.

MECHANICAL ENGINEERS with experience in heating and ventilating or the pulp and paper industry or with general mechanical layout and design work are required by a firm of consulting engineers in Montreal. Salary from $250-$350 according to experience. Apply to File No. 3568-V.

MECHANICAL ENGINEER, recent graduate, for junior position in the design department of a firm in Central Ontario making special heavy duty mobile equipment. Apply to File No. 3572-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 some electrical experience for the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-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 ENGINEERING DRAUGHTSMAN, fully experienced in kraft and sulphite mills processes and modern design, required by a pulp and paper firm on the West Coast. Salary open. Apply to File No. 3586-V.

METALLURGICAL

METALLURGIST, age 25-30, veteran, experience in Metallurgical Laboratory or Mine Assay office and Mining Mill practice decided advantage, required by a Montreal firm to be trained for Sales Representative. Salary depending on experience. Apply to File No. 3588-V.

MISCELLANEOUS

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in Western Ontario. Salary would be $300 to $350. Apply to File No. 3227-V.

ENGINEER SALESMAN, fluently bilingual, not necessarily a graduate but with some good experience on truck mechanical work and some sales background, age 35-40, is required by an automobile manufacturer for work in the Montreal area. Preference will be given to ex-service men and R.C.E.M.E. and workshop experience would be useful. Salary $250 to $350. Apply to File No. 3266-V.

ENGINEERING ACCOUNTANT, young graduate age 25-35, with engineering background and taste for accounting, is required to act as assistant to the secretary treasurer of a manufacturing concern in Montreal. Apply to File No. 3272-V.

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual, with some practical experience, is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

TECHNICAL SALES ENGINEERS are required by an oil company in the Montreal area. Candidates must be bilingual and experience may range from recent graduate up. Salary will be $150-$250 depending on qualifications. Apply to File No. 3320-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to Box No. 3428-V giving all particulars including salary expected.

CHIEF DRAUGHTSMAN to take charge ofengineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

QUALIFIED DRAUGHTSMAN, thoroughly capable in design and layout of industrial piping, steam, water, air etc. Salary open. Apply to File No. 3435-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. 3443-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.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

FORESTRY ENGINEER graduate, 25 to 35 years, required by a large paper company in the Prov. of Quebec. Good opportunity for advancement. Salary open. Apply to File No. 3462-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-V.

INDUSTRIAL MINERALOGIST, with Ph. D. or M.Sc. in geology, mineralogy, chemistry or metallurgy and knowledge of commercial processing of industrial metals, laboratory investigations and publishing of results. Must have at least five years experience with special reference to industrial minerals. Starting salary from $275 in prov. mines dept. Apply to File No. 3492-V.

GEOLOGISTS, with Ph. D. in economic or mining geology and intimate knowledge of structural geology, diamond drilling and geophysical methods. Must have at least five years practical experience, ability to publish results of original investigations and use of aerial photographs. Starting salary from $275. in Prov. Mines Dept. Apply to File No. 3492-V.

CHEMICAL OR MECHANICAL ENGINEER with construction experience in the chemical field, a knowledge of hydrocarbons and at least five years experience since graduation is required by a chemical firm in Western Ontario. Salary from $250. Apply to File No. 3502-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-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.

GRADUATE ENGINEERS with experience in mechanical and chemical process layouts are required by an engineering firm in Montreal. Salary from $300-400 according to experience. Apply to File No. 3520-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 qualificatons. Apply to File No. 3524-V.

INDUSTRIAL ENGINEER, bilingual, with considerable experience, is required by a firm of industrial engineers in Quebec. Salary according to capacity. Apply to File No. 3531-V.

SENIOR DRAUGHTSMAN is required immediately by a Calgary and Turner Valley Oil Company. Work will be mainly geological draughting. Single man preferred. Salary dependent upon qualifications. Apply to File No. 3536-V.

CHEMIST OR RESEARCH ENGINEER, to take charge of Control Development and Research staff. Must have supervisory ability and be able to show results. Wanted by electrochemical and engineering firm in the Niagara Peninsula. Salary from $200. Apply to File No. 3538-V.

DESIGN ENGINEER with several years experience in hydro-electric work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

JUNIOR ENGINEER OR DRAUGHTSMAN, preferably with experience in the design of heating and ventilating layouts, required by a firm of consulting engineers in Montreal. Salary open. Apply to File No. 3545-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.

CIVIL OR MECHANICAL ENGINEERS, preferably with pulp and paper experience, required for engineering and operating staff of a large Ontario corporation. Salary according to qualifications. Apply to File No. 3554-V.

CHEMICAL OR MECHANICAL ENGINEERS, age about 30, with at least five years' experience in the paper industry, required by an Ontario Company to train for executive positions. Salary open. Apply to File No. 3554-V.

CIVIL AND MECHANICAL ENGINEER, capable of detail work on compressor stations, piping layouts, surveying, etc., wanted by a gas producing and distributing utility in Southwestern Ontario. Preference to Service personnel. Good future for right man. Apply to File No. 3562-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.

CIVIL OR MECHANICAL ENGINEER with construction experience required by an Ontario firm manufacturing and installing building specialties for industrial plants. Salary open. Apply to File No. 3567-V.

SALES ENGINEER with experience to organize the sales and service or marine engines in the Prov. of Quebec. Must be bilingual. Headquarters Montreal. Salary $250 to start. Apply to File No. 3576-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.

ELECTRICAL OR MECHANICAL ENGINEERS, recent graduates, required for design work in the hydraulic side by a manufacturer in the Montreal area. Apply to File No. 3579-V.

MECHANICAL AND ELECTRICAL DRAUGHTSMEN required by a Montreal firm. Must have working knowledge of equipment layout, architectural, piping and design. Salary from $200 up. Apply to File No. 3588-V.

MECHANICAL AND ELECTRICAL ENGINEERS, from recent graduates up, are required for mechanieal and electrical maintenance, also design phases of project engineering work, by a Montreal firm. Salaries according to qualifications. Apply to File No. 3588-V.

GRADUATE ENGINEERS required as Development Engineer and Assistant to Sales Manager by a Montreal firm. Industrial, also sales and administrative experience necessary. Salary $200 up according to experience. Apply to File No. 3588-V.

INDUSTRIAL ENGINEER, 5 years' experience industrial manufacturing or process work, required by a Montreal firm for study and co-ordination of plant work. Salary $295 up according to qualifications. Apply to File No. 3588-V.

CHiEF DRAUGHTSMAN, under 35, 5-12 years' experience in drawing office, Including year or more as squad boss, required by a Montreal firm. Salary $225 up. Apply to File No. 3588-V.

Young Graduate Engineer

with proved administrative ability, knowledge of aeronautics and business methods, as personal assistant to director of research division. Must possess tact, good judgment, firmness and pleasant personality. Location Ottawa. Apply to File No. 3599-V.

CHEMICAL ENGINEER

for

JUNIOR ENGINEERING POSITION

in control department of large Pulp and Paper Mill in Western Ontario. Paper industry experience desirable but not necessary. This is an opportunity for the right man who desires to learn the Pulp and Paper industry. Apply to File No. 3593-V.

The Public Service of Canada Requires

Several PATENT EXAMINERS, $2,400-$2,640 for the Department of the Secretary of State, Ottawa. Salary to be increased to $2,700-$3,300 after three years of satisfactory service and a qualifying examination. Specialists in Chemistry, Electricity, Mechanics, Aeronautics, Hydraulics and Metallurgy required.

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

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Situations Wanted

PLANT ENGINEER, M.E.I.C., seeks position with industrial concern, preferably textile. Wide experience in charge of plant layout, all branches, design, selection and purchase of equipment, construction and maintenance. Apply to File No. 1662-W.

SALES ENGINEER, Jr. E.I.C., P. Eng., Que., age 32, B. Eng. McGill in Mechanical, experience in sales, design and plant engineering. Married. Bilingual. Location immaterial. Veteran. Available on short notice. Apply to File No. 1692-W.

GRADUATE ENGINEER, B.Sc. (Civil), M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to File No. 2440-W.

MECHANICAL ENGINEER, M.E.I.C. graduated N.S.T.C. 1940 age 30 years, married. Three years' experience in aircraft inspection, two years in R.C.A.F. as pilot. One year draughting, six months of which in pulp and paper. Desirous of getting more experience in pulp and paper industry. Apply to File No. 2617-W.

ELECTRICAL ENGINEER, S.E.I.C., age 27, married, class of 1946, formerly a 'Flight Engineer" in R.C.A.F., has approximately one and a half years' experience in mine and smelter electrical work. Position desired more along Mechanical line than Electrical. Will go anywhere, anytime. Apply to File No. 2631-W.

ELECTRICAL ENGINEER, graduate McGill University 1944, age 25, single. Experience in industrial, radio communications and as Radar officer in R.C.E.M.E. Interested in a position leading to sales engineering or industrial management. Services available on one month notice or less. Apply to File No. 2649-W.

ENGINEER, Prof. Eng. (Civil), M.E.I.C., thoroughly experienced in structural and mechanical design, estimating and sales work, will undertake worthwhile agency or representation for manufacturer in B.C. Apply to File No. 2687-W.

GRADUATE CHEMICAL ENGINEER, S.E.I.C., B.A.Sc., Toronto, 1946, available immediately. Interested in position with Consultant or in Production. Location preference: Hamilton, Ont. Apply to File No. 2721-W.

GRADUATE ELECTRICAL, TORONTO, 1932. M.E.I.C., P. Eng. Seeks responsible Administrative or Industrial Engineering position with Manufacturer, Supplier or User of Electrical Equipment and or Electrical or General Management, Engineering Services, preferably outside the Province of Quebec. Fourteen years' experience in Radio and Aviation Industries, including: four years radio development and manufacture, one year supervision of instruction radio trade school, six years supervision of installation, operation and maintenance of radio aids to air navigation, one year supervision of airline communications, two years equipment and sales engineering, aeronautical and railroad radio equipment. This included executive and administrative responsibility. Apply to File No. 2725-W.

GRADUATE FOREST ENGINEER, Jr. E.I.C., single, age 28, with six years' bush experience, in timber, improvement and operational surveys, operational planning and layout, construction and supervision, requires position as assistant logging superintendent or assistant logging engineer. Available immediately for service anywhere in Canada or British possessions. Details of experience and references furnished on request. Apply to File No. 2726-W.

ELECTRONICS ENGINEER, B.Eng., Honors, McGill, 1943, Electrical Lieutenant, R.C.N., since graduation, desires position with electronics equipment or component manufacturer in purchase control, sales, specifications, or development. Experience: Naval electronics maintenance, fitting, inspection, test; last 18 months O I/C technical identification, documentation and procurement adviser for components; extensive knowledge of Standard and commercial specifications, and component characteristics of major U.S. and Canadian manufacturers. Quebec-Ontario location preferably. Apply to File No. 2727-W.

PLANT ENGINEER, B.Eng., M.E.I.C., R.P.E. (Ont.), age 35, married, with 11 years' experience in design, construction and maintenance of electrical and mechanical installations and buildings. Aggressive, resourceful and co-operative Successful record in responsible supervisory position. Apply to File No. 2728-W.

AIRLINE ENGINEER with degree in Mechanical Engineering (McGill). Eight years' experience with major Canadian and foreign airlines. Has been concerned with practically all technical phases of a major airline operation, including engineering, maintenance, operations, statistics, operating costs, flight testing and training of flight personnel. Administrative experience, 500 hours' experience as flight crew on Trans-Atlantic operation. Age 33. Married, one dependent. Interested in responsible position with major airline or organization concerned with air transportation in general. Apply to File No. 2691-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. Interested in design work testing, research and calculations. Available on two weeks notice. Apply to File No. 2693-W.

ELECTRICAL ENGINEER, B.Sc., M.E.I.C., age 33, single, with experience in sales, purchasing, office management and production control. Very good connections with industrial plants in Ontario and Quebec. Available after July 20th. Location preference: Toronto, Montreal and Hamilton. Apply to File No. 2694-W.

SENIOR CIVIL ENGINEER, M.E.I.C., P.E.Q., with considerable experience in all building construction and specialization in reinforced concrete; seeks first class opening. Able to supervise work and qualified to take full charge of and execute contracts. Apply to File No. 2695-W.

MECHANICAL ENGINEER, Toronto '42, Jr. E.I.C., P. Eng., age 30. Four years' experience in tool repair, machine design, estimating, instructor in tool inspection, supervisor of production inspection, charge of engineering department handling design, draughting, purchasing and testing for modern manufacturing plant. Desires position as production engineer with firm of consulting engineers or as assistant production manager in progressive industry. Prefer Hamilton or Toronto. Apply to File No. 2711-W.

MECHANICAL ENGINEER, S.E.I.C., B.Sc., Qneen's 1945, age 24, married, veteran, one year experience in design of heavy machinery and draughting, course in Time and Motion Study at McGill. Interested in Industrial, Production or Maintenance Engineering. Prefer Montreal area or Ontario. Available on one-month notice. Apply to File No. 2715-W.

CHEMICAL ENGINEER, S.E.I.C., B.Eng., McGill '46. Age 24, single, bilingual. Practical experience during summers. Desires employment in pulp and paper industry. Available Sept. 1st. Will travel anywhere. Apply to File No. 2717-W.

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CONTENTS

COVER PICTURE

Canada with over 500 million forested acres is one of the world's richest timberlands. Chief product from these forests is the pulp and paper, with a gross value of more than 345 millions annually. Along the Gatineau River in Quebec, chief Canadian source of pulpwood, over 12½ million logs flow annually to the paper mills, near Hull, P.Q. The cover picture shows circular booms or "sasks" each consisting of approximately 25,000 logs being towed to the Mercier dam by tug-boat.

REPAIR OF WAR DAMAGED DWELLINGS IN THE LONDON AREA

BRIAN H. COLQUHOUN and WILLIAM O. MACLAREN, M.E.I.C.
Consulting Engineers, London, England

SUMMARY—Because of continuous air raids and the scarcity of materials and skilled labour, unorthodox methods had to be resorted to in carrying out emergency repair work to dwellings in the London area. This paper describes the organization and supervision of this work in one of London's boroughs, under a firm of consulting engineers.

Although nearly a year has passed since the end of the war in Europe, the work of repairing bomb damage, particularly in the London area, is still recognized by the government to be of major importance. At the present time, however, it is a vastly different proposition from that facing us some eighteen months ago. It is now an undertaking which can be comprehensively planned within known limits.

This article however, is more concerned with the extraordinarily difficult and unusual conditions brought about by continuous air raids, and with the necessarily unorthodox measures we took to control a housing situation for which there was no known precedent to guide us, and which taxed our resourcefulness and ingenuity to the full. We hope that it will prove the more interesting since it is to the best of our knowledge, the first paper to be published on the subject, and was first read, by invitation, before the Société des Ingénieurs Civils de France.

The information contained in this paper will be more fully appreciated if the situation in the latter half of 1944 is called to mind. London was experiencing the most severe continuous enemy air attacks. These round-the-clock raids allowed no daily respite, and the Londoner's morale suffered accordingly. A critical stage was reached by the last month of the year. The government were forced to the realization that if they were unable to repair dwelling houses more quickly than the enemy were able to destroy or damage them, serious difficulties would ensue from the ever-growing number of homeless and often completely destitute families in the densely populated areas. This could only be avoided by getting houses sufficiently repaired soon enough after the damage had been caused to ensure that the occupants could remain in them, and not demand re-housing by their already overwhelmed local authorities.

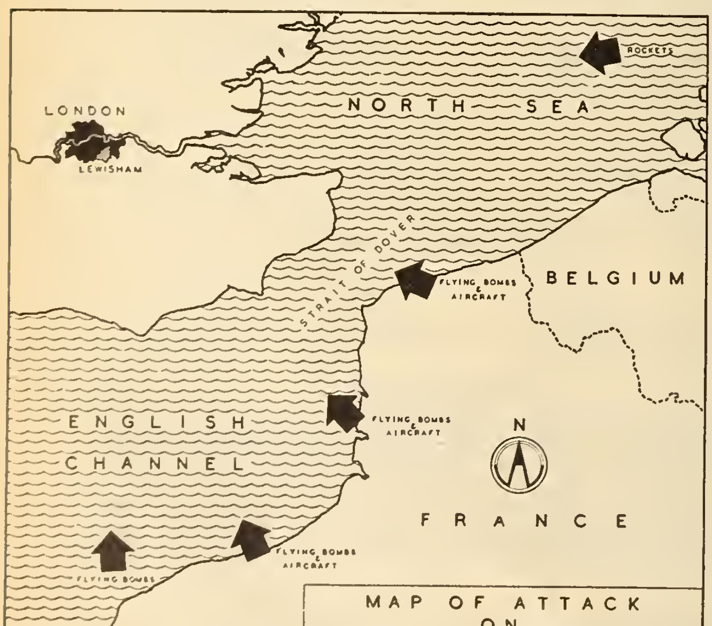


Fig. 1.

The position was, in fact, so acute that the government set up a special Emergency Committee headed by Sir Malcolm Eve, the chairman of the War Damage Commission, to undertake the task of organizing and controlling the whole of the repairs to war damaged houses in the country. Emergency measures had to be taken, and some 140,000 building operatives were employed in the London area alone on this work. In many instances the work was so vast that it was beyond the scope of the local authorities and their technical staffs, and special measures had to be taken to help in these cases. In the case of Lewisham, one of the largest boroughs of London, which had received almost the severest damage of all the London boroughs, we were asked by the Emergency Committee, headed by Sir Malcolm Eve, to accept an appointment as consulting engineers, to organize and supervise repairs to dwelling houses. Before discussing the methods used in undertaking this work, it is necessary to appreciate the position as it stood at that date, namely Christmas 1944.

Figure 1 shows the directions from which the enemy attacked the London area. The heavy attacks on London continued from the commencement of the Battle of Britain in the summer of 1940 to the spring of 1945, when the last rocket fell in Orpington on the outskirts of London. During that period, Britain was subjected to every form of aerial attack, ranging from high explosive bombs, oil and incendiary bombs, land mines and, in the latter stage, flying bombs and rockets. The brunt of these attacks was borne by London and the Home Counties, and the map shows the relation of the London area to the continental coast from whence most of the attacks were made. In the earlier stages, particularly in the period immediately following the fall of Dunkirk when the enemy was able to use the many airfields in France and Belgium, raids on Britain were made by piloted aircraft. The bombardment was continued with the greatest intensity until about the middle of 1941 when Germany attacked Russia, and although in the period after this time raiding became more sporadic, the attack was again intensified with the use of flying bombs, the first of which started on 12th June, 1944, six days after D day. The launching ramps were mainly sited in the Pas de Calais area, and despite concentrated attacks on this area by our aircraft and defence by anti-aircraft guns, fighter aircraft and other methods, thousands of these flying bombs reached London.

The final stages of the attack on the Greater London area by the use of rockets occurred between the last month of 1944 and April 1945. Most of these missiles were launched from the area round The Hague. The use of this highly destructive weapon caused great devastation in the London area, particularly in the densely populated districts, until the attacks ceased with the over-running of the sites by the Allies.

Extent of the Damage

Prior to the use of flying bombs and rockets, over 4,000,000 houses had been damaged in Great Britain, of which 200,000 had been totally destroyed or damaged beyond repair. During the flying bomb and rocket attacks the damage was proportionately much more serious. Each flying bomb damaged in varying degree an average of 900 houses per incident and each rocket an average of 1,100 houses per incident.

London's geographical position, her strategic importance, the concentration of administration, industry, and dense population all combined to make her the main target for attack. The immensity of the problem which faced us can better be appreciated when it is realized that, out of an approximate total of 2,150,000 houses in the London area, about 1,500,000 were damaged and 120,000 totally destroyed.

When it is also realized that out of a total number of 13,000,000 dwellings in Great Britain, almost 8,000,000 dwellings sustained some form of damage from aerial attack, it will be seen that the problem facing the country was one of considerable seriousness.

Since we were appointed as consulting engineers to organize and control the repair of war damage to dwelling houses in one of the London boroughs, namely the Borough of Lewisham, the details given in this paper indicating methods adopted to organize and control this work are of necessity descriptive of the methods which we ourselves used in the borough for which we were appointed, and are not necessarily indicative of the methods used in other sections of London.

The County of London is divided into 28 metropolitan boroughs, and Fig. 2 shows the position of the Borough of Lewisham in the Greater London area.

The Borough of Lewisham is situated in the south eastern part of London and occupies an area of approximately 10 sq. mi. It is the largest borough in population in the Greater London area, and is second only to the Borough of Wandsworth in area. Figure 3 shows only the Borough of Lewisham, and on this map is indicated the number and location of incidents created by various forms of aerial attack. As will be seen from this map, Lewisham suffered a total of 2,458 individual incidents, comprising 1,337 high explosive, approximately 986 incendiary bombs, 121 flying bombs and 14 rockets. When it is considered that the Borough of Lewisham is a very densely populated area and that each flying bomb or rocket damaged 900 to 1,100 houses on top of the damage suffered previously by high explosives and incendiaries, it will be realized that this Borough suffered very heavily. In fact, out of a total of 50,000 dwelling houses in the Borough, only 370 houses were undamaged by enemy action.

The problem which faced us on our arrival was quite simply to repair the largest number of houses in the shortest possible time, and for this purpose we were allocated some 5,300 building operatives working for 61 separate firms of small contractors. We were asked by the chairman of the War Damage Commission to aim at a target of repairing a total of 26,200 houses by the 1st April, 1945. On the date when we were appointed, 21st December, 1944, as consulting engineers to the Borough, London was still being subjected to extremely heavy attack in one form or another, and considering the urgency and immensity of the problem, steps had to be taken immediately to form an organization for this great task.

The first needs were for office accommodation for the organization to do this work, but the local authority had no accommodation available for this purpose. The first job then was to provide accommodation for our organization and this was done by the erection of eight temporary pre-fabricated huts and equipping them with partitions, lighting, heating and telephone service. Sufficient huts were erected and ready for use by the 1st of January, and in fact, control of the position in the borough was assumed upon that date.

We are still using these same temporary offices for accommodation for our site organization.

Shortly before the beginning of the war, steps had fortunately been taken to divide up the country into Civil Defence Regions of which the London area was one, and was again sub-divided into local Civil Defence Areas, each of these being responsible for the organization and protection of the civilian population during aerial attacks.

Figure 4 shows the way in which the borough, a Civil Defence Area, had been divided into eight further sub-areas. As boundaries between these areas are generally natural boundaries such as railways, streams or arterial roads, the sub-division as shown on this map lent itself very well to the organization required for our purpose. Our staff was, therefore, planned as indicated on Fig. 5.

Staff Organization

As will be seen from this illustration, the supervisory staff consists of an engineer-in-charge, together with a deputy engineer-in-charge and a total staff of 210 persons, 160 being highly experienced technical staff and 50 clerical staff.

It will further be seen that our organization was designed to include the careful supervision of basic problems such as material, labour and planning, and also specific detailed supervision for each area.

The general outline of the staff, therefore, under the engineer-in-charge and his deputy, is as shown on this chart. The Borough of Lewisham, as well as being divided into eight areas, is also divided into two sections by a railway line running from north to south with four areas on the west side and four areas on the east side.

For this purpose of co-ordination of supervision, two

MAP OF GREATER LONDON BOROUGHS

Fig. 2.

Fig. 3.

senior superintendents were appointed, one to control the out-door staff in the four areas on the west side and one to control the staff and work in the four eastern areas. Under the direct control of each senior superintendent are four area superintendents, one for each area, each of whom controls all the work being undertaken in his own area. The area superintendent works with the assistance of one senior technical assistant and a number of clerks of works and technical assistants, each of whom has one or more firms of contractors under his own direct control.

The physical work of repairing the dwelling houses in the borough is being undertaken at the present time by a total number of 125 firms of building contractors with a total labour force of approximately 6,500 building operatives.

Referring to the staff chart again (Fig. 5), it will be seen that it was also found advisable to set up other departments which, although working in close affinity with the supervising staff already described, are, in fact, separate sections, each of which is headed by a specialist. The necessity for setting up these separate sections will be made clear by a short description of each section.

The complaints section receives an average of 150 complaints and enquiries from householders, councillors, aldermen and others each week. These complaints and enquiries are immediately acknowledged and later distributed to the responsible senior technical assistant, and usually within 24 hours a fully detailed report is returned to the complaints section. This report is embodied in a reply sent directly by the head of the complaints section to the enquirer.

This department may be more correctly described as a public relations department, and some measure of its necessity may be indicated by the fact that, at the peak period, this department was dealing with about 100 enquiries per day.

The accounts and quantity surveyor's department is another self-contained unit under the immediate control of a chief resident quantity surveyor. This department is responsible for arranging financial details of all contracts and sub-contracts, for the measuring of all work undertaken by contractors on a measured basis, for the agreement of wages, salaries, overtime, claims and subsistance allowances, and also for the control of timekeepers and checkers whose work is to check the working times of the building operatives and to check the use of building materials supplied by the local authority.

The planning section is responsible for graphs and statistics giving an overall picture of the progress of the work, the material and labour positions, and future programmes. It also prepares all drawings required, particularly the great number covering the conversion of large houses into multiple family dwellings or flats. More recently it has also become responsible for the compilation of individual specifications for the repair of badly damaged houses, which will be covered in more detail later.

The labour manager deals with all questions regarding the employment and the working conditions of all the building operatives under our control, and is more particularly concerned with relations with the Ministry of Labour and National Service, and any government departments controlling labour conditions. The labour manager's job is a most difficult one, and he is responsible for the interpretation of various agreements between the industry and the employers, and one of his functions is to ensure that agreements reached between the industry and employers are fully recognized and operating smoothly. Building contractors are required to notify the labour manager before any man is discharged and the labour manager's permission must be sought and obtained before action of this kind is taken. Under the control of the labour manager is a welfare officer, whose main function is to ensure that the building operatives are properly housed, fed and entertained.

It has been stated before that the attacks by flying bombs and rockets were largely concentrated on London and Home Counties areas, and at the height of these attacks the government appealed to building operatives in other parts of the country to come to London as quickly as possible and volunteer to assist in the repair of dwelling houses. The response to this invitation was very considerable, but it meant that many thousands of building operatives had to leave their homes and families to come to boroughs, such as Lewisham to live under extremely difficult conditions. Just how difficult these conditions were will be realized when it is recollected that these thousands of volunteers had to be found accommodation in areas where more thousands were already homeless by reason of the bomb damage. The housing problem was temporarily solved by erecting huts and commandeering halls, hotels and big houses in many areas to accommodate both the building operatives and bombed-out families.

Because of this rather unique position, we have endeavoured to ensure that the living conditions for these men were clean and comfortable, that canteens were provided for adequate and proper feeding arrangements and that entertainment such as theatre shows, boxing matches, dances, cinemas, lectures and concerts were provided at frequent intervals. The attendance at shows of this nature has been extremely good and the increased production has more than justified the provision of these facilities.

Reference was made earlier in this paper to the target which had been set by the chairman of the War Damage Commission envisaging the repair of 26,200 houses within a period of three months. The problem which confronted us, therefore, meant that if we were to be successful in achieving this target figure it would be necessary to repair almost 2000 houses in every seven-day period. On the basis of available statistics covering the period immediately prior to our arrival in the borough the task appeared to be impossible, as the average rate at which houses were being repaired amounted to 220 houses per week. It was obvious therefore, that in order to achieve the target figure, every single man engaged on repairing war damage in the borough would have to give his very best, and that delays should be eliminated as far as possible.

In January 1945, we called a meeting of all contractors in the borough and this meeting was attended by approximately 500 persons, comprising the directors, foremen and agents of all the contracting firms for the borough. The current progress was indicated to them and the target figures were laid before them. Suggestions were considered and policy was formulated.

Classification of Damage

It is perhaps as well at this stage to analyze the type of damage being sustained by the dwellings in the area. Houses which had been entirely demolished by enemy action were classed as 'A' category houses; those which had been so badly damaged as to be beyond repair were classed 'B' category; houses which were so badly damaged that they were uninhabitable in their existing state were classed 'Cb'; houses which were very badly damaged and only contained perhaps one or two rooms that could be used were classed as 'Ca' houses, and those which were damaged but still largely inhabitable, whether the damage sustained was of a very minor or considerable nature, were classed as 'D' houses.

Figures 6 and 7 give some idea of the type of damage in the borough. Bearing in mind that a major consideration was to avoid an uncontrolled mass exodus of the population if at all possible, it was decided to concentrate on the repair of the 'D' damaged houses, at the same time repairing a small number of 'Ca' and 'Cb' houses, this latter work being done where people were living under conditions of acute hardship and where repairs were required by the medical officer of health.

Standards of Repair Work

The standard of repair work to dwelling houses in the London area falls into three categories, which are called for ease of reference:—

(a) First Aid
(b) Repairs to Comfort Standard.
(c) 99% completion.

The first aid work to dwelling houses consisted of ensuring that houses were made wind and weather tight and were repaired only sufficiently to ensure that continued occupation in the houses was possible. This first aid work was given the highest priority and every effort was made to carry out this first stage of repair within 24 hours after an incident had occurred, and in all cases this first aid work was completed to the affected houses within a maximum period of 48 hours after the incident.

The second category, that is the repair of dwelling houses to comfort standard, covered the second stage repair of making the house reasonably habitable for the occupants at that time. In other words, a miminum number of rooms were repaired to a reasonable standard of comfort comprising at least a kitchen, bathroom, one living room and one bedroom for a family of two or two

Fig. 4.

bedrooms for a couple with up to three children. Whereas the first stage, that is the first aid work, consisted at times of nailing sheets of ruberoid, hardboard or other temporary materials on window openings and possibly merely covering roofs with tarpaulins, the second stage consisted of proper repairs to windows, frames and sashes, the glazing with "recovered" glass and the permanent repair with tiles, slates or asbestos cement sheeting to roofs. An interesting point regarding the use of "recovered" or "R" glass as it was called, is that this was a substitute material manufactured from the vast quantities of broken glass which accumulated from the constant bombing of London, and although the material contained many imperfections and impurities, its use did much to alleviate the glass shortage at that time.

The third stage of repair on which we are engaged at present is the repair of the houses to 99 per cent completion, by repairing all rooms in the houses including decoration, and in the replacement of recovered sheet glass with polished clear sheet or plate glass.

The reason for not repairing houses to 100 per cent completion is to avoid having to negotiate the final details of compensation with the owner of each house. This we have insufficient time to do because of the large number of houses to be repaired, and by leaving the house almost, but not entirely completed, the onus has been left with the house-owner to make full details of his claim to the War Damage Commission, who are then responsible for settling the final claim with the owner.

In order properly to distribute the labour and supervisory personnel at our disposal, the firms of building contractors were placed in areas best suited for their own capabilities, and each contractor was given a proportion of the target figure to complete each week, commensurate with the type of his own organization, and more particularly in relation to the number of operatives employed by that firm.

First-Aid Repair

From January to April 1945, the building operatives and the firms of contractors under our control worked magnificently under appalling conditions, as rockets were falling, and attacks by a large number of flying bombs were still continuing. In fact, so much damage was being caused at this time when our programme was being launched that approximately 600 additional houses were receiving damage from enemy action each week due to new incidents as this work was progressing. In order to ensure, therefore, that the programme would not be completely dislocated by these new incidents, we created a 'first-aid squad' in each area, completely mobile and equipped with first-aid materials and light equipment. Although this mobile squad was normally engaged in repairing houses in the same way as other building operatives in the area, they were ready at a moment's notice to be sent to the scene of an incident within a matter of two hours after the incident occurred. From experience, we learned that it was quite useless sending building operatives to the scene of an incident earlier than two hours after the incident had occurred, this period being extremely necessary to allow the police, ambulances, fire brigades and heavy and light rescue squads to carry out their work of saving lives and preventing property being damaged by consequential fire.

Immediately the first-aid squad arrived, they were engaged in first removing or supporting dangerous structures and quickly repairing roofs, windows, and doors and restoring sanitary, cooking and heating services sufficiently only to ensure that the inhabitants could continue to live in their houses, not with complete comfort, but with shelter from the wind and weather and with improvised facilities to keep them going. All of this first-aid work was, of course, additional work to the programme which we had been set.

In connection with the immediate first-aid repair to buildings immediately following damage caused by enemy action, it is of interest to record that by encouraging householders to help themselves a great deal of bad temper and difficulty was avoided.

The procedure immediately following an incident, and in addition to the action already described, was to send one or two lorry loads of roofing felt, timber battens, nails and linen, asbestos board and hard board to the scene of each incident. On the side of each lorry was a sign inviting the householders to help themselves to materials and improve their own position by nailing up this material and so assist in making their own houses at least temporarily weather proof and inhabitable. The response given by the householders was extremely encouraging and this method proved itself to be highly successful.

Although all this first aid had to be carried on simultaneously with the main repair programme, we are very glad to say that because of the magnificent cooperation received from everybody under our control, we succeeded in achieving, and, in fact, passing with a considerable margin our target figure. In fact, on the 1st April, 1945, a total of 32,000 houses had been repaired up to a reasonable standard of comfort (Fig. 8).

Building Materials

This achievement, however, was not possible without considerable difficulties, one of the major ones being lack of materials. It will be noticed from the organization chart (Fig. 5) that a separate department had been set up to deal with building materials. This step was necessary for many reasons. The orthodox method of plastering partitions and ceilings for many years has been by the use of first fixing laths to give a key and by the application of two or three coats of plaster. Within the last 20 years, patent plasters have been developed to

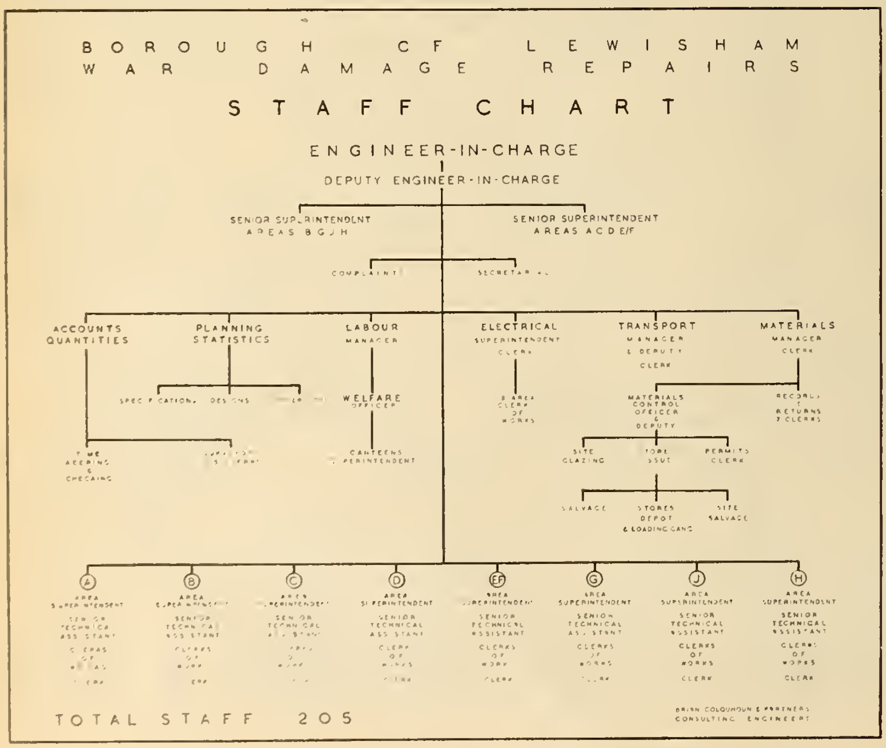


Fig. 5.

such an extent that many of the craftsmen had almost forgotten how to mix up the old fashioned type of lime plaster. One method that had come to the fore and had been used to a considerable extent during the past 15 years consisted of fixing sheets of plasterboard which only required a skim of patent plaster to finish either walls or ceilings. We mention this matter of plastering, particularly, because of the fact that in 1945 one of the biggest factories in the country producing patent plaster and plasterboard had been seriously damaged as a result of a severe explosion at a Royal Ordnance Factory bomb dump at Burton-on-Trent and was thereby rendered useless.

We were then faced with the immense problem of having to repair and surface ceilings and internal walls in houses and, at the same time, having to realize that the more orthodox and familiar materials with which the craftsmen were fully conversant in method of preparation and fixing, were, in fact, unobtainable.

Obviously then, the only method was to make the fullest possible use of substitute materials. Some supplies of plasterboard were fortunately received from America, and these were used to the fullest possible extent, but in order to eke out the meagre supplies, use had to be made of lime plaster which, as is well known, is difficult to work with, and must be very carefully mixed in order to obtain good results. Also, as lime plaster does not set quickly, an addition of a small quantity of cement was necessary in order to expedite the repair work.

Finally, in some cases, in the absence of other materials, use had to be made of wall board and laminated board, both of which materials are merely strengthened forms of cardboard and which were fixed to walls and ceilings to give some modicum of comfort until better materials were available.

One of the most difficult questions relating to shortage of materials was the extreme shortage of bricks. It will be realized that there are in England a very large number of brickworks which were, before the war, very well staffed with experienced craftsmen, versed in the industry of brick making. The need of the Armed Services and other forms of National Service in England was so great, however, that the labour force engaged on producing bricks was depleted to a very low level and consequently a very serious brick shortage ensued. One can appreciate, therefore, the difficulty which arose in the repair of brick houses under these conditions.

The main solution was in collecting loads of bricks from demolished and damaged houses and buildings, sending them to a central depot which was set up in the middle of the borough and was staffed with 50 women working under the control of one male foreman. These women received an average of 20 loads of bricks per day, stacked them by hand, and working with trowels cleaned all the old mortar off the bricks, then re-stacked them, and again loaded them for use in repairing the houses in the borough. In this way, we were able to re-use four million bricks within a period of three months.

Even as this paper is being written, there is still a very severe shortage of facing bricks in this country and we are still using very considerable quantities of salvaged bricks for the repair of our houses.

Timber in adequate supply is essential to the quick repair of door frames and doors, window frames and sashes, flooring, roofing and innumerable other items and is another material which presents considerable difficulty. When it is remembered that prior to the war 85 per cent of all our timber requirements were supplied from foreign countries, the immensity of the problem of supplying timber for our use and from our own sources during the war, will be realized.

We have had to resort to the use of considerable quantities of immature home grown timber and the use of this timber has not been at all satisfactory as insufficient time was available for proper seasoning for construction purposes. The greatest possible use has had to be made of salvaged timber, and demolished buildings were scoured for any available and useable timber which was sent to another depot we created in the borough for the purpose of cleaning and sawing it into useable sizes, shapes and lengths. Once again, female labour was used to withdraw nails and other foreign substances from this salvaged material with considerable success. Difficulty in relation to the supply of timber has meant that the strictest possible economy has had to be exercised in the use of timber. An example of the extent to which this was carried is that where normally perhaps 4 by 2 in. studding would be used in peace time, this had to be cut down to perhaps 3 by 1½ in. In fact, throughout the whole of the war period, every saving in the use of timber has had to be effected.

Fig. 6—Extent of damage caused by the incident of a flying bomb.

There is insufficient time to enumerate all the absences or shortages of building materials, but a very short list of the most aggravating items would cover such articles as all types of guttering and drain pipes, whether of cast iron, pressed steel or asbestos cement, all types of plumbing fixtures, roof slates, lead, zinc, glass and a multitude of other items normally used in building construction.

Two other specific items are well worthy of mention, the question of transport of materials and building operatives in a borough of this size, that is, of 6,500 acres in extent, is a matter of considerable importance. In the early stages, contractors were supplying their own conveyances and consequently a very great deal of petrol, time and money was being wasted by over-lapping and

Fig. 7—Another illustration of the type of damage caused in the bombing.

duplication. Some months ago, a system was set up in one of the eight areas of the borough whereby the leading building contractor in that area was made responsible for organizing the movement of all traffic in his own area and by ensuring that all motor vehicles in the area were put into one pool and used for given purposes, arrangements of full loads were possible and considerable economy thereby effected.

This transport pooling scheme was finally extended to all other areas in the borough and is now operating very efficiently and economically under the control of our central transport office. The consequential economy proved by this method amounts to £2,000 over a three months period.

Consideration had to be given also to the manufacture and replacement of pre-cast stone sills, lintels, steps, copings and items of that nature. In the past, prior to our arrival in the borough, each individual firm of contractors was in the habit of casting its own sections, and this was causing delays and, in some cases, the materials so made were of too low a quality to be used. A solution was found by importing into the borough a firm of contractors specializing in the manufacture and design of pre-cast concrete units. This firm co-operated with us very well, to the extent of setting up a special works in the centre of the borough and they are now obtaining orders from all contractors working under our control and after surveying the damaged buildings are preparing their own form work or shuttering, and casting sections for the use of all contractors in the borough.

Forms of Contract

It may be of interest to mention briefly the types of contracts which are in use. As will be appreciated, insufficient time was available to prepare individual contracts and specifications for each separate house in the borough before the work was commenced, and for this reason, a form of contract was devised by agreement between the industry and the government departments concerned of the type described in England as a prime cost form of contract. This type of contract is similar to the Canadian form of contract known as "cost plus".

We all agree that this form of contract is not a good one and has been very much abused by both contractors and operatives in many cases. Now that, fortunately, incidents have stopped, we have been able to consider other methods and in fact, as this paper is being written, we are changing our contracts from the "cost plus" system to contracts on a measured basis. The major difficulty in changing over the contracts to a measured basis is that every house must be surveyed, a specification drawn up, and the amount of required work measured and scheduled before any tenders can be obtained. When it is considered that there are still over 40,000 houses in the Borough of Lewisham which require further repair work, it will readily be seen that the amount of work involved in surveying, measuring and scheduling this work is a task of considerable magnitude. Because of its type, this new contract, now coming into use, is being confined only to contracts for the repair of heavily damaged houses. We are, however, considering a similar type of contract for the repair of the more lightly damaged houses. The method proposed is for each suitable contractor from whom we are accepting tenders for this type of work, to be given a master specification, which embodies the state of repair up to which the house must be brought when the contractor has finished work therein. The contractor is then requested to inspect each individual building and to quote a lump sum figure for carrying out the work required to repair the house and bring it from its existing state of damage up to the state embodied in the specification. This places a little more work and responsibility upon the shoulders of the contractors, and it relieves us as engineers of a very great amount of detail work, and this system, is in fact, permitting small jobbing builders to carry out their normal function as small building contractors.

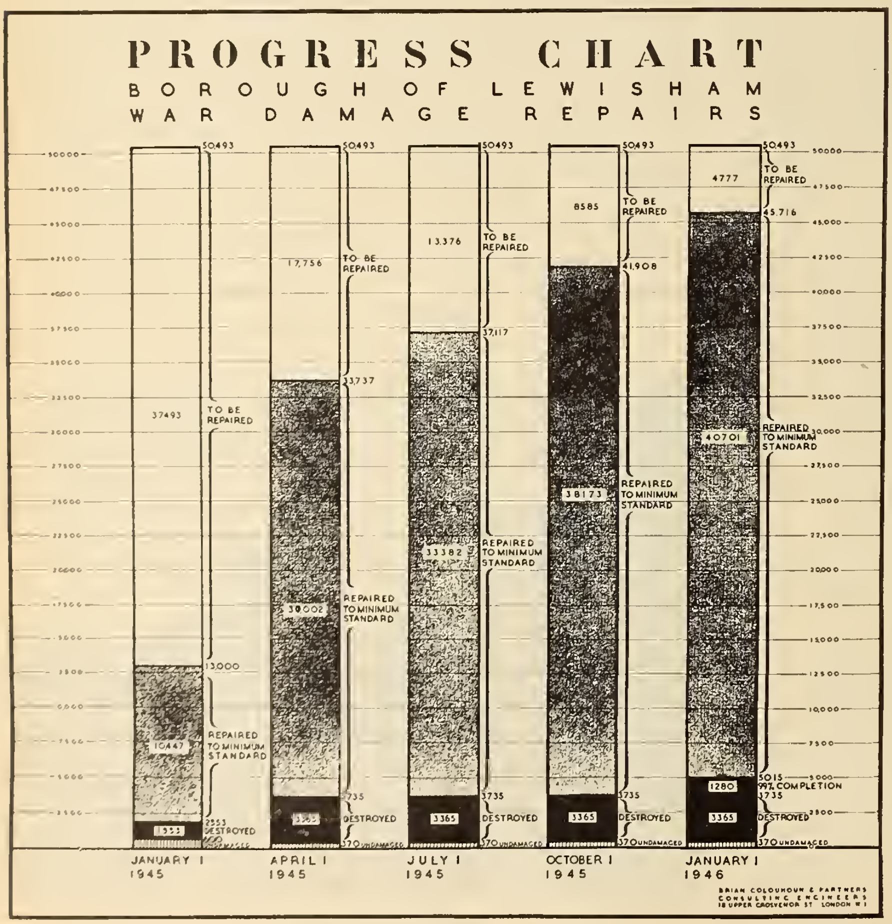


Fig. 8.

Progress of the Work

Before proceeding to the question of costs, it may be as well to examine Fig. 8, which gives an overall picture of progress achieved in the Borough.

The first column (Jan. 1st, 1945) shows the number of houses repaired in Lewisham during the period September 1939-January 1945 prior to our appointment as consulting engineers. The second column indicates the success of our methods in nearly tripling the previous total of houses repaired in three months. Due to our policy of concentrating on the lightly damaged properties the average time taken was 150 man-hours per house.

In the succeeding quarters the rise is not so spectacular, owing to the fact that we were undertaking the more heavily damaged properties. Man-hours per house gradually rose until the present average which is about 1500. In the last column it will be seen that we have started the 99 per cent repairs which will be gradually carried out on all the remaining houses in the Borough.

Costs

No information has yet been given of the way in which the cost of repairs to dwelling houses is being met in this coun-

(*Continued on page 572*)

PRESTRESSED REINFORCEMENT OF TIMBER TRUSSES

E. P. MUNTZ, M.E.I.C.
Consulting Engineer, Montreal

Precis

The information contained herein is of interest to present users and prospective purchasers of temporary war buildings containing timber trusses.

The reinforcement of a large number of Warren trusses is reviewed. The general conditions are given which lead up to the design of reinforcement, together with a description of the system adopted, the benefits derived therefrom, and costs.

Variations in drying shrinkage following erection are discussed in the appendix, giving reasons for the much better behaviour of trusses in some buildings than in others.

The effect of shrinkage on one class of joints is analysed. It is claimed that transverse bracing should be attached at centre of trusses (rather than at the sides) so that truss bolts may be tightened subsequent to erection without changing the transverse bracing.

The system of reinforcement adopted is based on the use of 0.30 in. dia. high strength steel truss wires (Fig. 7) and clamps developed by the author. The truss wires have been stressed in place against the trusses by hydraulic jacks, the load imposed being measured by the stretch in the wires.

Substantial relief is provided in end web members and in the bottom chords, and the cost is small. Camber of trusses is maintained. Deflections under live loads are reduced. The operation of hangar doors when supported by the trusses is assured.

Such reinforcing may be applied to a variety of trusses and to any bottom chord up to its dead load stress or to its capacity in compression.

Introduction

This article describes the principal causes of failure and methods used to restore the capacity of a great number of timber trusses.

The use of many buildings containing similar trusses will continue and the information contained herein is therefore of interest to present users as well as to prospective purchasers of buildings containing such trusses.

Timber has been one of our most generally used structural materials. Before the war, suitably seasoned timber meeting structural grading rules was generally available. With grading and inspection of seasoned timber at a high level, considerable test data on new methods of joining became available, leading to more precise designs as well as the design of structures not otherwise possible or economical in timber.

The very large war demand resulted in the use of considerable timber having a high moisture content as well as the use of some timber below structural grade. The limitations of such timber are great—much greater than provided for by some designers during the emergency. Seasoned structural grade timber probably will become available in increasing quantity but it will still be a long time before it is readily available in volume.

Many timber structures incorporating trusses of various spans were built during the war for industry and the armed services. The transverse shrinkage of the timber in some of these trusses has exceeded 5 per cent or over one inch in the width of a single truss. In buildings having ten trusses, the aggregate shrinkage is nearly a foot. Where transverse girts have been rigidly connected to the sides of trusses, the trusses on either side of the centre truss have been distorted, the bottom chords particularly being bowed towards the centre truss. The end trusses (back wall and door in hangars) have the greatest horizontal distortion. The lateral inward bowing of these end trusses is very noticeable, particularly when truss bolts have been tightened without extending the horizontal transverse girts between the trusses.

It follows that the transverse system should be connected at the centre of the trusses—not at the sides. Transverse shrinkage and swelling of the trusses would then take place freely without lateral distortions.

Joining

In general, the joining has been by split rings and bolts. There is no doubt that split rings are an excellent means for joining timber when reasonable deductions from maximum allowances are made for the spacing, end and edge distances, angle of load to grain, and grading of timber actually used.

These deductions have been too small in many cases in view of all the conditions, and failures have resulted. Many of these failures have been precipitated or aggravated by additional local stresses due to eccentric connections. (Figs. 1 and 2 show a widely used connection.) In general, posts or compression diagonals are single members in the centre. The chords are in two pieces on either side of the compression members and the tension members in two pieces on the outside of the chords. The vertical components of the tension and compression web members, of course, produce transverse bending, and the stress between the inside faces of chords and compression members frequently has been beyond the capacity of the timber. In some buildings about three years old, the measured distance between inside faces of lower chord members has been over one inch greater at the bottom than at the top of the member, and the full width of rings has been visible on both sides of the compression diagonals at the same time (Fig. 3). This has been due to shrinkage and to excessive compression between the top of inside faces of chord members and the compression web members.

This condition, of course, bends the timber tension diagonals and results in many secondary stresses causing various kinds of failure. Two of the most common are

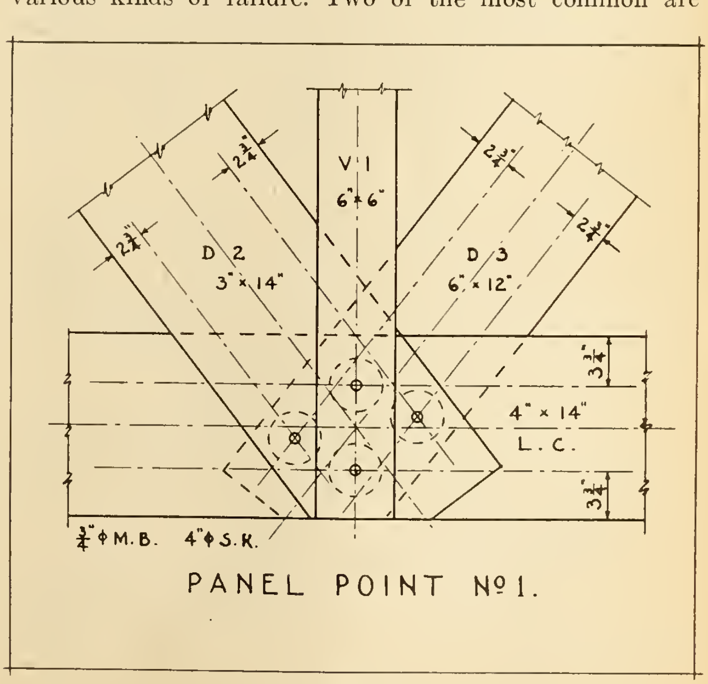


Fig. 1.

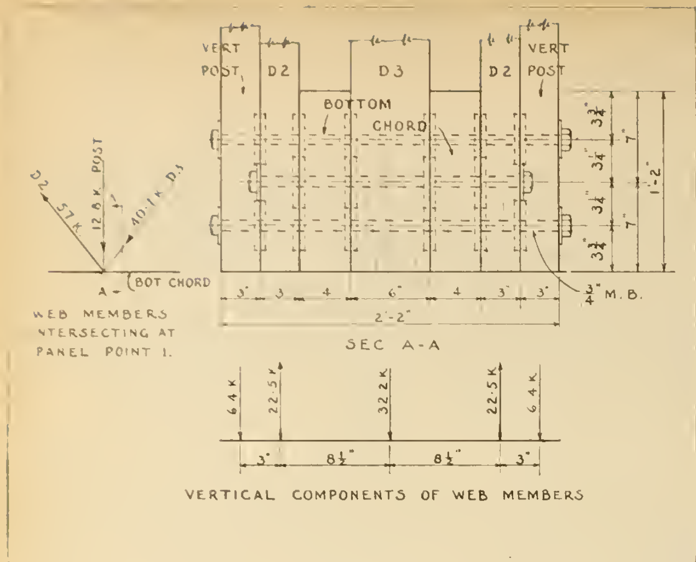


Fig. 2.

shown in Figs. 4 and 5, and these have occurred occasionally even when the distances from the ring connectors and bolts to the end of the member have been otherwise adequate.

Another condition which is of frequent occurrence is shown in Fig. 6. It is evident from the distribution of the rings as shown in the cross section (Fig. 2) that the tendency is to tear the chord members apart vertically.

In Fig. 1 the load in ¾ in. dia. bolts tightened to produce a body stress of 20,000 lb. per sq. in. (30,000 lb. per sq. in. at root of thread) would be 9,000 lb. each. Presume the bolts are so tightened when assembled before erection. The bearing stress of the 3 by 3 in. square washers on the timber would be 1000 lb. per sq. in. Presume also that large washers are provided to distribute the load uniformly from the bolts to the timber. The uniform compression between the chord members and the compression diagonals will then be 169 lb. per sq. in.

When the service loads are added, such a high bolt stress would provide for an over-all shrinkage of only 0.017 in. at the centre of the chord when the maximum compression between the chord and the compression diagonal is 300 lb. per sq. in. One inch shrinkage has been experienced at the bottom of the chord which corresponds to a minimum of 0.3 in. at the centre. The bolts would have to be retightened to this high stress over seventeen times and at the right time so as to keep the compression transverse to the grain at 300 lb. per sq. in. or lower. This, of course, is impractical not only in itself but because the transverse girts would have to be adjusted frequently.

If the faces are in contact but the bolts not stressed when the service loads are applied, the bolt stress due to the service loads will be 6100 lb. per sq. in. and the maximum compression 400 lb. per sq. in. Any shrinkage will produce greater maximum compression. It is thus evident that with a normal load due to hand tightening of 3500 lb. per bolt (or a bolt stress of 8000 lb. on the body) continual tightening is necessary.

Evidence of the large shrinkage experienced is the prevalence of hard wood washers up to 1¼ in. thick which it has been necessary to add under the steel washers on one side of the trusses because the bolt threads were too short. These washers have been made 4 in. square thus also reducing the bearing on the timber.

After the truss is in service, usually one bolt only at a time is tightened. Under dead load only, a single bolt and its washer bearings on the timber will be very much overloaded by the force necessary to overcome bending due to eccentric connections and friction of the timber on the rings. This has been calculated and is also shown in the field where many washers have been forced into the timber.

Where stresses due to eccentricity may be excessive unless bolts are continuously tightened as in Fig. 1, it is evident another design of joint is necessary.

If no arrangement of overlapping members can be formed within the range of material sizes available which will reduce the stresses to safe limits, then either steel or plywood gusset plates or other form of joint must be used. The author has used plywood gussets on several jobs.

Failures have occurred as shown in Figs. 4 and 5 at panel points 1 and 2 left and right. The trusses have sagged as much as 9 in. When the failures are at 1 and 2 L or R but not at both, the sag is of course not uniform but still may be several inches.

Undoubtedly similar joints and members which have not failed were near the point of failure or badly racked at time of failure elsewhere. Repair and reinforcement of a few individual panel points would therefore be followed probably by other failures. Such repairs seem to be something like putting new wine in old bottles and the cost would be continuing and heavy.

In some cases, no failures were apparent but the timber had shrunk leaving the bolts slack. These trusses had lost their original camber of nearly 3 in. and generally had a sag. When the chords were shored from the floor, bolts loosened, chords jacked to the original camber and bolts tightened, the trusses failed to hold the camber upon release of jacks and generally came down to the position before jacking.

Top chords in general are well supported laterally and have given little trouble, the new failures which have occurred being secondary to bad failures elsewhere.

Variations in drying shrinkage are discussed in the appendix.

Design Requirements for Reinforcement

These observations and many others lead to the conclusion that the reinforcement should meet the following design requirements:

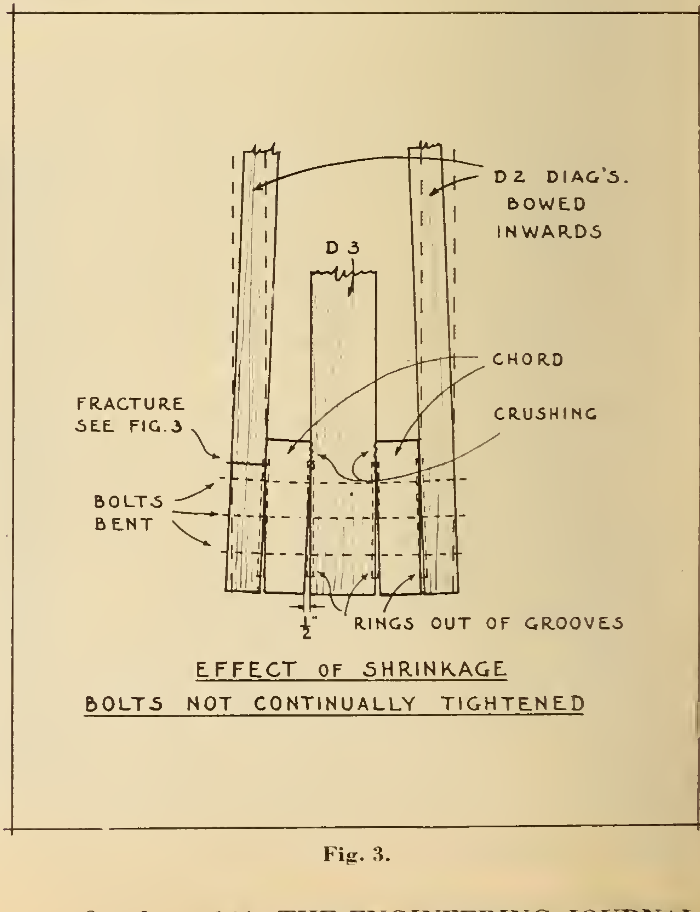


Fig. 3.

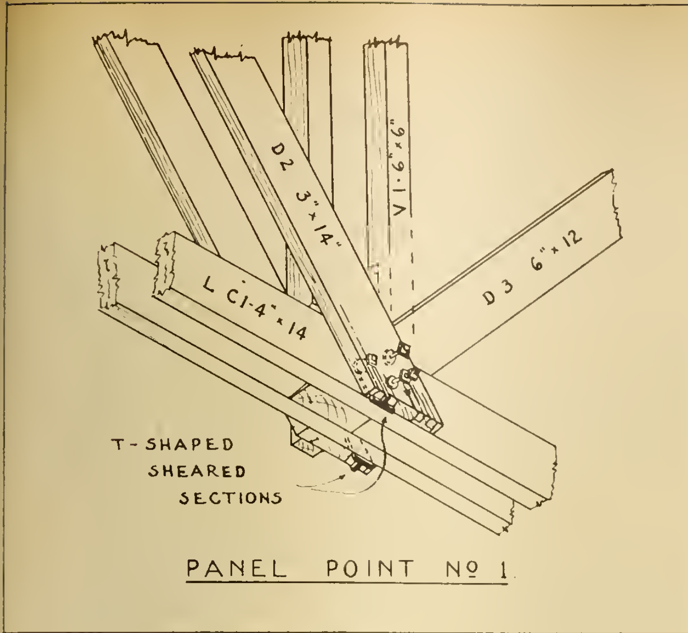


Fig. 4.

1. Provide general relief for web members in the first and second panels and for bottom chords.
2. Reduce stresses due to eccentric connections and slack bolts.
3. Permit sub-grade and partly failed members to remain in place to the extent that their deficiencies are supplemented by the reinforcement.
4. Maintain camber, particularly in door trusses, under normal service loads.

It is evident, of course, that any system of reinforcing to be economical must be flexible. The truss will take some proportion of the load as it deflects under full live load or even overload. If structural grade steel were used it would " hog " the load and would have to be designed to take the full load. Also, if structural grade steel were used, the reinforcement could not go through the trusses and would have to be placed on either side. Cost of end anchorages and bearings under the chords as well as of the main members would be prohibitive.

System of Reinforcement Adopted

The very economical system shown in Fig. 7 was then developed using truss rods of cold drawn high carbon steel wire stressed against the trusses. The increased stress in the wire is small for substantial deflections of the truss. For ½ in. deflection at points 1 and nearly one inch at points 2 the increase is less than 15 per cent.

This system has been applied to upwards of one thousand 112 ft. span Warren trusses. These trusses have seven 16 ft. panels with chords 10 ft. 3 in. centre to centre.

The system as applied to these trusses in single span buildings consists of eight truss wires running from end to end of top chord, four passing under and bearing up against panel points, 1 right and left and 2 right and left respectively. In plan two wires are on each side of each of the two timbers forming the chords. At the end bearings two wires are on each side of each of the two timbers forming the end posts.

Four and six wires have been used occasionally when the truss showed loss of camber and where ring spacing, etc., appeared inadequate even though no actual failure was evident. It was found that such trusses could be recambered without shoring or jacking from the floor.

In hangars the doors have been carried by the end trusses. The live load of the doors is approximately the same as the 40 lb. per sq. ft. live load used for intermediate trusses. The deflection at the centre upon closing the doors is approximately ½ in.

In double span buildings (two single trusses end to end), no anchorage is provided at the centre column. The wires bear on two 2¾ in. dia. standard steel pipe placed in snug holes through the double 5 by 22 in. columns. The pipes are filled with cement mortar.

The ends of the chords and tops of outside posts are bevelled to receive the ¾ by 10 by 18 in. steel bearing plates. The bearing blocks under the bottom chord consist of a 3 by 3 by ¼ in. angle with a 2 in. standard steel pipe in the bite of the angle, both 1 ft. 3 in. long. To the angle is attached two 3½ by 9 by ⅝ in. steel plates, one bearing against each 4 by 14 in. timber forming the bottom chord. The pipes in these blocks are also filled with cement mortar.

The wire was 0.30 in. dia. cold drawn high carbon steel having a breaking load of 12,600 lb. (178,000 lb. per sq. in.). It was stressed initially to 113,700 lb. per sq. in. to carry 7,200 lb. (102,000 lb. per sq. in.) after creep had become negligible.

The initial stress was determined from tests by M. F. Macnaughton. These tests were similar to others made for the author and described in Mr. Macnaughton's discussion of Col. Carrière's paper " Precompressed Concrete Design ". *(Engineering Journal,* August 1946).

Stressing by Hydraulic Jacks

Hydraulic jacks are used to prestress the wire. The jacks are Black Hawk Model EA-11 having a height of 11 in. and a hydraulic lift of 6½ in. These jacks act between the end bearing plates and a jack head engaging temporary clamps on two wires at a time. The permanent clamps against the bearing plates are left loose until the stressing is completed. When the load in the wires is transferred to the permanent clamps the excess length of wire required for jacking is cut off. The clamps and bearing plate do not project beyond the siding, the temporary opening in which is only 2 by 2 ft.

In single span buildings, the stressing is done from one end only. Actual measurements in the field show that the friction loss around the turns is practically negligible, particularly if the bearings at the turns are tapped with a hammer.

In two-span buildings the stressing is done from both ends.

An initial stretch of 1¼ in. in 20 ft. can be measured with practical accuracy without special equipment in the

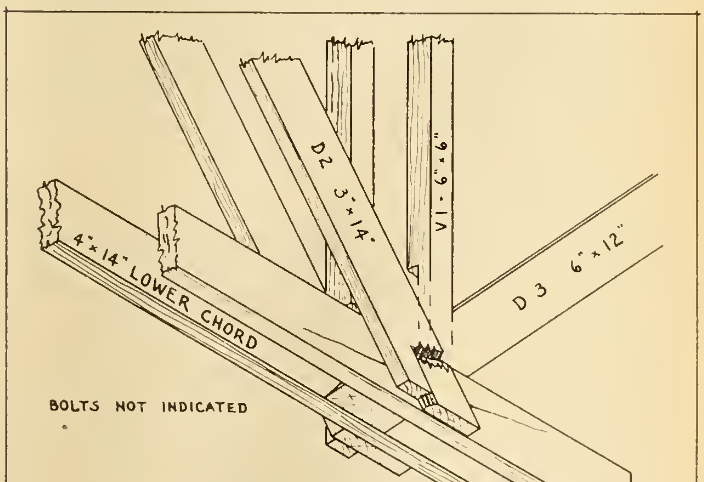


Fig. 5.

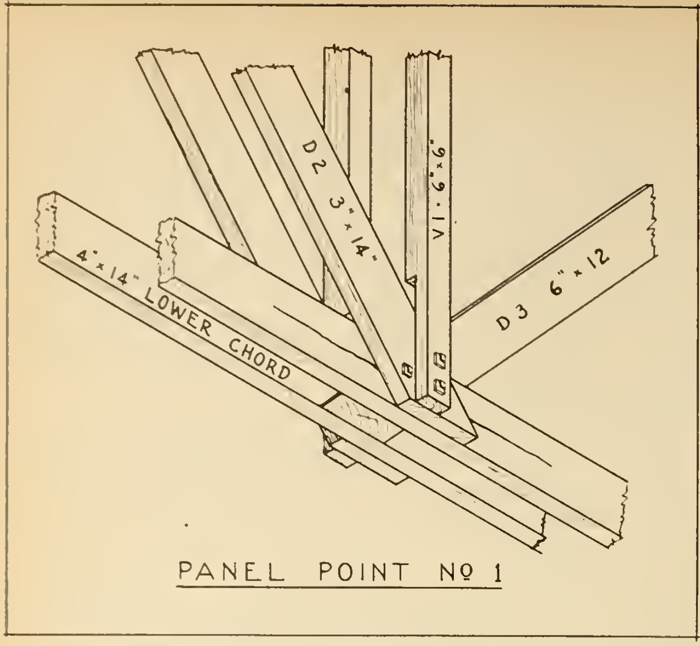


Fig. 6.

field. A 20 ft. length of unstressed wire is used as a gauge. One end of the gauge wire is secured to the wire to be stressed. The stretch in 20 ft. is measured by the difference between the other end of the gauge and a marker on the wire being stressed. The edge of a band of "electric" tape will provide a suitable marker. Of course the wire must not be nicked in any way. The hydraulic jacks can be equipped with gauges when procurable for measuring the load, thus making the procedure described above unnecessary except for periodic checking.

Clamps

The clamps were developed and patented by the author several years ago. They will securely grip the bare wire, and have been tested to loads 25 per cent in excess of the breaking load of the wire used. In breaking tests of the wire and clamps, the wire generally breaks clear of the clamps and always within 2 per cent of the breaking load of the bare wire.

Benefits of the System of Reinforcement

The shear stress in the 112 ft. span Warren trusses due to dead and live loads is reduced by 56 per cent in the panels adjoining the columns; by 32 per cent in the second panels, with no change in the third and mid-span panels where relief was not required.

Tensile stress in the timber bottom chord is reduced by 56 per cent in the panels adjoining columns; by 50 per cent in the second panels; and by 46 per cent in the third, and 42½ per cent at mid-span.

The bottom chord bearing blocks distribute the reaction from the wires evenly to the chords.

Timber web members may be left in place if the reduction in strength does not exceed the reduction in shear provided, i.e. the damage or deficiency may be 56 per cent in the first panel and 30 per cent in the second.

The camber in reinforced door trusses was reduced about one-half inch only when the doors were closed. The camber of two such trusses was checked monthly for six months without change.

The four design requirements or objectives noted earlier have thus been met.

The system can be applied to reinforce a variety of trusses.

Top Chords

In the original design the dead and live load compression in the centre panels of the top chord was 136,000 lb. The reduction in top chord compression at the centre due to upward bending by the prestressed truss wires is equal to the compression added by the horizontal reaction from the end bearing plates. Hence the stress at the centre is not increased.

The top chords as constructed were uniform throughout except at the ends. With the prestressed reinforcing, blocking has been added between the end posts and the ends of the main chord members. This blocking transmits the 51,000-lb. horizontal reaction from the end bearing plates. Thus the compression in end panels of the top chord is very much below the capacity. The top chords in general have given little trouble. They are well supported horizontally by the transverse roof sheeting directly nailed to them. Failures which have occurred are chiefly due to excessive sag caused by the failures elsewhere as noted above.

Additional Reinforcement Bottom Chords

Some bottom chords have split at the splices and elsewhere due to a variety of reasons. The loss in effective strength has been greater than the eight wires in the system described above could restore, that is, greater than 46 per cent at the splices. It has been found considerably more economical to supplement the reinforcing rather than renew the chords. Horizontal wires have been located immediately below or above and below the bottom chords. These wires have been stressed between bearing plates on the outside columns.

Such supplementary horizontal reinforcing can be applied equally well to reinforce the bottom chord of bow string or other types of trusses either steel or wood. A

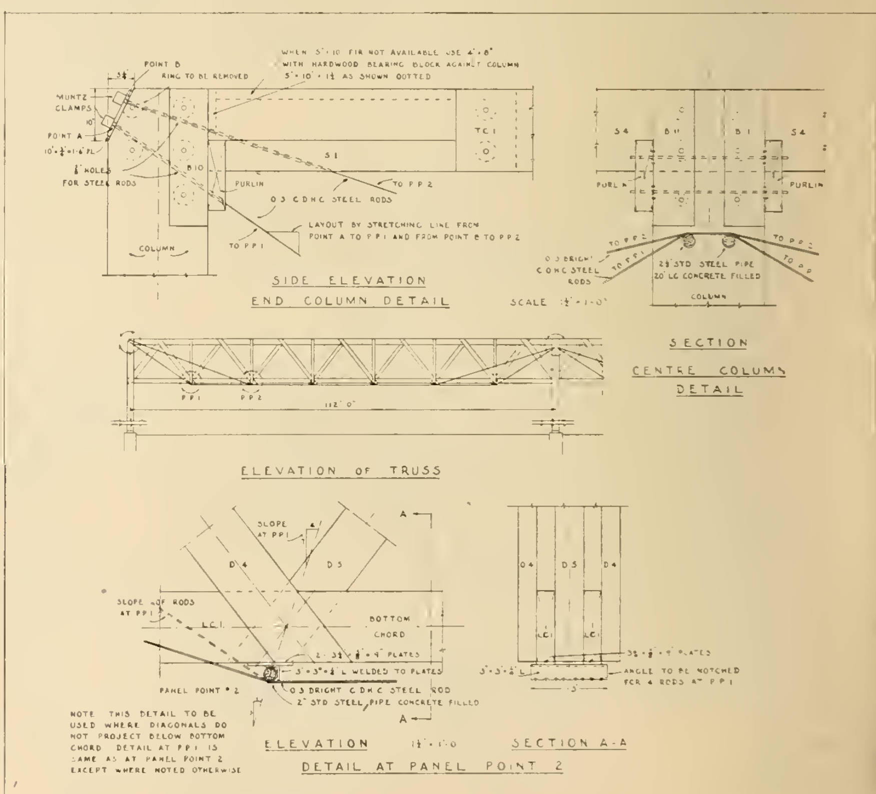


Fig. 7. (Patent applied for)

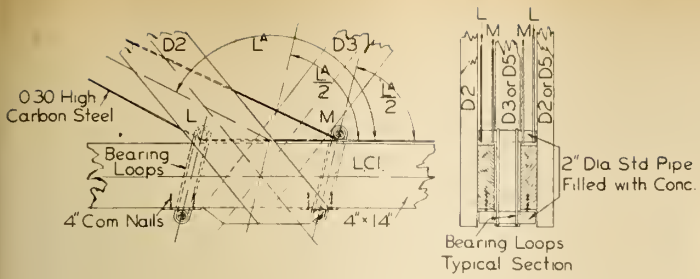


Fig. 8.

case has been studied recently in which it is proposed to reinforce the bottom chords on six 36 ft. trusses end to end with prestressed horizontal wires running from outside post to outside post or a total distance of about 216 ft.

Transverse Bracing

With the type of joint shown in Figs. 1 and 2 transverse bracing could not be attached at the centre of the truss at the panel points. It might be divided to engage on either side of the panel points in a new design using a different roof system. As noted earlier the shrinkage in the truss and tightening of truss bolts has been restrained by the transverse system and the trusses in many cases have been badly bowed. The restraint causing this bowing has been removed by cutting loose one end of the roof beams and rebolting after the truss has been tightened. The ends of these beams and the transverse girts at or near the bottom chord are carried by posts on the outside of the truss. The girts were cut in the centre and spliced. Wedges have been used in the cut between the splice plates so that the girts exert a slight thrust against the truss through the posts to which they are attached. These wedges can be driven at any time extending the girt whenever additional tightening of the trusses may be necessary.

Weight of Wire

The combined weight of 0.30 in. wire in eight rods for a single 112 ft. truss is about 240 lb. For 0.330 in. dia. if desired the weight is only 50 lb. more per single truss. The increment in total dead load for either is negligible.

Labour Costs

A foreman and six men can place the reinforcement excluding scaffold on two double trusses in three days, or 84 carpenter and rigger hours per truss. It has been found that the wire can be readily placed and accurately stressed by any good carpenter and rigger crew. One experienced man with a new crew, of course, helps materially to maintain reasonable labour cost.

Material Costs

The end bearing plates, bottom chord bearing blocks, centre column pipes, clamps and wire for one double truss cost approximately $135 f.o.b. Montreal. Cost of material for a single truss was less than $90.

It is evident from the above that the system has been found both economical and effective.

General Observations

When trusses have been recambered by jacking only and retightened, without supplementary web reinforcement, experience shows that the camber is lost quickly. No continuing relief is provided and doors suspended from such trusses require frequent adjustment.

Substantial, definite and continuing relief is provided, however, at relatively small cost, by the stressed wire system as described herein.

For trusses in bad condition, the cost of the system together with jacking, replacement of defective members and tightening is only about two-thirds of the cost without the system.

For trusses in relatively good condition where the sag is not more than 2 in., the stressed wire reinforcement has been applied and the trusses reconditioned and recambered without shores to the floor. Aircraft have actually been moved in and out under the trusses, while they were being reinforced and recambered.

Modified Arrangements

(a) Where the height of aircraft has required maintenance of clear headroom between floor and bottom chord between panel points, the arrangement shown in Fig. 8 has been used. The effective improvement for the same anchorage and wire is about 85 per cent of the values given for the standard arrangement as shown in Fig. 7.

(b) For an existing or new truss capable of taking reversal of stress, the principal elements of the reinforcement can be used to form a suspension system stressed to nearly the full working load against the truss. Fig. 9. The advantage of this system is of course that the prestressed suspension may be adjusted to give uniform vertical reactions at the panel points or to give reactions required by the condition of the existing truss.

Acknowledgements

Reinforcement of trusses by this system has been carried out in various locations during 1944 and 1945 extending from Moncton, N.B., to Kapuskasing, Ont., for the R.C.A.F. under the general direction of G/C F. H. Marani, O.B.E., S.O.C.E., No. 1 Air Command with F/L Allan Tubby and W.O.1 W. E. R. Patrick directly in

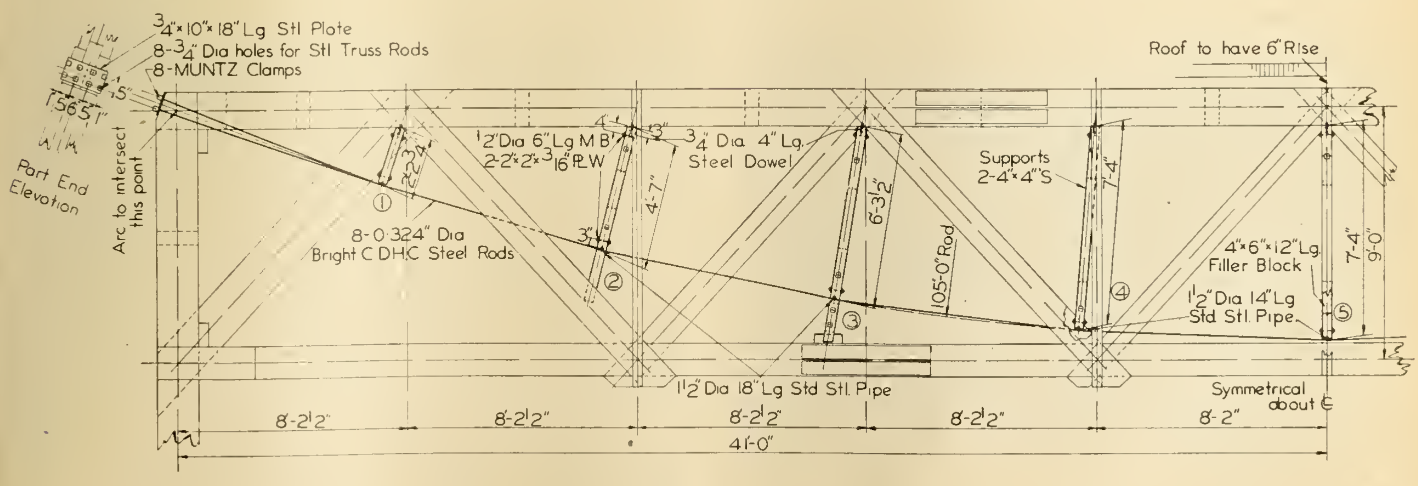


Fig. 9.

charge; in Toronto for DeHaviland Aircraft of Canada Limited for whom Mr. David Shepherd, M.E.I.C., was the consulting engineer, and elsewhere.

The work has been executed by the following contractors, A. F. Byers Construction Co. Ltd., Montreal, Hill-Clarke-Francis Limited, New Liskeard, Ont., Ambrose Wheeler, Moncton, N.B., and A. W. Robertson Limited, Toronto.

The special hardware including clamps, wire, bearing plates and bearing blocks was supplied by the A. F. Byers Construction Co. Ltd.

Appendix

Variations in Drying Shrinkage Following Erection

For timber of equal density with equal moisture content when erected, drying shrinkage will be slower at or near tide-water and will not reach the maximum experienced in dry hot areas in the interior.

Before the war, timber shipped from the west to east coast and Great Lakes ports by ship via the Panama Canal in summer was often checked due to too rapid drying shrinkage. The same was true of timber shipped by rail to eastern points in July and August unless air dry when leaving and protected from the sun in transit.

Presume timber *in an air dry condition* leaves the west coast by rail and is erected immediately upon arrival. At the east coast, tightening of bolted joints would be necessary only in a prolonged dry summer or dry interior heating conditions. One tightening might be made shortly after erection—six weeks to three months—and subsequent tightenings only when periodic changes in moisture content may have resulted in swelling, compression of washers into the timber and subsequent loosening of bolts. In drier areas of the interior, the early tightening will be much more frequent.

Also, the timber may go directly from mill to fabricating shop to job and may be erected in a comparatively short time. There will then be much more shrinkage subsequent to erection than if several months elapse between leaving the coast or the mill and erection.

The illustration given under the paragraph entitled Joining in the article is for the worst cases observed. It is clear that in many buildings where several months of dry weather may have elapsed between receipt of timber and erection, considerable drying shrinkage will have taken place before erection. The number of times which the joint shown in Fig. 1 must be tightened might be less, but the tightening must be practically continual until the shrinkage is overcome to keep the compression between chord members and centre diagonal down to 300 lb. per sq. in.

In many buildings, tightening has been carried on systematically, and apparently the trusses are in good condition. It is probable that few of all the buildings containing trusses with joints as shown in Fig. 1 have been subjected to a snow load of 40 lb. per sq. ft. In severely cold climates any snow remaining on flat roofs is probably light. In mild climates, any accumulation melts quickly when the roof is not insulated and the building is heated. In the latter case, any appreciable load is of short duration. The heaviest loads will occur from wet snow on well-insulated or unheated roofs or when ceilings are placed at lower chord level.

When snow is generally wet, i.e. at tidewater, drying shrinkage is neither rapid nor so great, and less damage will be done when tightening is intermittent.

When snow may be wet and shrinkage rapid and great as in southern Ontario, continual tightening of such joints as Fig. 1 is imperative.

In the midwest, snow loads have been light, probably due to high winds and light snow.

At the west coast, while snow might be heavy, drying shrinkage would be comparable to that at the east coast.

After the initial drying shrinkage has taken place and the bolts tightened, seasonal moisture changes may cause swelling and shrinkage which will loosen the bolts so that the compression across the grain will be excessive in the joint shown in Fig. 1.

Undoubtedly, early tightening after erection has been taken more seriously in some areas than in others, and, when snow loads have been light, has extended the useful occupancy of many buildings for the time being at least.

The system of reinforcement illustrated in Fig. 7 provides a substantial measure of relief as shown in the article.

When installed before drying shrinkage has taken place, the tightening of bolts would in general be reduced to reasonable intervals.

When installed after drying shrinkage has taken place, no further tightening of bolts should be required.

REPAIR OF WAR DAMAGE IN THE LONDON AREA

(*Continued from page 566*)

try. In 1939, a War Damage Fund was set up by the government. All property owners were required to contribute, monthly or annually, a sum of money proportionate to the value of their property. This money was retained by the Government and an assurance was given to all property owners that if any part of their property was damaged by enemy action the cost of repairing this property would be borne by the War Damage Fund. A small indication of the cost of repairing some of the damage caused to the London area is given by considering the cost already incurred in the borough under review in this paper.

The total cost of the repair work to dwelling houses which has been undertaken in the Borough of Lewisham from the 1st January 1945 to 31st December of the same year is approximately 3¼ million pounds, and in that period approximately 46,000 houses have been repaired to one stage or another. To date therefore, the average cost of repairing each house in the Borough is approximately £75. This by no means completes the work, since the majority of houses in the borough still require further work to bring them up to 99 per cent completion, and it is not yet possible to assess the final cost per house.

This applies to the whole of the London area. There is also the question of time to be assessed. At a conservative estimate it is considered that, even with the present high number of building operatives now engaged, there is still approximately two years' work to be done before all air raid damage to dwelling houses is completed.

This, of course, is not the whole problem as it excludes damage to churches, schools, office blocks, factory buildings, railway stations and buildings of other kinds yet to be repaired, and although a great deal of urgent work has already been done, it will be many years before the wounds which London has received will be healed again.

In conclusion, the authors would like to acknowledge the help given to them by various individuals in providing statistical information on which this paper is based and particularly to Mr. A. H. Shearing for his assistance in helping compile this paper.

SEARCHING FOR PETROLEUM IN THE MARITIMES

DONALD J. MacNEIL, M.E.I.C.
Consulting Geologist, Antigonish, N.S.

Paper delivered, on September 5th, 1946, at the Maritime Professional Meeting sponsored jointly by the Associations of Professional Engineers of Nova Scotia and New Brunswick, and The Engineering Institute of Canada, Digby, N.S.

Canada produces approximately 15 per cent of her requirements of crude oil, and even that small percentage is decreasing at a rapid rate. During the past two years there has been considerable activity in the Maritimes in regard to petroleum exploration. A very deep test was recently completed offshore near Prince Edward Island, and two tests were drilled in 1943 and 1944 in Inverness county, Nova Scotia. These efforts to find oil were not successful, although the company responsible for the Inverness tests has not abandoned the idea of finding oil in that part of the province. Currently, the Sun Oil Company is drilling a test near Amherst, N.S., with equipment that is designed to go deeper than 12,000 ft., and it is reasonable to assume that its success will introduce a period of intense geological investigation by other organizations interested in finding oil in this part of Canada. In addition to the above-mentioned projects, several oil companies are carrying out exploratory work through the medium of surface geological mapping, geophysical surveys, and core-hole drilling.

The term "wildcat", when applied to a test that is being drilled for oil, is often misinterpreted by the general public. Actually, any test that is located more than a mile from a productive well is a wildcat. Immediately following 1859, when the first successful oil well in North America was completed, the men who owned and operated the machines designed to drill these holes migrated from Pennsylvania westward and southwestward in the general direction of Kansas, Oklahoma and Texas. These wildcatters, moving slowly and relentlessly towards those areas that subsequently yielded so much petroleum, punched holes into the earth's crust all along the way. They were undaunted by disappointments, and were spurred to greater efforts when oil gushed over the derrick. It required a very special type of individual to follow the game in the early days; he was fired with a mixture of restlessness, curiosity and dogged determination. Economic and social conditions in North America were such that men with those characteristics were developed, and it may be safe to say that it is the absence of those circumstances in many parts of the world, and not entirely the lack of attractive geological conditions, that has retarded the discovery of petroleum in other countries where it has not yet been found.

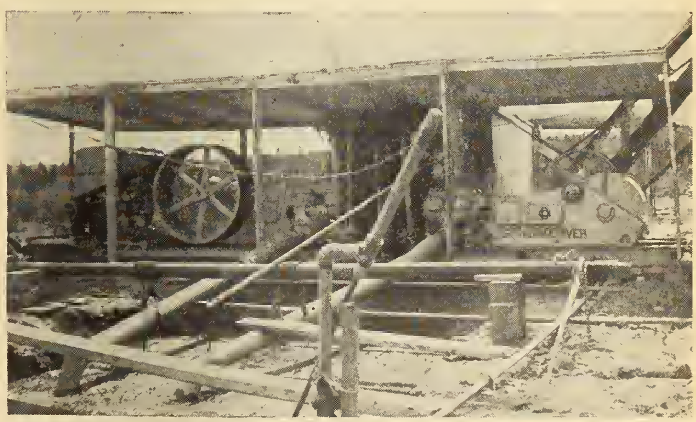
This paper deals with the mechanical and engineering side of oil exploration, rather than the geological phase. However, it perhaps would be well to refer briefly to the origin and natural accumulation of oil, just to refresh our memory on a bit of theory that many of us heard about at some time or other in the past.

The face of the earth is constantly changing. In some areas lavas from volcanoes are building hills and mountains; deep within the earth this same molten material is eating its way into portions of the earth's crust, cooling and solidifying before reaching the surface. There are, therefore, stresses and strains at work within the crust that produce displacements of the strata, wrinkling the beds into warps and folds, in some cases distorting them so much that they pile up into ridges and mountains. No sooner are these irregularities produced, in fact even while they are being formed, nature utilizing a variety of erosional agencies begins to level the high places, and the broken fragments are thus carried by the rivers to the sea, where they accumulate to form layers of shale and sandstone which, upon consolidation, become a part of the earth's crust. In the sea itself, where concentrates of calcium carbonate, calcium sulphate and sodium chloride become too great, they precipitate to the sea-floor, forming beds of limestone, gypsum and salt.

These sedimentary and chemical deposits, even after consolidation, are not completely solid. Microscopic voids are inevitable, and these are filled with sea water. Even as the deposits are pressed downward, and are consolidated as a result of the pressure exerted by superincumbent layers, this connate water is associated with the solid particles that make up the rock.

These processes have been going on for over a billion years; and ever since marine life first appeared upon this earth, plants and animals, many of them microscopic, have been trapped in the sand and the mud that form the sedimentary rocks. During some periods of the earth's history there were countless numbers of tiny organisms in certain seas, and as they died they formed a relatively high percentage of the accumulating sedimentary layers. The decomposition of these plants and animals may have yielded the hydrogen and produced the carbon necessary to form the hydrocarbons we call petroleum. These globules of oil traveled upward through the chains of water-filled voids in the sediments until they were stopped by an impervious roof, and if at that point the stratum happened to be tilted they migrated up-slope until the movement was interrupted by a reversal of dip. The continued generation of these globules, forcing their way upward in the direction taken by the earlier particles of oil, produced enormous pressures at the place of entrapment, often driving gas out of the oil into the highest parts of the folded reservoir rock. Thus in such a trap there would be, under pressure within the voids of the rock, gas, oil and water; with the gas and oil in the upper portion of the structure, and water down the flanks of the fold.

There are, therefore, in many places within the earth's crust, accumulations of oil and gas. It is difficult on first thought to imagine that enough petroleum could be trapped in the pores of a rock, or even in the cracks and fissures, to make the recovery of it worthwhile. However, many productive sandstones show porosities from 12 to 30 per



Pumping equipment used in connection with the Lion Oil Company's recent drilling operations near Mabou, N.S. The mud pit is in the foreground.

cent. There have been wells brought in with initial productions of 50,000 to 100,000 barrels of oil per day. One of the largest wells so far discovered, drilled in Mexico, yielded approximately 115,000,000 barrels in eight years. These, of course, are spectacular exceptions. If oil is discovered in Nova Scotia at the depths anticipated, a well that can yield 50 barrels of oil per day for eight years would not be unwelcome; but any reduction in that figure probably would make the project unprofitable.

The problem then is to find these buried oil-traps. It is obvious from the foregoing explanation that the search must be confined to sedimentary rocks. Oil prospectors must look for three things: first, strata in which oil could have been generated; second, rocks porous enough to serve as reservoirs for the petroleum; third, folding of the type that might have arrested the migration of the oil, thus forming a trap in which it could accumulate. In any area under investigation it is usual to find that during some period in the history of the region there was the right combination of geologic events to expose most of the sedimentary rock-section; consequently, under such circumstances, it is not difficult to determine whether or not there are source beds or reservoir rocks within the area. It is obvious also, if all the beds in the rock-section down through the earth's crust were acted upon simultaneously by forces capable of folding them, bends visible within the surface strata presumably would be present in the lower beds, down to and including the porous zones associated with the source rock. Conditions such as these have given rise to the discovery of many oil fields. However, there are areas where the surface beds do not reveal the type of folding that is present at depth; in fact, there are areas where rocks do not crop out on the surface at all, such as in the prairie regions of Canada and the United States.

Large quantities of oil have been discovered, and are still being found, in areas where the surface geology does not reveal clues as to geological conditions at depth; sometimes, in fact, by somebody digging his heel in the ground, or throwing a hat over his shoulder, and ordering the drill to be set up on the site thus selected. There are, however, scientific methods that can be applied successfully to exploration of that kind; these are now becoming more important in the search for oil, because many of the geologic features that can be interpreted by surface mapping have been tested. The seismograph, the gravimeter, the magnetometer, electrical resistivity apparatus, the electric log, the core-drill, soil analysis and the microscope all contribute to the success of the oil industry. It has been estimated [1] that out of every 100 wildcat tests drilled, 82 are now located on the basis of geological and geophysical work, the remaining 18 are located by unorthodox methods. Out of the locations selected scientifically, there is one successful well to 6½ failures; whereas of those located without the application of technological methods, there is one productive well to 17 that fail to produce.

As far as the geologist is concerned, the problem of finding oil in the Maritimes is somewhat different than it is in the well-known petroleum areas of North America. If the aforementioned theory on the origin of oil is correct, the rocks most favourable as source beds are those that were deposited in marine waters. In this part of Canada the sedimentary rock-section has a relatively thin zone of marine strata, in comparison to the great thickness of non-marine sediments. Although this restricts exploration to some extent, there are nevertheless large areas of the province covered or underlain by sediments that originated in marine and brackish waters. Furthermore, it has never been definitely shown that commercial quantities of oil could not have been generated in beds that were originally laid down in fresh-water basins.

The strata have been more tightly folded and more severely faulted in the Maritimes, particularly in New Brunswick and Nova Scotia, than they have been in many oil-producing areas. This fact does not preclude the presence of petroleum, it merely makes it more difficult to locate. The procedure for exploration may be confined to one of several methods, although in this part of North America it is generally felt that the results obtained by using one of the methods should be checked by a re-survey of the area utilizing some other procedure. In the parts of Nova Scotia where oil-bearing beds are thought to exist, it is safe to assume that the buried reservoir rocks were folded and faulted during the same period when strata now exposed at the surface were deformed. On the basis of that assumption, and as suggested earlier in this paper, it would be reasonable to suppose that the structural mapping of exposed bedrock in any such area would reveal structural conditions at depth. Unfortunately this procedure is complicated by the presence of salt, gypsum, and to some extent coal, in the stratigraphic section. It is obvious that the effects of stresses and strains upon massive beds will not be the same as upon the associated thinner, softer layers of the earth's crust. Beds of salt and gypsum act as zones of slippage, to such a degree that it is possible to find considerable folding and faulting above those relatively soft sections of rocks, while massive beds below them may be characterized by little or no faulting and very gentle folds. A somewhat analogous situation occurs where the surface rocks are so much younger than the buried oil-bearing strata that folds within the latter are obscured by the unfolded layers of the former.

Buried structures that cannot be delineated on the basis of surface exposures can be mapped in several ways. If, for instance, there is reason to believe that folds and faults within the deep crystalline rocks are reflected in the overlying petroleum-bearing zone, a magnetometer might be used to advantage. This instrument has a magnet, turning about a knife-edge, that will take a definite direction under the influence of the earth's magnetic field and the force of gravity. When the instrument is transferred to another location and set up exactly as before, the magnet will dip at a different angle. The difference between the readings taken at the two locations determines the difference in the strength of the magnetic field in the two places. There is a relationship between the depth of the crystalline rocks and the strength of the magnetic field, permitting the construction of a subsurface contour map depicting the elevation irregularities of the basement rocks. Certain types of subsurface faulting can also be detected with a magnetometer, provided the displacement has resulted in bringing two formations of different magnetic susceptibilities into juxtaposition.

Another geophysical method of subsurface mapping entails the use of the gravimeter. This instrument measures slight variations in the gravitational forces of the earth, which forces are affected by the distribution of rocks of varying density underlying the area. Buried geologic structures may also be mapped by a method that involves the discharging of explosives to create artificial earthquakes, the resultant waves being measured by seismographs placed a short distance away from the explosion. These waves travel at different speeds through the earth's crust, the rate of travel being dependent upon the degree of hardness or softness of the strata. For instance, in hard compact formations earthquake waves travel much more rapidly than they do in softer units of the earth's crust. An analysis of the waves, automatically picked up by a recording machine, affords a method for interpretation of

1. Alberta's Oil Industry. A Report of a Royal Commission published in 1940. Page 7.

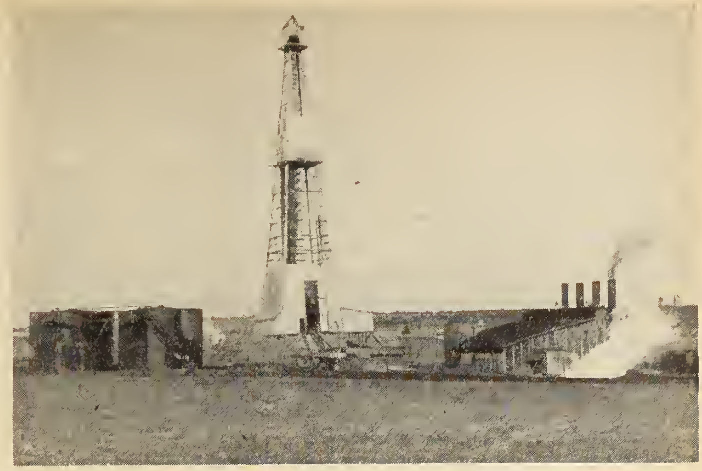
subsurface geologic structure. It will be noted that none of these geophysical methods reveals the presence or absence of petroleum, they are merely aids for determining the location and extent of buried folds that may be present within the investigated area.

When a geological structure assumed to be a favourable one for the entrapment of petroleum has been found, the next step is to bring the oil to the surface. Two methods of drilling are in general use; namely, the utilization of "cable" or "standard" tools, and the "rotary" method. Wells as deep as 3,500 ft. were drilled in China back in 220 B.C., in order to recover brine from buried salt deposits. The equipment used for that work was similar in many respects to the cable-tool rig that is often utilized today by drilling companies. The steel bit employed in this type of drilling is from 8 to 10 ft. long, with the cutting-end flattened into a fish-tail pattern. It is suspended by a cable to which an up and down motion is imparted by means of a walking-beam. It is periodically withdrawn from the hole, so that a bailer can be lowered to take up the rock cuttings.

Most oil wells now being drilled utilize what is known as the rotary system of drilling. This type of machinery varies in size and weight, depending upon the depth it is designed to reach. Rotary equipment is being used by the Sun Oil Company in its operations near Amherst, N.S. It consists of a 136-ft. steel derrick with a 30 by 30-ft. base, capable of carrying a load of over 500 tons. It rests on a heavy steel sub-structure, so that the derrick floor is about 12 ft. above the ground. On this floor there is a self-contained multiple-speed unitized draw-works complete with automatic cat-head and hydromatic brakes, its weight being about 25 tons. A steel rope, 1⅛ in. dia., wound on a drum operated by this machine, passes over a block on top of the derrick, and through a 5-sheave traveling block that weighs four tons, thus constituting a hoisting tackle for the drill-stem. Suspended to this line is a hollow square piece of steel about 40 ft. long. This unit, referred to as the "Kelly", fits through a square recess in a table that is set in the centre of the derrick floor, and which can be rotated by connections leading from the draw-works.

Each section of drill pipe is about 30 ft. long; the upper end is connected to the "Kelly", and a multi-toothed hollow bit is screwed on the bottom of the lowest section. As the hole gets deeper, new sections are inserted immediately below the "Kelly"; thus the whole stem can be rotated by turning the table. At the top of the "Kelly" there is a hydraulic rotary swivel which is connected to the pumps by means of a high-pressure hose. There are two pumps, one connected up as a spare, having a combined weight of 21,000 lb. The power plant consists of four Oilfield type boilers, each rated at 150 h.p. and 350 lb. water pressure. They are fired with fuel oil. In addition to the above-described units there is a cementing outfit, a mud-mixing plant, storage tanks for water and fuel, an electric generating plant, an electric and acetylene welding plant, a machine shop, a warehouse, and quarters for the technicians in charge of the job.

In starting a hole that may reach a total depth of two miles, a 20-in. bit is used for approximately the first 300 ft. A mud stream is forced down through the drill-stem; it issues from holes in the bit, and carries the cuttings upward along the outside of the pipe to a settling pit. Inserted in the mud line is a specially constructed unit that catches some of the rock fragments, where they may be examined by the geologist. It is usual practice to case the portion of the hole drilled with the 20-inch bit, using pipe that is 16 in. dia. A 12¼-in. hole may be drilled, and cased if necessary, from $\pm$ 300 ft. to $\pm$ 6,000 ft., and an 8⅝ in. hole from $\pm$ 6,000 ft. to the total depth.



Rotary equipment operated by the Sun Oil Company near Amherst, N.S.

The circulating mud-fluid plasters the walls of the hole, forming a thin coating that is usually firm enough to keep normal gas, oil or water pressures under control. If soft shales liable to cave are being drilled, a heavy mud is used; the extra weight is usually attained by adding barytes to the drilling fluid. The South American oil industry obtains approximately 100,000 tons of this mineral annually from Walton, N.S. Special preparations must be used in penetrating salt beds, gypsum, very porous sandstones and cavernous limestones.

The use of proper muds requires considerable skill and training. Dangerous and costly "blow-outs" and serious "cave-ins" can be avoided with well prepared muds. As a rule the pressures in gas, oil and water are approximately equal to the hydrostatic head to the depths at which they are encountered. As a precaution, in case the mud fails to hold the pressure under control, a special type of valve known as a blow-out preventer is connected to the surface casing; this is so located that it can be closed quickly if an emergency arises. There have been instances when pressures were so great that they overcame all safety measures, with the result that everything within a 50 ft. radius of the hole was hurled skyward, including the derrick, the draw-works and thousands of feet of drill-stem and casing. Blow-outs of this kind very quickly form huge craters, and often catch fire. To control them it is sometimes necessary to start another hole as close to the blow-out zone as possible, and by directional drilling intersect the well that is out of control. When the intersection has been effected, huge quantities of cement are pumped down the new hole until the escaping gas is choked off.

When the bit nears a zone in which oil is anticipated, the cuttings are examined with extra care, and if promising clues are detected a special type of formation tester is utilized to determine the productive value of the zone in question. If oil has been encountered, the column of mud is lowered by swabbing operations until the pressure in the oil sand is greater than that exerted by the drilling fluid, and the well starts to flow. Sometimes the pressures are so low that pumping equipment has to be installed to recover the oil. In the early days of drilling, before modern methods of bringing a well into production were devised, oil was occasionally encountered under pressures so great that it gushed over the derrick while frantic efforts were made to bring it under control.

The cost of drilling varies according to the lithological characteristics of the strata penetrated. In some areas it is possible to drill hundreds of feet without changing a bit; in other places the rock may be so hard that a bit will wear out during less than a foot of drilling. In Turner

(*Continued on page 578*)

EDUCATION FOR MANAGEMENT

L. URWICK, O.B.E., M.C., M.A., F.I.I.A.

Chairman, Committee on Management Education, Ministry of Education, London, England.

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The author is one of the outstanding experts in the field of management. He has written many articles on it and has been active on committees and in societies whose objects are the advancement of the science. The following article, which is reprinted with the permission of the Institute of Industrial Administration, is of importance to Canadians principally because of the information it gives about government recognition of the national importance of good industrial administration. It would be encouraging to see similar interest on the part of Canadian officials. (Ed.)

One of the outstanding features of the war period of 1914 to 1919 was the lesson that industrialists learned in regard to the high importance of management as a factor in production. A succeeding generation of industrialists between 1939 and 1945 were called upon to carry the responsibility for production for yet another major war with similar results. "The lessons of war" has become a temporary catchword in discussion of management problems. The lessons have indeed been valuable. In the first world war British experience taught the two major principles of the value of production control on a planned basis involving predetermined standards, and the importance of giving adequate attention to the human element. In the second world war both these principles were reaffirmed, but the lesson was carried much further. During the past five or six years, every aspect of management has been recognised as a factor bearing on the effectiveness with which war-like stores were being produced and made available.

A full appreciation of what management is and what it means to our national industrial system is still comparatively limited. Relatively few people have taken the trouble to study the subject deeply: fewer still are also equipped with the personal qualities and the opportunity to make such knowledge fully effective. But awareness of management and the part it can play in industry has been spreading more and more widely over the country in recent years. As a consequence, the work of the pioneers in this subject, and there have always been pioneers since the beginning of the Industrial Revolution, has begun to have a general influence.

To-day training for management has become a matter of widespread discussion. It should not be forgotten that behind this contemporary interest in educating managers for their profession there lies almost a hundred years of long and intense struggle, a struggle in which the few pleaded with the indifference of the many for recognition and acceptance of this need. Time after time technicians who had realised that something more than technical knowledge was required put the case to their fellows in the profession. A. J. Liversedge and J. Slater Lewis are two outstanding names.

Many of the Presidents or senior members of the Institutions—the Bramwells, the Dalbys, the Daileys, the Allinghams, the Donaldsons, and so on, have put the point. Coming closer to our own time, Sir Arthur Fleming,* as long ago as November, 1918, made a bold plea for the training of Works Managers. "Modern conditions are such that special training is required; modern management has a technique quite apart from the technology" of any particular industry.

The Contribution of Technical Colleges

It has taken more than a quarter of a century for these words to become part of the accepted thinking of a representative proportion of the industrial world as contrasted with a few pioneers. But during the intervening decades important and valuable developments were taking place. First-class work was put in up and down the country by some local education authorities and principals of senior technical colleges. Noting the signs of interest displayed in technical circles, they showed their initiative and sense of social purpose by trying to provide facilities in anticipation of any demand which might develop.

As early as 1903 the University of London was organising courses such as those on accountancy and business methods, which were in essence management courses. In 1918 the Manchester College of Technology founded a Department of Business Administration, which has remained to this day in the forefront of national effort in this field. Programmes of training in the technical colleges began to centre round the management aspects of the study courses for the various professional bodies bearing on industry, for instance, the Institute of Cost and Works Accountants, the Institution of Production Engineers, and the Institutions of Mechanical and Electrical Engineers.

A land-mark appeared in October, 1924, when the Institution of Mechanical Engineers decided to adopt in their membership examination scheme the subject, "The Economics of Engineering." A few years later the London County Council Education Committee took upon itself responsibility for providing at every appropriate senior technical institute adequate facilities for teaching the syllabus. Some years later for the Institution of Electrical Engineers a corresponding step was taken.

In 1927 a second land-mark was set up. The Institute of Industrial Administration elaborated its first examination scheme. The Regent Street Polytechnic established appropriate courses of study leading to the examinations of the Institute. A few years later impetus was given to the study of management on the commercial side by the reports of the Goodenough Committee on Salesmanship. In 1935 the Institute of Export started their own professional training scheme for those who wished to gain appropriate qualifications in this highly important branch of British business. 1936 provided yet another land-mark. The first Summer School for teachers of management was organised by the London County Council Education Committee. It was held at the South London Technical Institute and was, as in 1937, 1938 and 1939, ably assisted by members of the present I.I.A. Education Committee.

Throughout these years the Association of Technical Institutions played an active and invaluable part in the evolution of appropriate schemes of training. Without the ready co-operation offered by the Association to the technical bodies concerned, progress would not have been possible. At its summer meeting of 1933 the Association welcomed what was probably the first paper of its kind in this field, given by Mr. G. A. Robinson, under the title of "An Experiment in Management Education." Four years later Mr. Byng and Mr. Robinson gave a joint paper on "Management in Education and Industry." This showed the extent to which interest in the subject had developed and the noteworthy response which had been forthcoming from the technical colleges: no less than 49 colleges were providing Courses of Instruction in the Fundamentals of Industrial Administration.† Again in 1939, the Association turned its attention to the problem with a paper on the developments that had taken place in the United States.‡

The Response of Industry

Industry in its official capacity was less responsive. In

* Chairman, Education and Training Committee, British Management Council.

† The No. (1946) is 70.

‡ "Technical and Vocational Education in the U.S.A." G. A. Robinson.

the late 1920's some interest in the whole field of management was taken by the Education Committee of the Federation of British Industries. But the economic conditions of the thirties seem to have been unfavourable to initiative. It appears to have been almost another fifteen years before the subject was revived in the Federation's activities. The report of its Education Committee, dated May, 1944, carried the memorable sentence: " It is becoming increasingly felt that there is a science of management and business administration which it may be possible to teach academically and which should certainly be studied practically ". The leaders of industry in the United States had come to the conclusion that it was possible to teach business administration academically at least twenty years earlier.

Individual industrialists on the other hand took a more lively interest in the matter. Many gave time and effort to the activities of the British Association for Commercial and Industrial Education and to other bodies such as the Management Research Groups which were concerned with the promotion of education for industrial management. Others collaborated with various Technical Colleges. But, taking industry as a whole, it seemed that the old philosophy was still predominant. It was assumed that because a man acquired the title " Director," he became proficient in management automatically, or that if he had taken the trouble to gain qualifications in a purely technological field, he was educated adequately for the administrative responsibilities that come to him later in life.

It needed the second world war in thirty years to precipitate any major change in this outlook and to yield any general appreciation of the importance of management as a factor in industrial efficiency.

Management training during the war of 1939-1945 again owed much to the collaboration and help offered by the education authorities and the technical colleges. The first major problems that arose centred on the weakness of immediate supervision. When, on the basis of the work done previously by the Institute of Industrial Administration, the Ministry of Labour and National Service launched a scheme for a brief study course of training in works supervision, the technical colleges throughout the length and breadth of the country rose to the task. Several thousand foremen completed these courses. Large numbers are at present attending courses. Many await training. Their normal activities had been heavily curtailed by war conditions. Much of their teaching staff had been absorbed for other duties. Those left were preoccupied with the training requirements of the fighting services. Their buildings were largely occupied. But, in spite of all this, they were ready to meet the national need to provide facilities for foremen to learn in the little time permitted of the principles and practice of sound supervision. A similar response met the somewhat later demands for training in personnel management and for higher managers.

The Present Position

In one sense then we stand to-day at the climax of a century and a half of development. Within the past few months there have been three official developments, which in total mean that the case for deliberate instruction in Management has been accepted by the nation. There is a considerable degree of national concern that the appropriate activities should be initiated and the facilities provided which will make possible in future the deliberate training in Management of all who may assume responsibility for the control of others.

In the first place, there has been the " Newson-Smith " Report on " Training for Business Administration." This Committee was concerned with a limited aspect of the problem, namely, " to consider how far the absorption into industry and commerce of every man and woman released from war service would be facilitated by the provision of training in Business Administration and Salesmanship, and to make recommendations about suitable courses of training." But though restricted to those whose business careers have been postponed or interrupted by war service, the Committee could not have been appointed or a Ministry devoted public time and money to its work had there not been a national recognition of the need for training in management. In some quarters the Committee's Report was received with a certain disappointment, due to the general nature of the findings. Closer study of the Report suggests that the Committee's recommendation that a definite course of " basic training " should be provided was in fact public acceptance of training in management as an important contemporary need in business.

More important was the Report of the " Percy " Committee on Higher Technological Education. This Committee was concerned primarily with the field of technical training in its early stages. But inevitably, as its deliberations proceeded, members were impressed with the degree to which men and women of technical training turn over to administration in the later stages of their careers. They thus find themselves called upon to exercise a skill to which their technical education has made little contribution. The Committee therefore called attention to " the question of training in what may be conveniently called Management Studies." This is perhaps the most important official Report in the field of education of recent years. It records (Para. 71):—

> " We have been impressed by the statement made by several of our witnesses, that the highly trained technician is often ignorant of the principles of industrial organisation 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."

On this basis, the Committee made three recommendations. The first calls for a study of the subjects of Scientific Management, Industrial Psychology and the like; that is to say, the subjects that go to make up the content of the technique of management. This study should, in the first place, be in the nature of a general introduction included in the final year of the technological studies. The second envisages the institution of a national post-graduate centre for the study of Industrial Administration. The third suggests that there should be appropriate Refresher Courses in such studies.

The Nature of Management

These findings clearly contemplate that every man or woman who is going on to either the intermediate or the higher levels of management in industry or commerce should have full opportunity in their earlier careers, as well as later on, for attaining both the general level of knowledge and the specific understanding of the techniques of management required to discharge managerial responsibilities effectively.

Management is both a science—in that it rests on various applied sciences and can only advance its own technique by objective study—and also an art in that it is concerned essentially with the behaviour of individuals and calls for the exercise of a tact or judgment which is not as yet susceptible to precise measurement or within the field of exact knowledge. From this dual character derives the appropriate pattern of education and training. On the one side, there are the technological and economic disciplines that describe the total situation in which management is applied and which forms the basis of its techniques—fields such as Psychology, Economics, Law, Industrial History and Sociology. Issuing from these are what may be described as " tool " subjects, the applied sciences that have built up the methods common to management wherever applied, as, for instance, Accountancy, Cost Control, Statistical Method, Work Measurement and Incentives, Office Organisation and Method, and Engineering Principles. Thirdly, there is the modern technique of Administration itself, including the history of its evolution, the theory of Organisation and the principles of Command and Control. In addition, the Manager in business should have a working knowledge of its major functions and the management methods applicable to each. These major functions are production, distribution, finance, development and personnel. But before a man or woman becomes effective as a Manager, there must be added to this knowledge proper experience and practice in its application. In recent years the development of the Training Within Industry Programme for Supervisors has made an important contribution to this aspect of the problem. The further elaboration of such facilities is a matter for industry or for the professional bodies in management, such as the Institute of Industrial Administration.

The Education Authorities and the Colleges in their task of providing suitable facilities for management study have an equally practical issue to face. It springs from the multiplication of syllabuses in this particular field. The existing courses have been designed primarily in relation to the requirements of various professional bodies. It was therefore inevitable that before long there would be quite a number of similar subjects set by different organisations, in which broadly the same subject matter was being studied, but with differences of emphasis deriving from the special interests of the sponsoring Institutions. Such a position is quite understandable when looked at from the standpoint of the individual institution concerned with the standards of this or that profession within the management field. But from the point of view of a Technical College concerned to provide the broadest possible facilities for its local community it was bound to lead to a chaos of curricula, none of them commanding a sufficient number of students to justify special arrangements.

In 1939 it was found by the Education and Training Committee of the British Management Council that the Technical Colleges were being called upon to provide study courses in one or more "Management Subjects" for some 23 professional societies covering a total of over 100 syllabuses. In addition, in quite a number of colleges there were special requirements laid down by the industrial needs of the district. One might quote, for instance, colleges in Lancashire or South Yorkshire where the bias towards the Textile Industries necessarily led a college to tackle most of their management studies in that setting.§

Since the cessation of hostilities, the Education Committee of the Institute of Industrial Administration has done some valuable work in assimilating the syllabuses of a number of institutions. But those who are most concerned to secure co-ordination are most doubtful whether purely voluntary efforts among a variety of independent bodies, each with its own interests to serve, can attain a degree of unity which will enable the colleges to implement the "Percy" Committee recommendations. On the other hand, unless a solution is found for this problem, further progress in the development of management instruction may be jeopardised.

With this thought in mind, the Ministry of Education has recently set up a Committee to study the problem on a national basis. Its terms of reference are: "to advise the Minister on educational facilities required for management in industry and commerce, with particular reference to the steps to be taken in regard to the organisation of studies, bearing in mind the various requirements of professional organisations and the need for their co-ordination."

The Committee has not completed its deliberations. But it is to be hoped that it will be able to formulate a general programme of Management Study that will provide a common basis for the curricula of all the specialised interests that have a competence in this field, while at the same time providing adequately for the particular needs of the individual institutions.

If this can be achieved two major steps in the organisation of management education in this country will have been surmounted.

1. The nature of training for management *per se* as distinct from training for any one of the specialised functions contributing to the total task will have been isolated and defined.
2. The task of all persons and institutions responsible for the provision of educational facilities will have been clarified and simplified.

§ e.g., "Economics of the Cotton Industry." City and Guilds of London Institute.

SEARCHING FOR PETROLEUM IN THE MARITIMES

(*Continued from page 575*)

Valley, Alberta, where the average depth is probably around 6,000 ft. the cost is approximately $155,000 per hole. In the Maritimes, if drilling ever gets underway on a big scale, using current labour and material price indices, the cost of a 6,000-ft. hole will be in the neighbourhood of $75,000.

If oilfields are discovered in this part of Canada, as a result of the investigations now being made, the oil undoubtedly will be transferred to the refineries by tank car. Eventually, if production warrants it, pipelines will be constructed. At the present time about 75 per cent of the crude oil transported in the United States is carried by pipelines. These arteries criss-cross the country in a maze that totals 140,000 miles, representing an investment of over one billion dollars, and an annual payroll of fifty million dollars. These lines have almost 25,000,000 barrels of oil continuously in the pipes[2]. It is possible, in some of the larger systems, to ship several grades of oil through the same channels. For instance, in the Big Inch line, running from Longview, Texas, to New York, a number of orders may be shipped, one directly behind the other, each batch possessing different properties. If an occasion arises where it is necessary to rush one of the consignments that may have been put into the lines behind the other orders, instructions are phoned ahead to one of the several sidings along the line, and the pipe is cleared for the rush order by drawing the preceding batches into tanks long enough to permit the special consignment to flow through to its destination.

The discovery of commercial quantities of oil in the Maritimes would bring great benefits to this part of the Dominion. In time, if such an industry is developed, there will be a variety of engineering projects in connection with its expansion. It will give rise to additional orders for our steel mills; new industries having as their basis the exploitation of petroleum by-products will be introduced; business houses and factories needing gas and oil for fuel will be established near the petroleum-producing areas. It is to be hoped, therefore, that the efforts to find oil in the Maritimes will not be lessened, and that those who are sponsoring it will receive sufficient encouragement to spur them on to a successful conclusion.

[2]. John J. Floharty, in "Flowing Gold", page 113.

From Month to Month

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

RECENT ACTIVITIES IN COMMUNITY PLANNING

The first meeting of the Institute Committee on Community Planning was held in Peterborough on August 19th, with every member present, plus the general secretary. The Committee recognized the important part that the Institute has to play in the development of community planning in Canada. This interest is related both to the welfare of the citizens in general, and to the welfare of the profession in particular.

As preliminary steps in meeting these obligations, the Committee presented two proposals which were received by Council at its September meeting and unanimously approved. The first was that every branch of the Institute be urged to devote part of its programme for this year to a discussion of the subject. All branches have been told of this suggestion and the Committee is at present endeavoring to secure experts in the field who would be willing to speak before the branches.

The other recommendation was that the main portion of the 1947 annual meeting programme be devoted to the development of the subject of community planning. In the discussion on this item of the agenda, several members of Council expressed the opinion that there was perhaps at present no subject of greater importance to engineers and to the citizens in general and the suggestion was therefore passed on to the annual meeting committee with a strong recommendation that it be implemented.

The Committee has undertaken to secure immediately one or more world famous engineers who would come to the annual meeting to speak on the subject of community planning. The general secretary has undertaken to make inquiries along this line during his visit to England.

Another feature which the committee recommends for the annual meeting would be exhibits of models that would show planning projects from different parts of Canada and the United States, and perhaps South America as well. It is believed that such an exhibit would not only be of great interest to the engineers, but also would be of interest to the public, and therefore might bring many hundreds of people to the exhibition space at the time of the annual meeting. In this way the Institute could render a service that would go far beyond the interest of those attending the annual meeting.

Community Planning Association

In the July issue of the *Journal,* an account was published of the meeting held in Ottawa in June, the outcome of which was a proposal for establishing the Community Planning Association of Canada. The Institute was invited to participate in the formation of the new organization and to appoint three representatives to the interior board of directors. At its Digby meeting, Council approved of the Institute participating in the newly formed association and appointed the following representatives: R. L. Dobbin, manager of public utilities for Peterborough, and chairman of the Institute Committee on Community Planning; N. B. MacRostie, consulting engineer of Ottawa; and Dr. L. Austin Wright, general secretary of the Institute.

National Capital Planning Committee

At the same meeting, Council also appointed Institute representatives to the National Capital Planning Committee, an organization set up by the Federal Government to be responsible for the replanning of the city of Ottawa. They are: E. L. Cousins, consulting engineer of Toronto, and Dr. Arthur Surveyer, consulting engineer of Montreal.

ENGINEERS OF COMMONWEALTH MEET IN LONDON

The long awaited conference of representatives of Commonwealth engineering institutions has been completed. For two weeks the group met daily in London, concluding with a banquet at Grosvenor House, on Friday, September 27th. Representatives were there from India, South Africa, Australia, New Zealand and Canada, with the institutions of civil, mechanical and electrical engineers acting as hosts.

The agenda was made up of subjects most of which have been under discussion by engineers for many years. It was helpful to finally face these problems around a table and to reach unanimous decisions as to their solutions. Many resolutions were passed for submission to the councils of the various organizations—all leading toward closer cooperation between the institutions and the parts of the Commonwealth. These resolutions will be presented to the Council of the Institute shortly, after which it is expected they will be reported in the *Journal.*

The three "home" institutions shared the responsibilities and the honours equally. The meetings were held in rotation at the headquarters of the institutions, with the chairman and secretary changing in accordance with the location. The chairman in each instance was the president of the society.

It would be difficult to imagine a better organized programme, or better conducted meetings. It was this excellent preparation and direction that made it possible to cover so much ground in the limited period of time. There were several visits to points of historic or scientific interest, which provided breaks between the business session and added much to the pleasure and profit of the conference. These breaks included visits to the Battersea Power Station, the National Physical Laboratory, the G.P.O. Research Establishment, the new Waterloo Bridge, the Port of London, the Royal Observatory and a tour of the City of London, under the very capable guidance of the City Engineer, to see the amount of damage done during the war.

Such tours, though too brief to present a full picture, did give the visitors opportunities to appreciate what England experienced and accomplished during the war, and to see the plans that are being made to meet the future. It is heartening to see a nation with its eyes fixed so firmly on the future, in spite of the awfulness of the immediate past.

On every count the conference was a success, and out of it should come many things of benefit to the profession. It is possible, too, that the continued cooperation of the societies will uncover more subjects requiring attention, and will produce answers to many of the problems already before the profession.

The Engineering Institute's representatives were the president and the general secretary, who report that much more information about the conference will be presented to the membership in subsequent numbers of the *Journal.*

ENGINEERS' PLANS ENTERING CANADA DUTY FREE

In the budget speech presented at the last session of Parliament, announcement was made of amendments to the customs tariff whereby certain engineers' plans are now permitted to enter Canada duty-free. These plans are described as follows in Item 180e of Schedule A of the customs tariff.

> Engineers' plans, drawings or blueprints of machines and plant equipment, plant layouts, foundations for machinery and other plant equipment, structural supports and towers and similar outside structures, dams, spillways, and other hydro construction, wiring, piping, platforms, ladders, stairs, etc., not to include office or other buildings.,

Previous to the amendment, such plans were subject to the following rates of duty:

British preferential tariff, 12½ per cent; intermediate and general tariff, 22½ per cent.

As soon as the matter was brought to the attention of the Institute, a communication was sent to the Minister of Finance inquiring as to the reason for removing the restrictions. A delayed answer explained that the main object of the tariff item was " to help reduce the cost of equipping new plants in Canada ". Meanwhile, the legislation was introduced in the House of Commons and passed.

In the course of the discussion in the House, the Acting Minister of Finance made the following statement in answer to a question raised by Mr. John R. MacNicol:

> " I must say I am not as familiar with the subject as the hon. member for Davenport. I have looked into it, particularly since the discussion took place in the house and since I received the letter from Mr. Wright, the secretary of the Engineering Institute of Canada, relating to the matter. The purpose of including plans of this kind on the free list is to lower the cost of production in Canada by lowering the cost of the construction of industrial plants and the installation of machinery. It was thoroughly investigated by the tariff branch, and it is felt desirable to do this. Should it develop that it is injurious to the engineering profession in Canada it will, of course, be reconsidered, but the feeling is that it should be tested out first. In view of the investigations to which I have referred, it is felt that it is desirable to put plans of this kind on the free list, and that it will not be injurious to the profession in Canada."

Previously, in the Committee of Ways and Means, the Minister had answered the question as to whether the engineers had been consulted before introducing the legislation, by saying that the engineers did not need protection in this respect.

Further discussion with a high official of the Tariff Board yielded the information that the legislation was designed to take care of those cases where Canadian engineers are not regarded as qualified in special highly technical industrial processes. Referring to the text of the tariff item, it is difficult to see what highly specialized technique, beyond the skill of Canadian engineers, is required for the design of " Plant layouts, foundations for machinery and other plant equipment, structural supports and towers and similar outside structures, dams, spillways, and other hydro construction, wiring, piping, platforms, ladders, stairs, etc."

It would seem that the amendment makes it possible now for an American engineer to ship plans duty-free into Canada for everything except the shell of an industrial building. The following excerpt from a letter written to the Institute by a member confirms this belief: " I had an example this week where American engineers brought a set of plans into Canada completely drawn as far as the floor plans were concerned and with enough notations on the drawings so that any draughtsman could draw the building. In other words, this American company draw up a complete floor plan, including foundations, and all the Canadian architect is going to get out of the job is the shell of the building, for which I would think he could not expect to get anything but a very small fee. You will note that the Canadian engineer gets nothing."

The matter was discussed at the September meeting of Council and the general secretary was instructed to communicate with other national organizations who might be interested to join with the Institute in making further representations to the government authorities.

In his letter to the Institute, the Acting Minister of Finance says: " The representations you made will be reviewed after the Item has been in operation for a period of six months or so." Members who may become aware of specific instances where the new legislation has been detrimental to engineers will do a service to the profession by conveying the information to Institute Headquarters.

LIST OF NOMINEES FOR OFFICERS

The report of the Nominating Committee, as accepted by Council at the meeting held on June 22nd, 1946, is published herewith for the information of all corporate members as required by sections 19 and 40 of the by-laws:

President	L. F. Grant	Kingston
Vice-Presidents:		
* Zone "A" (Western Prov.)	G. S. Coultis	Calgary
* Zone " B " (Prov. of Ont.)	W. L. Saunders	Ottawa
* Zone " C " (Prov. of Que.)	R. S. Eadie	Montreal
	R. E. Heartz	Montreal
	A. W. Whitaker, Jr.	Montreal
Councillors:		
† Halifax Branch	L. E. Mitchell	Halifax
† Saint John Branch	C. D. McAllister	Saint John
† Saguenay Branch	W. J. Thomson	Arvida
† St. Maurice V. Br.	Viggo Jepsen	Grand'Mère
§ Montreal Branch	J. A. Beauchemin	Montreal
	K. G. Cameron	Montreal
	C. E. Gelinas	Montreal
† Kingston Branch	J. R. Carter	Kingston
† Ottawa Branch	J. H. Irvine	Ottawa
‡ Toronto Branch	C. F. Morrison	Toronto
† London Branch	V. A. McKillop	London
† Border Cities Br.	A. H. MacQuarrie	Windsor
† Lakehead Branch	S. T. McCavour	Fort William
† Saskatchewan Br.	N. B. Hutcheon	Saskatoon
† Edmonton Branch	F. R. Burfield	Edmonton
† Kootenay Branch	S. C. Montgomery	Trail
† Vancouver Branch	T. V. Berry	Vancouver

* 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.
‡ Three councillors to be elected for three years each.

ERRATUM

Discussion on J. G. G. Kerry's Paper

A typographical error in the author's closing remarks to the above discussion has taken much weight from the argument. On page 553 of the September issue, in the left-hand column, seven lines from the bottom, it is stated that the difference in water level between Lake George and Lake Champlain is 30 ft. Actually the difference is 230 ft. We apologize to the author and to our readers.

GEORGE HERRICK DUGGAN

1862 - 1946

A deplorable highway accident has ended the career of a distinguished member of the Institute who was not only an engineer of outstanding achievement, but also a leading figure in the period of rapid industrial growth through which Canada has been passing during the last fifty years.

George Herrick Duggan was born in Toronto eighty-four years ago. He was educated at Upper Canada College and at the University of Toronto, where he completed a post-graduate course in 1884. His first professional employment was with the engineering department of the Canadian Pacific Railway, which he left in 1886 to take an appointment with the Dominion Bridge Company, the organization over whose activities he was later to preside so effectively. In 1891 he was appointed its chief engineer, holding that position for ten years until he went to Sydney as assistant to the president of the Dominion Iron and Steel Company and the Dominion Coal Company. He became second vice-president and general manager of the latter company in 1904.

G. H. Duggan, D.Sc., LL.D., Hon.M.E.I.C.

In 1910 he returned to the Dominion Bridge Company. At this time preliminary work on the Quebec Bridge had just been commenced. On the formation of the St. Lawrence Bridge Company Mr. Duggan was chosen as its chief engineer, so that for a considerable time he was mainly concerned with the progress of that great engineering work. At the same time he held the position of chief engineer of the Dominion Bridge Company.

In 1912 he was appointed general manager of the Dominion Bridge Company, becoming vice-president in 1917, and president in the following year. He retained that office till 1936, when, after eighteen years service, he resigned to accept the chairmanship of the board of directors.

He was active almost to the last. Besides holding the chairmanship of the board of the Bridge Company, he was president of the Dominion Engineering Works, the Robb Engineering Works, and a number of other allied organizations. He was a vice-president of the Royal Bank of Canada. His long list of directorships included such firms as the Shawinigan Water and Power Co., the Steel Company of Canada, the Dominion Steel and Coal Company, and many other important industrial and engineering enterprises.

Mr. Duggan did much to support and extend the activities of the Institute, which he joined in 1888, in the days of the Canadian Society of Civil Engineers. He served on the Institute council for nine years, was vice-president for five years and president in 1916. In 1931 he was awarded the Sir John Kennedy Medal. In 1937, having endowed the Institute's medal and prize now known by his name, he was elected an Honorary Member of the Institute. The American Society of Civil Engineers did him a similar honour in 1936. Four years later he was made an Honorary Life Member of the Canadian Standards Association, in recognition of his long service to that body.

His membership in the Institution of Civil Engineers (Great Britain) dates from 1912 and he served on the council of that body in 1918. He was a vice-president of the Canadian Institute of Mining and Metallurgy in 1906 and a past councillor of that Institute.

Mr. Duggan received the honorary degree of LL.D. from both McGill and Queens Universities. His contributions to engineering progress were recognized by his alma mater in 1920, when the University of Toronto conferred upon him the degree of D.Sc.

No sketch of the life of George Herrick Duggan would be complete without some account of his varied activities in pursuit of his main hobby, yacht sailing and designing. As a young graduate he began to work out the very original ideas which later led to the design and construction of the remarkable sloop 'Seawanhaka' which won and defended the well known international cup of that name from 1896 to 1901. His designs for cruising yachts were more conservative, but proved very successful. He owned and sailed several larger yachts in the great lakes, in the St. Lawrence, and in salt water. His skill, and his hospitality, were esteemed by the numerous friends who had the pleasure of cruising or racing in his company. Most of his associates and fellow club-members regarded 'The Skipper' as the ultimate authority on matters nautical.

He was instrumental in founding the Toronto Yacht Club, the Royal St. Lawrence Yacht Club, and the Royal Cape Breton Yacht Club. He was Captain of the Toronto Yacht Club 1883-4, Commodore of the Royal St. Lawrence Yacht Club 1889-90 (and Honorary Commodore since 1915), Commodore of the Royal Cape Breton Yacht Club 1905-10. In 1893 he received the bronze medal and certificate of the Royal Humane Society for saving life.

Besides the various yacht clubs in whose activities he took such great interest, he belonged to a large number of social and sporting clubs. He was a keen and skilful fisherman, and took every opportunity of angling for trout and salmon in the Laurentians and on the rivers of the lower St. Lawrence.

During the Great War, Mr. and Mrs. Duggan had the great sorrow of losing their two sons, both killed in action. Lieut. H. S. Duggan, R.E., died in October 1915, and his brother, Major K. L. Duggan, 5th C.M.R., was killed two years later. Mr. Duggan himself survived an almost fatal automobile accident near Montreal some ten years ago; a long period of convalescence followed.

It has often been said that the training and experience of an engineer give a man of suitable personality an excellent chance to achieve success as an executive in organizing or directing industrial and financial affairs. George

Herrick Duggan had the necessary characteristics, and with his business associates became prominent in the development of Canadian industry as we know it today. He had a thorough knowledge of the technical as well as of the financial aspects of engineering work and possessed a pioneering spirit which he retained throughout his life. Further, he was helped by the analytical quality of his mind, his farsightedness, his determination, and his courage.

In private life he was quiet in manner, genial, and hospitable to a high degree. Only those who knew him well were aware of his many acts of charity or of his benefactions to the societies and institutions in which he took an interest.

His death takes from us a man of proved worth, whose life's work did much to raise the status of the engineer in the eyes of the general public, but who never advertised himself or sought publicity.

DEAN SACKETT OF E.C.P.D. PASSES AWAY

Dr. Robert L. Sackett, for more than twenty years dean of engineering at Pennsylvania State College, died in New York City, on October 6th, 1946. His close association with the work of the Engineers' Council for Professional Development in recent years had made him known to many Institute officers who had learned to admire his sterling character and sound judgment. His death will be felt with a sense of personal loss within the Institute.

The following eulogy was written by Dr. Allan R. Cullimore, President of Newark College of Engineering, and a close friend of Dean Sackett:

To comment adequately upon the life, the achievement, and the interests of a man like Robert L. Sackett is an impossible task. Few men have been given the wealth and variety of interests which Dr. Sackett possessed, and the privilege is given to few of us to make contributions—very eminently constructive contributions—in so many fields and over such a wide range of human endeavor sustained over such a long period of time.

His first work, characterized as it was by a blending of engineering practice in a consulting capacity and teaching, led him from Earlam College to the Deanship at Pennsylvania State. During this time he was active not only in the educational field, but in the professional field as well, keeping his interest sustained in the fields of both civil and mechanical engineering. He was President of the Society for the Promotion of Engineering Education and received the Lamme Medal of that Society as the foremost teacher of engineering in the then current year, and of this medal and citation he was most proud. Honors were bestowed upon him by his Alma Mater and, fortunately, in the fields of both education and engineering, recognition was accorded to his work. He was a member of many learned societies and contributed substantially throughout the years to technical literature, particularly bearing upon the problems and orientation of the young engineer.

In many ways Dean Sackett's contribution since he left the active teaching profession has been on a broader front than ever. As time progressed, he remained active, serving on boards, committees, and commissions, not only of the engineering societies, but of the Engineers' Council for Professional Development, where he rendered unique services to the profession over many years. He was a marvel of energy to those who knew him best and who appreciated the tremendous range and weight of his responsibilities. I cannot recall having met a man in any field of human endeavour who was so genuinely, so actively, and so consistently constructive in so many varied fields, and I can recall no one who has through the years kept a finer sensitivity to those things which are worthwhile in our lives, and who could take a stand at the same time so firm and so flexible with respect to things of both the mind and the spirit.

It is, however, significant that the things by which Dr. Sackett has been best known, and the thing which will persist longest, is his interest and his thought with respect to the guidance of youth—particularly the young engineer. It is hard to pick out the projects with which he was especially familiar or with which he had uncommon interest for the simple reason that he was familiar with anything—one might almost say everything—which bore upon the relationship of the young man to his profession of engineering, and he was concerned intimately with all movements which served to make that relationship either more stable or more understandable.

His professional work as a consulting engineer in the first years of his professional life was characterized not only by his native good judgment, but by a very definite interest in those things which had to do with the human, the broader and the ethical values inherent in the relations of a consulting engineer with his clients.

In his professional teaching life—particularly in his Deanship at the Pennsylvania State College—this point of view developed, and he found in that situation a chance to practice and test many of his theories and points of view which afterwards became so helpful over such a wide field. And his help was not limited solely to the students in his own institution. For many young engineers, and I think we can truthfully say for *all* young engineers who came into contact with Dean Sackett, he was always a leader, always inspiring, and furnished, both by precept and example, a pattern which could be followed by the most eminent as well as the most humble.

It has been my privilege to work with him closely, even intimately, in the last dozen years, and to help him as I might with projects which had to do primarily with the choosing and the guiding of young engineers, and I have come to know and to appreciate what a unique and truly remarkable man he was. I have never seen fused into one personality so many of the attributes which are commonly thought to enter into and characterize a great man. Particularly in the later years, when Dr. Sackett was doing some of his best work—a work which he followed through to the end with the same thought and interest and the same vigor which characterized the earlier years—one always found him kindly and firm, *very firm* indeed, in his fundamental concepts concerning matters of morals and ethics. His was a firmness which was born of a deep sincerity of purpose, and with this firmness was a great tolerance, a great resiliency of thought, which made it possible for those of us who were somewhat younger to feel that in him we had always a contemporary—always one who stood at the same age level—although of greater stature, and I would submit that the feeling was shared by young and old alike.

Dr. Sackett never outgrew a fresh and ever renewing interest in the problems of youth, and in many ways he remained youthful in his thinking to the end. No man in the history of American professional education has had more influence on the lives of young men in his own profession than had Dean Sackett. Those of us who are left and who have lost a leader realize only too well how hard his place will be to fill, and while we do realize and feel very deeply a personal loss, greater and more vital even than this will be the loss to many of the younger men in the profession, those just coming in and those who will enter and who will not have the opportunity to profit as we have profited for so long by the activities and interests of a man who considered their interests and their enlightenment a matter of his first concern.

I have marvelled at the wealth and variety of his recreation. I have marvelled as I talked to him about things of professional interest and then watched him paint a picture. I have marvelled, too, at his youth evidenced in his thinking, and his youth evidenced in his recreation of sailing. Neither in his professional life nor in recreation did he have the slightest trace of fear. The startling thing to some of us in this day and this age is that he never complained. I think I never once heard him express a thought that even verged on the cynical.

It seemed to me that in the later years of his life when I came to know him so well, his philosophy was best expressed in the words of another great sailor (for sailing was the sport he loved so well), another hero, in the full sense of the word, for Dean Sackett was truly heroic in mold—a quotation which we shared and enjoyed together:

"There lies the port; the vessel puffs her sail:
There gloom the dark broad seas. My mariners,
Souls that have toil'd, and wrought, and thought with me—
That ever with a frolic welcome took
The thunder and the sunshine. . . . . . .
Some work of noble note, may yet be done,
Not unbecoming men that strove with Gods.
The lights begin to twinkle from the rocks:
The long day wanes: the slow moon climbs: the deep
Moans round with many voices. Come, my friends,
'Tis not too late to seek a newer world.
Push off, and sitting well in order smite
The sounding furrows; for my purpose holds
To sail beyond the sunset, and the paths
Of all the western stars, until I die."

PRESIDENTIAL VISIT TO QUEBEC AND EASTERN ONTARIO

Arrangements have been completed for President Hayes to visit in November the branches in Ontario and Quebec which were not included in his western itinerary last spring. The schedule of meetings is as follows:

Quebec	Monday, November 18th
St. Maurice Valley	Wednesday, November 20th
Montreal	Thursday, November 21st
Cornwall	Friday, November 22nd
Regional Meeting of Council	Saturday, November 23rd
Kingston	Monday, November 25th
Ottawa	Tuesday, November 26th
Peterborough	Wednesday, November 27th

Details of the functions which will be organized in each branch for the occasion are not available as yet. Notices will be sent in due course by the secretary-treasurer to all members in each branch concerned.

In Cornwall, Mr. Hayes will preside at the inauguration of the new branch, and it is hoped that he will be supported by a large representation of Institute officers. Any present or past officers who may wish to join the presidential party on any part or on the entire trip will be quite welcome but are asked to notify Headquarters.

The president will be accompanied by Mrs. Hayes, Councillor G. J. Currie of Halifax and by representatives from Headquarters.

CORNWALL BRANCH TO BE INAUGURATED

The first officers of the new Cornwall Branch of the Institute have been appointed, and their names appeared on the branch officers page of the September Journal. Short biographies of the chairman, D. Ross-Ross, and the secretary-treasurer, W. P. Nesbitt, will be found in the Personals column of this issue.

The official inauguration of the branch will take place at a dinner meeting to be held at the Cornwallis Hotel, Cornwall, at 6.30 p.m. on November 22nd. President J. B. Hayes will present the charter to the new branch, and it is expected that he will be accompanied by several vice-presidents and councillors. The officers of the new branch hope that there will be large delegations from neighbouring branches and send a pressing invitation to all members who may wish to come and celebrate the event with them.

The next day, Saturday November 23rd, a regional meeting of Council of the Institute will be held at the Cornwallis Hotel. All present and past officers of the Institute will be quite welcome to attend.

The territory of the Cornwall Branch includes the towns of Morrisburg, Alexandria, Cardinal, Maitland, Prescott. It is the twenty-eighth branch of the Institute, and the third to be inaugurated within the past year.

Dean Adrien Pouliot, M.E.I.C., of the Faculty of Science, Laval University, Quebec, was invited to give a lecture at the Sorbonne, Paris, October 10th, on the occasion of his visit to France. The meeting was under the auspices of the Association des Ingénieurs-Docteurs de France which took this opportunity of conferring upon Dean Pouliot their highest distinction, "la grande médaille d'honneur". From right to left: M. Le Lièvre, representing the Ministry of Information, Prince Louis de Broglie, General Georges Vanier, Canadian Ambassador, M. Varlon, president of the Association, Dean Pouliot and M. Jaxe.

New York Times photograph

As the result of experience in the Institute's employment service for the past six months, it is desired to put before the members a picture of how the service works and how they can make the best use of it.

Requests for the use of the service are received from both members and employers either by letter, by telephone or by a personal visit. The bulk of both are by letter. Once an application is received it is classified, both men and jobs being set up under the same basic file headings, i.e., a civil engineer with mining experience. Naturally a man or job may appear under several headings depending on the qualifications held or required. By classifying both men and jobs under the same simple number code it is an easy matter to find out what men fit a job and vice versa.

Once a job is classified three things happen. The first is that a check is made of all "open" men's files, which correspond to the qualifications desired. The records of these men are then sent or given to the prospective employer. Care is taken that a record is not sent to the man's present employer. These records are sent out with the request that they be treated as confidential and returned to the Institute as soon as the desired information is obtained from them. The second step is that a slip giving details of the opening is placed in a file on the Rehabilitation Officer's desk, where the information is available to any member who calls in to see him. The third step is that a short description of the opening, written up in this office, is placed in the Situations Vacant column of the *Journal*, provided it is still open and there has been no request to keep it confidential.

A member's request for assistance goes through the reverse process. If he comes in, he is given the addresses of firms where a suitable vacancy is believed to exist, together with the name of the particular person with whom he should deal. If he writes in, his record is sent out to all known suitable openings. His file is then opened and whenever a suitable vacancy appears his record automatically goes forward to the prospective employer. This file is kept open until it is learned that the member is satisfactorily employed.

The above are the mechanics of the job routine. In addition there are the replies to advertisements in the *Journal*. These are received in this office, checked quickly with particular reference to present employer and sent forward to the advertiser under covering letter. Whenever possible, the application leaves here the day it is received. On occasion, such as immediately after the issue of the *Journal*, the load is too heavy to keep up the pace. Applications to openings that no longer exist are checked in detail and whenever possible re-routed to a similar position.

On occasion it is asked why mimeographed form letters are used whenever possible and what has happened to the close personal touch of the past. The answer is that the membership of the Institute has increased considerably in the past few years and the available staff is loaded to the utmost. Overtime work is the rule rather than the exception. Hence every possible short cut is used, although we would greatly prefer to retain the older style. It is felt that speed of service is the target to be aimed at, so as to get members' names before possible employers without any delay. This also makes it virtually impossible to notify members of vacancies as they occur or to give more details than appear in the *Journal*.

A few statistics may be of interest at this point. There are at present some 2,800 men's files in existence, all of whom have made more than passing use of this service in the past eighteen years. There are, of course, very many more who have no files. At the begininng of last January there were 54 open job files. Since then 425 files have been opened and 332 files closed, leaving 147 files open as at the end of September. The maximum number of openings under any one file to date this year is 26. The maximum number of records sent out at any one time to a prospective employer is 78. The average is about 10. The maximum number of times any one man's record has been submitted to prospective employers is 41. The total number of placements known of to date this year is 158. It is believed that there are many more but it is very difficult to obtain records of placements. Over 700 men have been interviewed. The files of 98 men are at present on the open list. Correspondence on employment has been received from every continent, and many telephone requests for information.

In conclusion it is desired to ask for help from the members. The success of this service depends on cordial relations with prospective employers and a knowledge of where the jobs are. To maintain the former it is essential that records be up to date and all correspondence answered promptly. Complaints are frequently received that employers often do not even acknowledge letters written to them. It can be attested from personal experience that this situation is not one-sided. Members and possible jobs are scattered all over Canada, and occasionally outside of it. Would it be too much to ask members to bring the existence and operation of this service to the attention of possible employers whenever they hear of an opening which an engineer might fill?

A. J. Kerry, *Rehabilitation Officer.*

MEETING OF COUNCIL

A regional meeting of the Council of the Institute held at The Digby Pines, Digby, N.S., on Wednesday, September 4th, 1946, convening at three o'clock p.m.

Present: President J. B. Hayes (Halifax) in the chair; Councillors G. J. Currie (Halifax), A. E. Flynn (Halifax), S. W. Gray (Halifax—representing the Association of Professional Engineers of Nova Scotia), J. B. Stirling (Montreal), A. A. Turnbull (Saint John), Paul Vincent (Quebec), General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past-Presidents A. J. Grant (St. Catharines) and H. W. McKiel (Sackville); Past-Councillors K. L. Dawson, F. W. W. Doane, J. R. Kaye and I. P. Macnab, of Halifax, J. R. Morrison and C. M. Smyth, of Sydney; T. H. Dickson (Moncton), and J. J. Traill (Toronto); J. L. Cavanagh, president, W. H. Chisholm, Howard Fellows, and D. S. Wickwire, councillors of the Association of Professional Engineers of Nova Scotia; R. M. Richardson, councillor, representing the president of the Association of Professional Engineers of New Brunswick; Marc Boyer, registrar of the Corporation of Professional Engineers of Quebec; G. A. Gaherty (Montreal), chairman of the Committee on Western Water Problems; Leo Roy (Montreal), formerly secretary of the Quebec Branch; Morley G. Taylor, of Maracaibo, Venezuela; S. G. Naish, secretary-treasurer, and J. H. Fraser, a member of the Cape Breton Branch; J. D. Kline, secretary-treasurer, and W. C. Risley, member of the executive of the Halifax Branch.

The president welcomed the councillors and guests and expressed his pleasure at presiding over a regional meeting of Council in the maritime provinces. He invited everyone to take part in the various discussions.

The president informed the meeting that the treasurer of the Institute, Mr. J. A. Lalonde and Mrs. Lalonde had suffered a serious motor car accident a few weeks ago. He reported that they were both recovering satisfactorily, but he suggested that the councillors might wish to send a message to them. It was agreed that a telegram expressing Council's wishes for a quick and complete recovery be sent by the general secretary.

Engineering Education: The general secretary presented a report from Vice-President C. E. Sisson on a conference held in Toronto on May 29th, between representatives of several engineering organizations and a group of deans and teachers of engineering. Mr. Sisson was the official representative of the Institute.

Professor Flynn, who was present at the conference, representing the Nova Scotia Technical College, reported in greater detail on the conference, and informed the meeting that arrangements had been made by the Universities Conference for the educators in the engineering field to meet regularly as an activity of the conference. Professor Flynn believed that this was a very satisfactory development, and thought it held great possibilities for the future.

Canadian Construction Association: In the absence of Mr. E. P. Muntz, chairman of the committee on this matter, the president asked Mr. Stirling, a member of the committee, to explain to the meeting the background of the Council's interest in this subject. Mr. Stirling explained that the Canadian Construction Association had approached the Government with the recommendation that the standard specification regarding foundation conditions should be altered so that it would be fair to contractors doing work for the various Government departments. The Association had asked the Institute and the Royal Architectural Institute of Canada to support it in its appeal and the Institute had communicated with several of the departments concerned, but in each instance had received what was considered to be an unsatisfactory reply. The matter had been considered further by a special committee appointed by Council, but the committee felt that it was not yet in possession of adequate information to make a final recommendation. Mr. Stirling explained that it was the committee's intention to propose that they join with the Royal Architectural Institute, the Canadian Construction Association and the National Construction Council in an interview with the deputy ministers and chief engineers of the departments concerned with a view to getting closer together on the subject.

Committee on Professional Interests: Mr. J. B. Stirling, chairman of the Committee, reported on many items of business which had been before the committee since the last meeting of Council, including the following:

(1) A proposal from the New Brunswick branches with regard to amending the co-operative agreement with the Association in that province. The committee recommended that, in view of Council's decision to refer to the Association all applicants who would be required to write an examination for admission, there was no further likelihood of confusion developing, as had occurred in at least one case in the past. Therefore the committee recommended that no effort be made to have the agreement amended.

(2) Memorandum from Toronto Branch re Institute policy. This memorandum made several recommendations with regard to the reorganization and the operation of Council. Mr. Stirling's report pointed out that a draft of a reply had been presented by him at the regional meeting of Council held in Toronto in April. The draft had been circulated to councillors with the April minutes, and as no criticism or discussions had been received, the committee considered that it was acceptable as a final answer to the Toronto executive. Accordingly, the committee recommended that Council authorize the presentation of this reply to the Toronto executive.

(3) Letter from a member criticizing a Journal editorial. Mr. Stirling reported that a letter had been received from a member strongly criticizing statements made in the Journal under the heading "Legislation in Quebec". As the committee accepted the responsibility for this editorial, he had again checked the facts and had replied to the member that from this point of view there was nothing to be withdrawn from the editorial. The committee had examined the subject very carefully and had made what they hoped was an acceptable and satisfactory answer.

(4) Relationship between the Engineering Institute and the Canadian Council of Professional Engineers and Scientists. Mr. Stirling reported on an exchange of letters between his committee and the president of the Canadian Council relative to the Institute's policy on cooperation.

(5) Cooperation with the American Society of Mechanical Engineers. The report drew attention to the successful joint meeting held last June, in Detroit, with The American Society of Mechanical Engineers. This was part of a programme developed under the recently completed co-operative agreement with that society.

(6) Changes in Committee. The report informed Council of the resignation of Mr. Norman Eager, of Hamilton, from the committee, and requested Council's approval of the appointment to the committee of Mr. L. A. Duchastel, of Montreal.

The report was received and approved unanimously.

Engineers' Council for Professional Development: It was unanimously agreed that Dean C. R. Young be renominated as the Institute's representative on the Executive Committee of the Engineers' Council for Professional Development (E.C.P.D.).

It was also unanimously agreed that Mr. E. V. Buchanan, of London, Ontario, be nominated as the Institute's representative on the E.C.P.D. Committee on Professional Recognition, to replace Mr. J. A. Vance, who has served on this committee for six years, and who is not eligible for reappointment.

The membership of the Institute's committee to study and report on the proposed Canons of Ethics, now under consideration by a special committee of E.C.P.D., was noted and approved as follows: A. E. Berry, E. A. Cross, O. Holden, N. MacNicol, W. S. Wilson.

Agreements with Provincial Associations: A letter had been received from the secretary of the Saint John Branch inquiring as to the method to be followed in handling the $5.00 increase in annual fees in the case of joint members under the co-operative agreement.

The Finance Committee recommends that the joint fee be increased $5.00 in those provinces where there is a co-operative agreement, and that the branches be rebated on the standard basis, the rebate to be deducted by the association before remitting the amount to Headquarters, or the full amount could be forwarded to Headquarters and the rebate returned to the branches. Following some discussion it was unanimously agreed that the general secretary should discuss this matter with the associations concerned.

International Technical Congress—Paris: The Finance Committee recommends that the Institute do not participate in this Congress.

The Committee's reasons for making this recommendation are as follows:—

(1) The Congress is being sponsored by a group of people who have stated that its purpose is to estab-

blish a new international engineering and scientific federation, sometimes referred to in the literature as "world union of engineers". In other words there is no official or constituted authority promoting the Congress.

(2) In view of the objective described in (1) the Committee judges the Congress in the same light as it judges the proposed international federation. The Committee is unable to see anything that can be accomplished by such a federation that is not already being accomplished by existing organizations.

(3) The proposed federation is not supported by the British Institutions of Civil, Electrical and Mechanical Engineers, or by the Founders Societies in the United States.

(4) The expense involved would be substantial and it was felt that the money could be used to better advantage in other activities.

(5) The Committee is informed that the promoters of the proposal are not prominent in the field of professional organization, and the literature which has come to the Institute gives ample support to this.

This recommendation was discussed at considerable length during which much additional information was disclosed. Council agreed unanimously to accept the Committee's recommendation not to participate in the Congress.

The suggestion was made that the Institute might have an observer at the meeting who could later inform the Institute of what had occurred. Several difficulties were mentioned that would be involved in such an idea and eventually it was left with the president and the general secretary while in London to keep informed of the situation through whatever means they thought most appropriate.

The meeting adjourned for dinner at five forty p.m.

The meeting reconvened at seven thirty p.m. with President Hayes in the chair.

A telegram from Mr. R. E. Heartz, chairman of the committee, was presented, in which the committee requested Council's permission to plan a survey of the economic status of the members of the Institute.

The general secretary explained that this telegram was the outcome of a meeting of the committee which had taken place in Montreal on Tuesday, September 3rd. The committee had studied a project now under way under the auspices of the Founder Societies of the United States, with the collaboration of the Federal Department of Labour. The questionnaire prepared by the societies was studied in detail, and the committee found that it offered new opportunities for gathering useful information about the profession. The questionnaire had been approved by the American Societies of Civil, Electrical, Mechanical, Mining and Chemical Engineers, and the Institute's committee found it unusually comprehensive and, at the same time, not complicated. The committee believes that a similar questionnaire, adjusted to meet Canadian conditions, would place in the hands of the Institute a volume of extremely important information which, in association with similar information gathered for the United States, would present a comprehensive picture of the economic conditions of the profession for North America.

For many months the committee had been kept closely informed by the American societies of what they were planning and preliminary drafts of the literature had been in the hands of the committee for many months.

In the discussion which followed there was some difference of opinion, some persons suggesting that the profession had already been subjected to too many questionnaires, and others believing that a really comprehensive survey would serve a useful purpose. Finally, on the motion of Mr. Currie, seconded by Mr. Vincent, it was agreed that the committee's recommendation be accepted, and that the plans in full detail be presented to a subsequent meeting.

The Engineer in the Civil Service: The general secretary reported briefly on the report of the Royal Commission on Administrative Classifications in the Public Service, pointing out that none of the recommendations made by the Institute's committee to the Commission had been incorporated in its report. It was explained that the Institute's criticism of the report was given in detail in the August number of the *Engineering Journal*. The committee was far from satisfied with the result and was proposing to continue its campaign for proper recognition of the engineers in the service.

Committee on Rehabilitation: A letter from Major-General Howard Kennedy was presented, in which he asked that Council accept his resignation as chairman of the Committee on Rehabilitation. This resignation was made necessary by the fact that he was now employed in Ontario and spent the major portion of his time in areas remote from the centres where it would be possible for him to be of assistance.

Reluctantly Council accepted the resignation, instructing the general secretary to thank Major-General Kennedy for the excellent service which had been rendered.

Annual Meeting 1948: A communication was presented from the Calgary Branch inviting Council to hold the 1948 annual meeting of the Institute at the Banff Springs Hotel in June of that year. Mr. Gaherty suggested that if Banff was to be considered for such a meeting it might be desirable to consult the American societies and see if a joint meeting with one or more of the societies could be arranged.

The meeting heartily approved of the suggestion of holding a professional meeting in Banff in 1948, and before finally accepting the invitation, on the motion of Mr. Turnbull, seconded by Mr. Currie, it was agreed that the general secretary be instructed to investigate the possibilities of securing hotel accommodation at that time, discussing the matter with the hotel company and the officers of the Calgary Branch.

Canadian Chamber of Commerce: It was unanimously agreed that Dr. Arthur Surveyer of Montreal be renominated as the Institute's representative on the National Board of Directors of the Canadian Chamber of Commerce.

National Construction Council: Correspondence was presented from the National Construction Council in which the Council asks the Institute's support in making representation to the Department of National Defence, with a view to speeding up the demolition of temporary buildings, in order to release much needed building materials.

Following considerable discussion it was felt that, in view of the recent release by the Department of Reconstruction and Supply, concerning salvage of materials and buildings, which appears to be under way on a large scale across Canada, no useful purpose would be served by sending further memoranda to the Department, as suggested by the National Construction Council.

Canadian Scientific Film Association: Mr. Wright described briefly the proposal for the establishment of the Canadian Scientific Film Association, the purpose of which is to co-ordinate the use and production of scientific films in Canada. A draft constitution, patterned after that of the British Scientific Film Association has been prepared by an interim committee, and it would appear that the Institute would benefit by becoming a member of the new association, which would undertake to route and schedule the distribution of appropriate films throughout its branches.

The general secretary further explained that the Institute had been invited to become a charter member. The inaugural meeting would be held in Ottawa on September 18th and he thought it was desirable to have a representative present at that meeting. Mr. Ralph C. Purser, of Ottawa, who had been approached to see if he would act as the Institute's representative, had suggested that it would be preferable to appoint someone from Headquarters but that he would be pleased to act as alternate.

On the motion of Professor Flynn, seconded by Mr. Currie, it was unanimously resolved that the Institute should become a member of the Canadian Scientific Film Association and that Mr. Trudel, the assistant general secretary, be appointed as the Institute's representative with Mr. R. C. Purser as alternate. Mr. Trudel was instructed to attend the inaugural meeting on September 18th.

Changes in Branch Territory: Mr. Trudel drew attention to the fact that, with the new list of members now in the course of preparation, a geographical list would also be issued. It had been suggested that the branch allocation of certain non-resident areas might very well be reviewed at this time. He referred particularly to the Northwest territories and certain mining areas in Northern Quebec, which, at the present time, are attached to the Ottawa Branch. Following some discussion, it was unanimously agreed that Headquarters be authorized to approach the various branches concerned and after consultation and agreement between the branches be given authority to reallocate certain districts as may be found more advantageous and satisfactory to the branches and members concerned.

Proposals for New Technical Committees: The general secretary reminded Council that during the course of the discussion following the paper presented at the annual meeting by J. G. G. Kerry on " The Winter Temperature Cycle of the St. Lawrence Waters — A Plea for more Data ", several speakers had recommended that the Institute take some action with regard to collecting the additional data which Mr. Kerry believes could be used to great advantage in properly studying the subject. These speakers had emphasized the importance both from the Canadian and the American point of view of an engineering study of this subject. Many of the discussors had recommended that the Institute endeavour to arrange co-operation in the study with the American Society of Civil Engineers, and perhaps also with the American and Canadian governments. Council agreed unanimously that the general secretary should discuss this matter with the American Society of Civil Engineers, to see if a joint study could be developed, reporting back to Council at a subsequent meeting.

The general secretary reported that recently a member of the Institute had brought to his attention a serious problem which was developing on the Great Lakes with regard to shore erosion. The member was of the opinion that a scientific study should be made in order to determine methods of combatting this great waste of the country's resources. The matter was submitted to Council to see if any action should be taken.

A very general discussion followed in which it was agreed that this was indeed a great problem not only related to the Great Lakes but also related to many other lakes and rivers. If it were possible for the Institute to study the subject, it should result in making a genuine contribution to the economic welfare of the country. Finally, it was agreed unanimously that the suggestion be submitted to the Toronto Branch Executive with the recommendation that they examine the situation in relationship to the Toronto area, making recommendations to Council as to action which might be taken both in that area and in more remote areas as well.

It was decided that the next meeting of Council would be held in Montreal towards the end of October.

ELECTIONS AND TRANSFERS

A number of applications were considered and the following elections and transfers were effected:

Members

Anderson, Samuel Charles, B.Sc. (London Univ.), sales engr., Sawyer-Massey, Hamilton, Ont.

Bleaken, Maynard Dollery, B.A.Sc. (Toronto), 74 Simpson Ave., Toronto, Ont.

Davidson, Philip, B.A.Sc. (Toronto), vice-pres. and chief engr., Robinson Engineering & Development Co., Calgary, Alta.

DeBlois, Howard Crawford, Grad. (R.M.C.); M.A. (Mech. Sciences), (Cambridge Univ.), engr., Canadian Industries Limited, Shawinigan Falls, Que.

Doherty, Thomas Beatty, B.Sc. (Chem. Engrg.), (Queen); S.M. (M.I.T.), process and development engr., Imperial Oil Limited, Sarnia, Ont.

Dunlop, William Hamilton, squad foreman i/c structl. contracts, Canadian Bridge Co., Windsor, Ont.

Eberts, Hermann Livingston, Graduate (R.M.C.); B.Sc. (Elect.), (McGill), sr. engr., Stevenson & Kellogg, Montreal, Que.

Harrison, William Edwin, B.Sc. (Mech.), (Queen's), chief instrument engr., i/c instrument dept., Imperial Oil Limited, Sarnia, Ont.

Laird, William Douglas, B.Sc. (Civil), (Manitoba), tech. information service, Dept. of Reconstruction, Westmount, Que.

Meyer, Karl Rudolf, B.Sc. (Engrg.), (Univ. of London, Eng.), mech. mgr., Stadler-Hurter & Co., Ltd., Montreal, Que.

Roden, Berkeley, B.Sc. (Aero. Engrg.), (Michigan), engr. on design, Canadair Limited, Montreal, Que.

Simpson, Robert E., B.Sc. (Queen's), (R.C.E.M.E.), White Motor Co., Montreal, Que.

Smith, Roy Hamilton, B.Sc. (Chem. Engrg.), (McGill), engrg. and development dept., Imperial Oil Limited, Sarnia, Ont.

Tarbox, John William, B.A.Sc. (British Columbia), jr., hydraulics dept., H.E.P.C. of Ontario, Toronto, Ont.

Watt, Andrew Gibb, chief draftsman, structl. dept., Saint John Drydock & Shipbuilding Co., Ltd., East Saint John, N.B.

Wyman, Russell Asquith, B.Sc. (General Course), (Manitoba), research engr., Aluminum Laboratories Limited, Arvida, Que.

Juniors

Cuke, Norman Hampden, B.Eng. (Metall.), (McGill), engr., development and engrg. dept., Canadian Liquid Air Co., Ltd., Montreal, Que.

Gregg, John William, B.Sc. (Petroleum Engrg.), (California), petroleum engr., Denton-Spencer Co., Ltd., Calgary, Alta.

MacDonald, Roderick Edward, B.Sc. (Acadia Univ.), student engr., Dominion Iron & Steel Co., Ltd., Sydney, N.S.

Rattenbury, David James, B.A.Sc. (Mech.) (British Columbia), chief dftsman., Canadian Sumner Iron Works, Vancouver, B.C.

Richer, Jean Herbert, B.Eng. (Mech.), (McGill), Lieut., R.C.N.V.R., Montreal, Que.

Sorensen, Eric Edgar, B.Sc. (Chem. Engrg.), (Queen's), late Lieut., R.C.E., 384 Earl St., Kingston, Ont.

Teskey, Robert Hugh, B.Sc. (Chem. Engrg.), (Alberta), chemical engr., Madison Natural Gas Co., Black Diamond, Alta.

Warren, Mark Prospere, B.Eng. (Met.), (McGill), late Lieut., R.C.E.M.E., 921 St. Joseph Blvd. E., Montreal, Que.

Wolever, Frank Day, B.Eng. (Mech.), (McGill), late Lieut., R.C.N. V.R., 536 Prince Albert Ave., Westmount, Que.

Yuill, Edward Stanfield, B.Sc. (Physics), (Mt. Allison); B.A.Sc. (Engrg. Physics), (Toronto), engr., control and development lab., cable and wire divn., Northern Electric, Montreal, Que.

Transferred from the class of Junior to that of Member

Angel, John Bartlett, B.Eng. (Met.), (McGill), managing-dir., United Nail & Foundry Co., Ltd., St. John's, Nfld.

Dutton, William Lawrason, B.A.Sc. (Civil), (Toronto), asst. to chief engr., Union Gas Co. of Canada, Ltd., Chatham, Ont.

Painter, Gilbert Walter, B.Eng. (Elect.), (McGill), transport. specialist, Canadian General Electric Co., Ltd., Toronto, Ont.

Sommerville, Donald Barton, B.A.Sc. (Toronto), vice-pres. and genl. mgr., St. Catharines Steel Products Co., Ltd., St. Catharines, Ont.

Transferred from the class of Student to that of Member

Duncan, Gaylen Rupert, B.Eng. (Elect.), (McGill), Electric Tamper & Equipt. Co. of Canada, Ltd., Toronto, Ont.

McRae, Robert Bruce, B.Sc. (Elect.), (Alberta), plant engr. and supvr. of purchases, Julius Kayser & Co., Ltd., Sherbrooke, Que.

Mikkelborg, Gordon Hodgson, B.Sc. (Mech.), (Sask.), development engr., Quebec North Shore Paper Co., Baie Comeau, Que.

Nathanson, Solomon, B.Eng. (Civil), (McGill); M.Sc. (Civil Engrg.), (M.I.T.), designer with Charles Mayer, designer of structl. steel and concrete, Brooklyn, N.Y.

Sansom, Ralph Thomas, B.Sc. (Elect.), (New Brunswick), asst. engr., signals dept., Canadian National Railways, Moncton, N.B.

Slater, Stewart, Major, R.C.E., Graduate, R.M.C.; B.Sc. (Civil), (Queen's), Royal Military College, Kingston, Ont.

Transferred from the class of Student to that of Junior

Hughes, Gerald Francis George, B.Sc. (Elect.), (New Brunswick), Canadian Government Trade Commissioner, Glasgow, Scotland.

Admitted as Students

Barker, Peter, B.A.Sc. (Toronto), 24 Willcocks St., Toronto, Ont.
Bratty, Lewis George, B.A.Sc. (Chem. Engrg.), (Toronto), 194 Connor Drive, Toronto, Ont.
Breen, Lloyd Stanley (Toronto), 72-11th St., New Toronto, Ont.
Brown, Donald Boyd (McGill), 548 Prince Arthur St. W., Montreal, Que.
Brown, Frederick Wallace (Toronto), Geo-Technical Development Co., Bourlamaque, Que.
Campbell, Douglas Keith McLellan (McGill), 332 South St., Halifax, N.S.
Evans, Charles (Toronto), 3000-15th St., Detroit, Mich.
Goddard, Rex Wendell, B.Sc. (Queen's), 105 Ronan Ave., Toronto, Ont.
Lake, Addison Arthur, B.A.Sc. (Mech.), (B.C.), 3821 Harvard Ave., Montreal, Que.
Mantha, Guy Kenneth (McGill), 5116 Cote St. Paul Road, Montreal, Que.
Marchionni, Dante Aldo (McGill), 8060 Lajeunesse St., Montreal, Que.
McEwen, James Eric, B.A.Sc. (Toronto), power plant test engr., Canadian Kodak, Toronto, Ont.
McKerron, Donald, B.A.Sc. (Met.), (Toronto), jr. engr., Dominion Steel & Coal Corp., Sydney, N.S.
McLean, John Allan (Toronto), 591 Gilmour St., Ottawa, Ont.
Nemetz, Alvin Sydney (B.C.), 6229 Angus Drive, Vancouver, B.C.
Orkin, Richard Cottingham, B.A.Sc. (Acadia), 137 Percival Ave., Montreal West, Que.
Oznst, Walter Bronek (Alberta), 10561-76th Ave., Edmonton, Alta.
Power, Donald James (N.S. Tech.), 136 Quinpool Road, Halifax, N.S.
Prifogle, John Stanley, B.A.Sc. (Mech.), (Toronto), 620 South West "A" St., Richmond, Indiana.
Proctor, Reuben Peter (N.S. Tech.), Armdale, N.S.
Spivak, Sidney Gerald, B.A.Sc. (Chem. Engrg.), (Toronto), engrg. dept., Electric Auto-Lite Co., Bay City, Mich.
van Beck, George John (Dalhousie), 27 Moran St., Halifax, N.S.
Wilson, James Franklin (McGill), 2737 McCallum Ave., Regina, Sask.
Wiseblatt, Lazare (McGill), 3408 Northcliffe Ave., Montreal, Que.

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

Alberta

Members

Clarke, John Wesley, B.Sc. (London, Univ.) civil engr., Haddin & Miles Ltd., 801-13th Ave. W., Calgary, Alta.
Donaldson, William A., airway engr., Department of Transport, Edmonton, Alta.
Hind, Robin Cyril, B.Sc. (Elect.), (Alta.), apparatus sales engr., Canadian General Electric, Calgary, Alta.
Macnab, Thomas Morrow, B.Sc. (Mining), (Alberta), Ituna Works Mgr., Demerara Bauxite Co., Ituna, British Guiana, S.A.
Maggs, Percy James, B.Sc. (City & Guilds Coll., London), waterworks supvr., Calgary Power Co., Ltd., Wetaskiwin, Alta.
Ross, Herrick H., B.Sc. (Elect.), (Manitoba), elect. engr., Purity Flour Mills Ltd., East Calgary, Alta.

Junior

Mackenzie, Robert Bain Anderson, B.Sc. (Alberta), 11153 Saskatchewan Drive, Edmonton, Alta.

Junior to Member

Stanley, Donald Russell, B.Sc. (Alberta), prov. sanitary engr., Dept. of Health, Alberta Govt., Edmonton, Alta.

Student to Member

Kirkland, William Dalton, B.Sc. (Elect.), (Alberta), elect. engr., City Power Plant, Edmonton, Alta.

Saskatchewan

Member

Keith, Ralph Richard, B.Sc. (Mech.), (Sask.), asst. supt., Sask. Power Commission, Saskatoon, Sask.

Junior to Member

Bing-Wo, Reginald, B.Sc. (Civil), (Sask.), asst. hydraulic engr., P.F.R.A., Regina, Sask.

New Brunswick

Member

Spence, Earl Boyce, B.Sc. (Mech.), (N.S. Tech.), sr. engr., International Paper Co., Dalhousie, N.B.

Junior to Member

Mundee, Lawrence Sterling, B.Sc. (Elect.), (N.B.), Asst. equipt. engr., N.B. Telephone Co., Ltd., Saint John, N.B.

Quebec

Members

Bartlett, Oswald Willoughby, B.Sc. (London Univ.), design engr., Fraser-Brace Engrg. Co., Ltd., Montreal, Que.
Fear, William Davidson, B.A.Sc. (Toronto), asst. engr., E. A. Ryan, consultg. engr., Montreal, Que.
Halyard, Robert Henry, B.Eng. (Liverpool Univ.), engr., designer, Fraser-Brace Engrg. Co., Ltd., Montreal, Que.
Lundy, James Armstrong, B.A.Sc. (Toronto), sr. technician, Canadian Car & Foundry Co., Ltd., St. Laurent, Que.
Michaud, Joseph Marcel, B.Eng. (Mining), (McGill), mine engr., King Mine, Asbestos Corporation Ltd., Thetford Mines, Que.

Juniors

MacNaughton, John William, B.Eng. (Mech.), (McGill), asst. res. scientist, Canadian Armament Research & Development Establishment, Quebec, Que.
Paine, Frederick J., B.Eng. (Civil), (McGill), jr. designer, Dominion Bridge Co., Montreal, Que.
Sternfeld, Sol. I., B.Eng. (Chem.), (McGill), 5838 Durocher Ave., Outremont, Que.

Junior to Member

Demers, Georges, B.A.Sc., C.E. (Poly.), consultg. engr., 126 St. Peter St., Quebec City, Que.

Personals

News of the Personal Activities of members of the Institute

Donald Ross-Ross, M.E.I.C., is the chairman of the new Cornwall Branch of the Institute. Born in Montreal, he graduated from McGill University in 1917 with a B.Sc. in mechanical engineering. He served in the R.C.N. until 1919, when he went to Toronto, Ont., as instructor in steam power plant engineering for the Central Technical School. From 1920 to 1925 he was with the Dominion Rubber Company, Montreal, first in the planning department and later as assistant mechanical superintendent. He then joined the Cornwall division of Howard Smith Paper Mills Limited. He first served as combustion engineer, and was promoted to the position of assistant to the mill manager in 1927, production engineer in 1928, and chief industrial engineer in 1929. Two years later his title applied also to subsidiary companies, and gradually he assumed charge of purchasing and cost accounting. He was personnel supervisor for the company for several years.

William P. Nesbitt, M.E.I.C., has been appointed secretary-treasurer of the new Cornwall Branch. He was born in Merritton, Ont., and graduated from Queen's University, Kingston, Ont., in 1935 as a B.Sc. in mechanical engineering. He was first employed by Alliance Paper Mills, Merritton, and in 1936 went to the engineering department of Fraser Companies Limited, Edmundston, N.B. In 1938 he entered the Canadian International Paper Company's engineering department and was located at Hawkesbury, Ont., and Temiskaming, Que. He transferred to the Consolidated Paper Corporation, Grand'Mere, Que., in 1939, where he remained for two years as master mechanic, when he entered the employ of the Howard Smith Paper Mills in the Cornwall Division. He was appointed mechanical superintendent by his company in 1943.

T. G. Anglin, M.E.I.C., announces the formation of the T. G. Anglin Engineering Company Limited, Montreal, by the former associates of the late Walter J. Armstrong, M.E.I.C., consulting engineer of Montreal.

R. C. Flitton, M.E.I.C., has been appointed sales manager of Canadian Vickers Limited, Montreal, Que. He has been with the company since 1933, when he transferred from the William Hamilton Company Limited, Peterborough, Ont. He was first superintendent of industrial shops for the company and has latterly been chief estimator for the engineering division. He represents the Montreal Branch on the Council of the Institute.

C. M. Brant, M.E.I.C., has been appointed controller of radio (air) with the Civil Aviation Division of the Newfoundland Government. He is seconded to that government by the United Kingdom Ministry of Civil Aviation. He first went from the Air Ministry to Newfoundland in 1937 as technical superintendent for the transatlantic air base at Botwood. Transferring to the R.A.F. in 1942, he was first stationed at Gander, Nfld., as signals officer, and later at Bermuda, B.W.I., and Dorval, Que. He returned to Gander in May of this year and assumed his duties as controller.

John Allan Jones, M.E.I.C., has been named British Columbia regional supervisor for the Central Mortgage and Housing Corporation. A graduate of the University of British Columbia, he was general superintendent and assistant manager of the B.C. Bridge and Dredging Company, Vancouver, prior to joining the R.C.A.F. in 1939 as a flying officer. He attained the rank of group captain and was placed in charge of R.C.A.F. construction in Canada. Retired to the reserve in 1945, he became chief engineer for the Commonwealth Construction Company of Vancouver, later joining the Corporation as an engineer.

Dr. F. Noakes, M.E.I.C., is now associate pofessor of electrical engineering at the University of British Columbia. He had been employed since 1943 in the laboratories of the Hydro-Electric Power Commission of Ontario, Toronto, and lectured in electrical engineering at the University of Toronto from 1940 to 1943.

M. S. Mitchell, M.E.I.C., formerly of the department of civil engineering of the University of Alberta, is a partner in the Lethbridge firm of architects and engineers, Meech, Mitchell and Meech.. He was with the university during the academic sessions of 1943, 44 and 45, as sessional instructor.

T. M. Moran, M.E.I.C., vice-president of the B.C. Electric Railway Company Limited, is also carrying on work related to the gas division of British Columbia Motor Transportation Limited, and has been appointed vice-president for British Columbia of the Northwest Electric Light and Power Association.

Roger Lessard, M.E.I.C., is professor of mathematics at Ecole Polytechnique, Montreal. He graduated in 1941 from the Ecole, and has since been employed by the Milton Hersey Company Limited on storage dam construction at Dolbeau, Que., by Marine Industries Limited, Sorel, Que., by the Dominion Rubber Company at St. Jérome, Que., and by the Technical School of Hull, Que., as professor of mathematics and engineering.

Col. A. L. Mieville, M.E.I.C., is managing director of Bailimo Limited in London, England. He has been with the British Ministry of Supply Mission in Washington, D.C., for the past several years, and in 1940 was with the Ministry of Labor and National Service in London. In 1937 he was purchasing agent for Switchgear and Cowans Limited, Manchester, England.

C. V. F. Weir, M.E.I.C., is in Calgary, Alta., employed by the Calgary Transit System as assistant superintendent. On his release from the R.C.E. in 1945 with the rank of major, he returned as an electrical engineer to the City of Edmonton Power Plant where he had been employed in 1938 as a field engineer.

W. J. Orr, M.E.I.C., has accepted the position of mechanical engineer in the technical division of the Public Works Department of the City of Montreal. He was previously with Jas. A. Kearns, consulting engineer, Montreal.

Gordon MacL. Pitts, M.E.I.C., a representative of McGill University on the Council of the City of Montreal, was elected in September to serve as pro-mayor of the city for the ensuing three months. Mr. Pitts is a member of the board of governors of McGill, and a past-president of the McGill Graduates Society. He represented the Montreal Branch on the council of the Institute in 1942, 1943 and 1944.

D. B. Simpkin, M.E.I.C., is in Burlington, Ont., where he is employed as a designer by the Hamilton Bridge Company Ltd. Since his release from the R.C.E. in August 1945, he had been in Noranda, Que., with the Noranda Mines Limited.

Philip Simpson, M.E.I.C., was made an Associate Fellow of the Royal Aeronautical Society in May 1946. He is an aircraft standards engineer with Handley Page Limited in London, England. He went to England in 1932 and has since been associated with that company's aircraft standards and technical publications.

G. E. Smith, M.E.I.C., has been appointed engineer, right of way, Atlantic Region, for the C.N.R. at Moncton, N.B. He entered the employ of the railway as a draughtsman at Moncton in 1919, became third assistant engineer in 1937, and was acting division engineer at New Glasgow and Campbellton, N.B., in 1944. Returning to Moncton in 1945, he was assistant engineer until his recent appointment. He represented the Moncton Branch on the council of the Institute in 1940, 1941 and 1942.

Ernest Smith, M.E.I.C., who was district engineer at Nelson, B.C., for the British Columbia Department of Public Works, has been transferred to Victoria, B.C., in the same capacity. With the Department he has served at Prince Rupert, B.C., and at New Westminster, B.C., as assistant district engineer, and he went to Nelson as district engineer in 1941.

H. C. Spence, M.E.I.C., is in Calgary, Alta., where he has assumed the post of manager of the newly opened Calgary branch of the Central Mortgage and Housing Corporation. He served during the war with the administrative branch of the R.C.A.F. finally with the rank of Wing Commander. Prior to the war he was secretary of the Highway Traffic and Taxicab Office for the Municipal and Public Utility Board of the Province of Manitoba.

R. D. Sutherland, M.E.I.C., who was deputy adjutant general, with the rank of brigadier, with the Department of National Defence at Ottawa, Ont., for the past two years is now district manager for Rogers Majesic Limited in Montreal. From 1940 to 1942 he was Q.M.G., Atlantic Command, located at Halifax, N.S. In civil life prior to the war he was merchandise manager for the Canadian Westinghouse Company Limited, Montreal.

F. C. Wightman, M.E.I.C., of Amherst, N.B., has been appointed town manager for Sackville, N.B. He had been active as a municipal consultant in Amherst since his release in 1944 with the rank of major from the R.C.E. With the R.C.E. he was chief engineer officer at Camp Borden, Ont., and later O/C of No. 2 Works Company at Ottawa, Ont. Prior to war service he was for some years county engineer with the Department of Highways at Truro, N.S., and was town manager for Kentville, N.S. in 1937.

W. Raywood Smith, M.E.I.C., has resigned as county engineer for Middlesex County, Ont., his resignation to be effective at the end of this year. It is expected he will enter private practice. He has been county engineer since 1941 after some years service as assistant county engineer.

R. C. Gauthier, M.E.I.C., has joined the firm of Lalonde and Valois, Montreal, as a structural engineer. He had been assistant designer for the Dominion Bridge Company at Winnipeg, Man., since 1944.

A. R. Moffat, M.E.I.C., is a civil engineer in the surveys and engineering branch of the Department of Mines and Resources, Ottawa, Ont. He was previously at Arnprior, Ont., as assistant engineer on construction for the Ontario Hydro-Electric Power Commission.

M. R. Quintal, M.E.I.C., is in Quebec, where he is employed as an engineer in the soils division of the Department of Highways of the provincial government.

A. LeB. Ross, M.E.I.C., has accepted a position as works manager with Mueller Limited, Sarnia, Ont. He was formerly at Ajax, Ont., as plant engineer for Defence Industries Limited. He was with D.I.L. in Montreal in 1941, transferring to Oshawa, Ont., in 1942, and to Ajax in 1943.

J. B. Lalande, JR.E.I.C., who was with Canadian Westinghouse Limited in Hamilton, Ont., since his graduation in 1944 from Ecole Polytechnique, Montreal, has been transferred to the company's Montreal office.

Guy Savard, JR.E.I.C., is with the Société d'Oxygène et d'Acetylène d'Extrême-Orient, at Singapour. He left the Canadian Liquid Air Company, Montreal, in 1940, to enlist in the Royal Canadian Dragoons, and served overseas during the war.

F. E. Ayers, JR.E.I.C., is with the Canadian National Railways as instrumentman with the Port Arthur division.

W. K. Clawson, JR.E.I.C., has been appointed assistant engineer for Middlesex County, Ont. It is expected that he will succeed the resigning engineer at the beginning of 1947. On his recent release from the R.C.E., with the rank of major, he joined the Horton Steel Works Limited and was located at the Fort Erie Plant.

A. B. Extence, JR.E.I.C., who was discharged from the navy with the rank of lieutenant (E) late in 1945, has been at M.I.T., Cambridge, Mass., since last March, where he has been doing graduate studies.

F. S. Hutton, JR.E.I.C., has been transferred by Canadian National Railways from Stratford to London, Ont. He is assistant division engineer for the London division.

F. L. Peckover, JR.E.I.C., has been for the past two years with the National Research Council as a junior research engineer in the hydraulics laboratory of the division of mechanical engineering at Ottawa, Ont., and served as secretary of the N.R.C. Associate Committee on Soil and Snow Mechanics. He was recently granted leave of absence of one year in order to study in the field of soil mechanics and foundation engineering at the graduate school of engineering of Harvard University, Cambridge, Mass. He has been at the University since September.

G. W. Ross, JR.E.I.C., joined the Canadian General Electric Company on his release from the R.C.A.F. in 1945. First located in Toronto, he was later transferred to Ottawa as a lighting specialist, and is now in Sydney, N.S., as sales representative for the company.

G. J. Dunne, JR.E.I.C., has been employed since March last with Frank W. Horner Limited, Montreal. He is supervisor of the fine chemical department which is under development.

R. E. Gohier, JR.E.I.C., formerly a metallurgist with Sorel Industries Limited at Sorel, Que., is now with the gas distribution department of the Quebec Hydro-Electric Commission, and is located in Montreal.

G. W. Hudson, JR.E.I.C., who had been with the National Research Council, Ottawa, Ont., is now at Guelph, Ont., in the engineering department of the Hammond Manufacturing Company Limited.

F. A. Hunt, JR.E.I.C., was discharged from the army early this year and has returned to the Canadian National Railways in Toronto, Ont. He is an assistant engineer in the Toronto Terminals division office.

N. G. Wrightson, S.E.I.C., who served overseas in the R.C.A., has accepted employment with Darling Brothers Limited, Montreal.

W. F. Dawson, S.E.I.C., B.ENG., and former demonstrator in the Faculty of Engineering at McGill University, Montreal, is in Maracaibo, Venezuela, in the employ of the Caribbean Petroleum Company Limited.

K. G. Richardson, S.E.I.C., is in Toronto, Ont., where he is following the Junior Engineers' Training Course of the Hydro Electric Power Commission of Ontario.

Obituaries

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

James Moscrip Rothwell, M.E.I.C., a member of the Vancouver Branch of the Institute, died suddenly on September 9th, 1946.

He was born in Walkerton, Ont., in 1896, and received his early education in Galt, Ont. Joining the Canadian Forces in 1916, he saw service overseas until the temination of the war. He was invalided home and spent almost a year in hospital before attending the University of British Columbia, from which institution he graduated in 1927 with the degree of B.A.Sc. in civil engineering.

After a few months spent with the Greater Vancouver Water District as field engineer, he joined the staff of the City of Vancouver engineering department as assistant in the surveys department. He remained on the municipal staff and at the time of his death he was assistant city surveyor.

Mr. Rothwell was a member of the Association of Professional Engineers of British Columbia and of the Association of Land Surveyors of British Columbia. He joined the Institute in 1927 as a Student, transferred to Associate Member in 1938 and to Member in 1940. He had been on the executive of the Vancouver Branch for the past two years.

Arthur Reginald Roberts, M.E.I.C., chairman of the department of mechanical engineering of McGill University, Montreal, died suddenly on September 6th, 1946.

Born in Montreal in 1883, Pofessor Roberts received a B.Sc. degree from McGill in 1903 and an M.Sc. in 1904. He secured employment that year as assistant chief draughtsman with the Dominion Coal Company, Montreal, and went the following year to the Montreal Rolling Mills Company.

He commenced his long connection with McGill University in 1908, joining the teaching staff as a lecturer in mechanical engineering. Within the next four years he became assistant professor and associate professor. He was appointed professor in 1928 and in 1943 chairman of the department of mechanical engineering.

Professor Roberts was a member of The American Society of Mechanical Engineers. He joined the Engineering Institute in 1904 as a Student, transferring to Associate Member in 1911, and to Member in 1940.

F. J. Heuperman, M.E.I.C.

Frederick Justinus Heuperman, M.E.I.C., of Calgary, Alta., died on August 16th, 1946.

He was born in 1887 in Amsterdam, Holland, and came to Canada in 1906. He became a Dominion Land Surveyor in 1911, and later the same year received his Alberta Land Surveyor's Certificate. From 1911 to 1914 he carried out extensive surveying projects in Northern Alberta and surveyed many timber limits. At one time he was in partnership with A. P. Patrick, one of the pioneer surveyors of the west.

Mr. Heuperman joined the engineering staff of the Canadian Western Natural Gas, Light, Heat and Power Company Limited in January 1914 as assistant engineer, and remained with the company. He was appointed general superintendent for the company in April this year.

He was a member of the Association of Professional Engineers of Alberta, and of the Alberta Land Surveyors Association. He joined the Engineering Institute as an Associate Member in 1925. becoming a member in 1940. Active in the Calgary Branch, he served as secretary for one year and has been a member of the branch executive on numerous occasions.

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*

The Calgary Branch held its first general meeting of the season on Thursday September 26th.

A report of progress on subscriptions to the Harry F. Bennett Educational Fund was read. A number of the new members were introduced to the meeting and welcomed by the chairman, H. R. Younger.

Through the courtesy of the Alberta Wheat Pool, three films were shown. The picture "Northwest Frontier" traced the development of Canada's northland, and the growth of its industries, transportation and communication systems.

The other films dealt with the salmon fishing industries in Alaska and in the Fraser river. The methods of fishing and processing fish in the canneries as well as the scientific study of the return of the fish to the spawning grounds were outlined. Of particular interest was a description of the measures taken to assist the fish in returning to the spawning grounds over rapids and falls.

The chairman thanked Mr. Davidson and Mr. Pettinger for presenting an entertaining and interesting programme.

HAMILTON BRANCH

L. C. Sentance, M.E.I.C. - - - - *Secretary-Treasurer*
I. M. Macdonald, Jr.E.I.C. - - - *Branch News Editor*

On Thursday, September 26th 1946, the Hamilton Branch of the Institute held the first meeting of the 1946-47 season at MacMaster University with Chairman A. R. Hannaford presiding.

E. G. Wyckoff introduced Brigadier D. H. Storms, C.B.E., M.C., the speaker of the evening. Brigadier Storms is general manager of Housing Enterprises of Canada Ltd., and dealt with that organization in his talk on **Housing in Canada, the Problems and Prospects.**

Housing Enterprises and other similar organizations are taking care of housing for medium salaried groups, but one third of the population of Canada in the low income brackets has no housing of decent standards, and some provision will have to be made for them. It will be necessary for federal, provincial and municipal authorities to combine in this effort.

Brigadier Storms said that it is evident that the problem of house building will be a major one for the next few years, despite all that is being done by government agencies and projects such as Housing Enterprises. He predicted continuing difficulty in obtaining materials in all branches of the building industry. While some delays are due to a shortage of labour, others are due to manufacturers not producing what they can in seeking higher prices or tax relief.

He suggested the cutting of red tape and establishing standard building codes across the Dominion. He said that in the project of which he is head it is necessary to have 24 separate legal agreements before work can proceed. Shortages are being partially alleviated by large-scale salvage operations. Many former army camps have been purchased and lumber, nails and plumbing reclaimed, along with other materials.

Brigadier Storms gave an outline of the various housing projects and the financial assistance given by the government, and explained that Housing Enterprises Ltd. is a private enterprise operated on a non-profit basis by the 42 life insurance companies in Canada with government assistance. It aims at providing low-rental housing units to which former servicemen are given priority, so that there is slight chance of the average civilian getting any of these units.

Abandonment of the old fashioned, conventional methods of construction of the horse and buggy days, and development of house building along the modern lines adopted in other industries was advocated by the speaker, who said research in radical methods of construction is being undertaken by his organization. Wider use of steel and precast concrete was included in some of these experiments. In this connection he invited inspection of the project under way in Hamilton at Lawrence Woods.

At the conclusion of his address, Brigadier Storms was tendered the thanks of the meeting by C. H. Hutton.

KINGSTON BRANCH

J. E. Thom, m.e.i.c. - *Secretary-Treasurer*

The annual meeting of the Kingston Branch was held on Wednesday, July 3rd, 1946, and included a showing of the film **Heat and Its Control** by Johns-Manville. This partly animated sound film was enjoyed very much by the attending members. The meeting then retired to the Faculty Players Lounge, Old Arts Building, Queen's University, for refreshments and the election of officers.

The following members have been elected for the year 1946-47; R. D. Bennett, chairman; C. E. Craig, vice-chairman. The Executive committee consists of: R. J. Kennedy, K. H. McKibbon, W. J. Piercy, and M. J. Saunders, J. E. Thom, of the construction department of Canadian Industries Limited, is secretary-treasurer.

LETHBRIDGE BRANCH

Thomas Miard, m.e.i.c. - - - - *Secretary-Treasurer*
E. A. Lawrence, s.e.i.c. - - - - *Branch News Editor*

Mr. Wm. Murday, chief installation engineer for Richard Sutcliffe Ltd., Horbury, England spoke on **Belt Conveyers in Britain** at the first dinner meeting of the fall season of the Lethbridge Branch of the Institute on Saturday evening, September 21. Chairman R. S. Lawrence presided.

Mr. Don Livingston introduced Mr. Murday who, previous to his present position, had been chief engineer for two large English collieries. He has had 26 years' experience with conveyors.

The speaker pointed out there was a great manpower shortage in Britain, and mechanization released men for other duties, thus increasing production.

In 1938, a self-acting incline in a hundred year old British colliery was replaced with a full belt conveyor system 2172 ft. long, releasing 42 men who had attended the incline. The conveyor carried 750 tons per seven-hour shift. The system was installed 1¼ miles from the bottom of the shaft. The belting was supplied in rolls seven feet in diameter which could not be handled in the mine. Each roll was hung under the cage, and allowed to revolve, the belting being carried from the foot of the shaft in mine cars.

In a colliery controlled by the Ministry of Mines the joints in the 30-inch six-ply belt had only 55 or 60 percent of the belt strength. Although vulcanizers are not flameproof, permission was obtained from His Majesty's Inspectorate to vulcanize the belts underground, increasing the joint strength to 90 per cent.

At a limestone quarry in North Wales, ships loading 1,000 tons came in with the tide, then retired to the bay with the ebb, to await the next tide. 150 to 200 tons were loaded per tide. During blackouts the work was dangerous for both shoremen and crew, and enemy action sank three ships. A conveyor system costing $170,000 was installed, with bunkers feeding a 42-inch conveyor running 1050 ft. along the jetty with a speed of 350 ft. per minute. A 1,000 ton cargo can now be loaded in a single tide.

In a large ammunition dump Mr. Murday's company installed conveyors which had to operate around bends up to 40 deg. At these angles, between the end of one belt and the start of the next, an independent frame was made on a suitable radius. The frames were fitted with tapered ball-bearing rollers. As a box came from the conveyor, the taper on the rollers guided it around the bend. When the next box left the conveyor, it pushed the first one along the rollers onto the next belt. Thirty miles of conveyor were installed in this storage area, replacing 14 locomotives. They have carried over six million tons of ammunition.

Mr. Murday mentioned several other installations, and in closing said there was a place for conveyors in every industry.

Answering questions, he stated the greatest single length of conveyor should be about 3,000 ft. On level runs the motor should be at the front, and on grades above 1 in 7 it should be at the top of the incline. The maximum grade is 1 in 3, as above that the material will fall by itself. Belts are troughed, and have self aligning rollers. Belt speeds vary from 120 to 500 ft. per minute. Direct starting can be used on belts travelling under 300 ft. per minute.

A. L. H. Somerville thanked the speaker.

Brown's trio presented enjoyable dinner music, and Mr. Morton Brown led the community singing, and sang three solos, accompanied by Mrs. G. Brown.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - - - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - - - *Branch News-Editor*

A special invitation was extended to members of the Ottawa Branch and their friends to attend a showing of scientific films at the National Research Laboratories auditorium on the evening of Wednesday, September 18. The showing, open to the public, constituted the closing item of a one-day inaugural meeting of the newly-formed Canadian Scientific Film Association.

The programme of films, which lasted about ninety minutes, was purposely selected for variety in subject matter and method of treatment and wide general appeal. Various aspects of scientific film production and technique were illustrated, and the possibilities of the use of films in relation to Canadian science and industry were illustrated. Subjects covered by the programme included: the tailless glider, the electron microscope, high speed photographic techniques, the human ear, vegetable insects, the search for oil in Western Canada, and the art of camouflage.

SAGUENAY BRANCH

J. E. Dyck, m.e.i.c. - - - - - *Secretary-Treasurer*

The Saguenay Branch was addressed by two speakers on September 24th, on subjects relating to architecture.

Mr. Gordon Webber, instructor in visual design, McGill University, spoke on the subject **How Student Architects View Arvida and District.** Each year, fourth and fifth year students of the McGill School of Architecture, as part of their regular course, visit a district to study and sketch such settings as houses, farms, factories, etc. This year, 20 students under the direction of Mr. Webber chose Arvida and district as a subject for their sketches and paintings.

Mr. Webber pointed out that the object of his students' work was to portray in their sketches the character of the district in an interesting and exciting manner. He mentioned too, that the tremendous industrial development of the Saguenay district had to be seen to be fully appreciated.

Mr. Spencer Sales, assistant professor of Architecture at McGill University, spoke on **Town Planning in Postwar England.** Mr. Sales, who just recently came to this country from England has had considerable experience in that country in connection with post war reconstruction of towns. He explained that since his interest lay in town planning, his visit to Arvida was prompted by a desire to see a new town in this country built almost entirely in the last ten years. His impressions of Arvida were very favourable and he felt that, with proper foresight in the future, Arvida could serve as a model town.

In England the problem was to decentralize large congested areas such as London. The plan there was to build satellite towns on the fringe of the large city, each town to cover 600 acres and accommodate 60,000 inhabitants. It was intended to bring diversified types of light industry to these towns. The speed of this work was still being retarded due to lack of building materials. In answer to a question as to what incentive people would have to move to these towns Mr. Sales pointed out that the prospect of a house in preference to a flat, as well as the advantage of living close to one's job, would serve as sufficient incentive. The use of prefabricated houses, however, was not contemplated and the speaker thought that standard methods of house construction would be employed. In conclusion Mr. Sales pointed out that rebuilding of towns in England could not be considered a short term undertaking and believed that a minimum period of 30 years would be required to complete the full project.

A. Cunningham thanked both speakers for their interesting talks.

SARNIA BRANCH

F. F. Dyer, M.E.I.C. - - - - - - - *Secretary-Treasurer*

A. E. K. Bunnell, consultant to the Provincial Department of Planning and Development, spoke to a dinner meeting of the Sarnia Branch of the Institute on October 3rd, 1946. His subject was **Community Planning.**

Mr. Bunnell stressed the part the engineer takes in community planning, from the first inception of the municipality through all stages of its development. He defined planning as, " thought before action ", and pointed out the necessity of planning to adequately provide for municipal services, such as water supply, sewers, and sewage disposal, schools, parks, traffic thoroughfares, etc.

The modern thought, by those who have studied the subject, is that municipalities should be limited in size, at a point where services can be made available at reasonable cost. Surrounding such a municipal area, should be a green belt of park, and agricultural land, restricted as to population density. Further growth in the area should take the form of satellite communities, with their own establishments, outside this green belt. This system would enable a municipality to know the extent to which it would be called on to provide future utilities. Studies made of community statistics show that after a certain stage has been reached, the cost per capita increases as the population of the municipality increases.

Mr. Bunnell briefly touched on the master plan for Sarnia, prepared by Mr. Wilson, and felt that a serious mistake had been made when the city failed to acquire the property necessary to develop the " Civic Centre " idea as set out in the plan. He also stated, in regard to the riverfront, that he knew of no municipality that had lost control of its waterfront, as Sarnia had done, that had not lived to regret it. Toronto, he said, had now acquired practically all of its waterfront, some 12 or more miles, at a cost of millions of dollars. Communities are all very much alike, and should seek something that will express their own individuality and develop it.

A plea was made for a wider interest in civic affairs by the individual citizen, and on the part of municipal councils; more thought to long range views both for community planning and financial planning.

The meeting was held in the Polymer Cafeteria, with a good representation of the engineering profession present. W. E. Dill acted as chairman.

TORONTO BRANCH

E. G. Tallman, M.E.I.C. - *Secretary-Treasurer*
E. R. Graydon, M.E.I.C. - *Branch News Editor*

The opening meeting of the 1946-47 season of the Toronto Branch was held on October 4th in the auditorium of the Royal Ontario Museum.

The meeting, conducted by Chairman Edgar Cross, was attended by some 400 members and their ladies, and gave promise of a most successful season to come. Colonel J. T. Wilson, a member of the Branch and Deputy Director of **Exercise Musk-Ox,** gave a fascinating account of the expedition through all its stages. Slides illustrated many of the points, and the National Film Board record film of the expedition " White Safari " was shown. Colour moving-pictures of the expedition brought this part of the meeting to a close.

During a brief period of discussion, the meeting heard a very humorous comparison between the equipment used on the Scott Antarctic expedition and that on the " Musk-Ox ". Professor Griffith Taylor, who made the comparison was a member of the Scott expedition.

A vote of thanks to Colonel Wilson for his excellent presentation was then moved by Professor C. F. Morrison, and the meeting was adjourned.

Library Notes

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

BOOK REVIEWS

X-RAYS IN PRACTICE

Wayne T. Sproull. New York, London, McGraw-Hill; Toronto, Embassy, 1946. 615 pp., illus., 9 x 5¾ in., cloth, $6.00

Reviewed by E. S. Kelsey, M.E.I.C*

This volume has been written to serve both as an up to date text book on the theory and application of X-Rays and as a convenient reference book on the subject.

The history, fundamentals and characteristics of X-rays and X-ray spectra provide an introduction to this comprehensive work. With emphasis on the practical aspects, the book proceeds with the generation, absorption, scattering and deffraction of X-rays, the measurement and recording of X-rays, and descriptions of X-ray equipment. Particular applications dealt with include industrial radiography, medical applications, crystallography, fluoroscopy, micro-radiography, and numerous minor uses.

Electronics Research Engineer, Northern Electric Company Ltd., Montreal.

Well selected questions and problems at the end of each chapter review the subject matter and assist the student in obtaining a proper grasp of it. The arrangement of material and thorough indexing should make it a convenient reference book for the practising engineer or physicist. Moreover, the numerous references to source material in foot notes throughout the volume, not only furnish an extensive bibliography, but also serve to make the book a most useful guide to the technical literature on X-rays in practice. The work is excellently illustrated with numerous figures and photographs, including many interesting radiographs.

One minor criticism is offered. In a work which so thoroughly caters to the needs of the practising physicist and engineer and which is so completely up to date in other respects (even the atomic bomb is included), it is disappointing to see continued adherence to the outmoded e.s. units. In all fields of applied electronics, the trend is towards complete superseding of the old theoretical e.s.u. and e.m.u. systems of units by the m.k.s. system which is both theoretical and practical.

LINCOLN'S INCENTIVE SYSTEM

J. F. Lincoln. New York and London, McGraw-Hill; Toronto, Embassy, 1946. 192 pp. illus., charts, 9 x 5¾ in., cloth, $2.00.

Reviewed by E. D. Kellogg*

Anyone who reads this book in order to obtain information on the setting of piece-work rates or the technical details of setting up wage incentive plans will be disappointed. The book does not cover the limited technical aspects of incentives which are usually so dear to the hearts of time study men and industrial engineers in general.

I can, however, highly recommend this publication to all those employed in the administrative and policy making levels of management. The book should be a "must" for union executives, and it would do no harm if it were read by some of our income tax administrators.

The first part of the book is devoted to a detailed analysis of the progress of the Lincoln Electric Company, Cleveland, Ohio, under incentive management. Coming as they do from a reputable well known organization, it would seem that the figures reported can be relied upon. Briefly, the Lincoln Electric Company has been able to consistently, over a period of years, reduce the cost of their product, improve the quality of their product, increase their production, decrease their selling prices, and last but not least, increase their wages to an extent which is well unbelievable.

Much of the book is devoted to the necessary steps to be taken by management before an incentive plan can be installed. A point which is often neglected on most works on incentives, but which is well emphasized in this book, is the necessity of developing in the workers their latent skills and abilities. This can be best done by supervisors and foremen with well developed leadership qualities. Management must be highly skilled in improving methods of operation and in the overall planning of the production operation. Then, when we have a competent management organization and a highly refined production standard, it is time to develop a piece-work or incentive system.

As far as the actual installation of incentive standards is concerned, practically no attention is paid to this in the book. The author states that time study men must, in his opinion, be entirely familiar with the job conditions and able themselves to perform any of the operations which they are studying. This is a good point and is often overlooked. In the Lincoln incentive operation, a piece-work rate, once established, is regarded as a contract between labour and management and is, therefore, never changed.

The well known dodge of changing methods or materials to a slight degree in order to cut a high rate piece-work is not tolerated under the Lincoln system. This is extremely important since it develops a high degree of confidence in the system by the workers. This attitude alone may account for a great deal for the success of the plan.

**Vice-President, Stevenson & Kellogg Ltd., Montreal.*

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Art of Scale Model Aircraft Building:
V. J. G. Woodason; edited by Walter Buchler. London, Useful Publications, n.d. 110 pp., illus., paper.

Autobiography of Science:
Edited by Forest Ray Moulton and Justus J. Schifferes. Garden City, N.Y., Doubleday, Doran; Toronto, McClelland & Stewart, 1945. 666 pp., cloth.

Development of Improved Means for Evaluating Effects of Torsional Vibration on Internal Combustion Engine Installations:
S.A.E. War Engineering Board, New York, Society of Automotive Engineers, 1946. 578 pp., illus., cloth.

Electric Motors and Generators and Related Drives:
E. S. Lincoln. New York, Essential Books; Toronto, Wm. Collins, c1945. 381 pp., illus., cloth.

Materials-Handling Equipment; a Modern Manual:
Matthew W. Potts. 172 pp., illus., cloth.

Principles and Practice of Heat Treatment; 2d ed:
J. Winning. Manchester, Emmott, 1945. 108 pp., illus., paper.

PROCEEDINGS, TRANSACTIONS, ETC.

American Institute of Electrical Engineers:
Transactions, v 64, 1945.

American Society of Civil Engineers:
Transactions, v 110, 1945.

Canada. Eighth Census, 1941:
Volume 2—Population by Local Subdivisions. Canada, King's Printer, 1944.

Canada. Civil Service Commission:
Thirty-seventh Annual Report, 1945.

Canada. Dept. of Mines and Resources. Bureau of Mines:
Manufacturers of Clay Products in Canada, 1945.

Institution of Mechanical Engineers:
Brief Subject and Author Index of Papers in the Proceedings, 1847-1945 and in the Journal March 1939—March 1946.

Institution of Water Engineers:
Transactions, v 50, 1945.

Nova Scotia. Board of Commissioners of Public Utilities:
Report, 1945.

Research Council of Alberta:
Annual Report, 1945. (Report No. 47).

Society of Naval Architects and Marine Engineers:
Transactions, v 53m 1945.

TECHNICAL BULLETINS, ETC.

American Public Works Association—Standard Specifications for Public Works Construction:
F—Portland Cement Concrete Pavements, 1944.

American Society of Mechanical Engineers:
A.P.I.—A.S.M.E. Code for Unfired Pressure Vessels, 1943 with 1944 Supp.
...A.S.M.E. Boiler Code Interpretations, 1946.
...A.S.M.E. Welding Qualifications, 1946.

Bituminous Coal Research, Inc. Technical Reports:
No. 7, May 1946—Application of Overfire Jets to Prevent Smoke in Stationary Plants, by Richard B. Engdahl.
...No. 9, May 1946—Corrosion of Feed Screws of Small Underfeed Stokers, by Ralph A. Sherman, John F. Foster, and Don A. Hinckle.

British Standards Institution:
B.S. 1322:1946—Synthetic Resin (Aminoplastic) Moulding Materials and Mouldings.

Canadian Standards Association:
List of Electrical Equipment, 1st ed, January 1946. Supp. "A", May 1946.

Electrochemical Society: Preprints:
90-3—Dielectric Properties of Phenolic Resins and Molded Compositions, by Lawrence M. Debing.—90-4—Magnesium as a Galvanic Anode; Some Factors Affecting its Performance, by H. A. Robinson.

Harvard University. Graduate School of Engineering. Publications:
No. 417—Cylindrical Antenna; Current and Impedance, by R. King and D. Middleton.
...No. 418—Rock Defects and Loads on Tunnel Supports, by Karl Terzaghi.
...No. 420—Symmetrical Antenna Arrays, by Charles W. Harrison, Jr. Theory for Three-Element Broadside Arrays, by Charles W. Harrison, Jr.
...No. 423—On the Propagation of Small Disturbances in a moving Compressible Fluid, G. F. Carrier and F. D. Carlson.

Illinois Institute of Technology. Research Publications:
Electricity (v 2 n 2 March 1942).—Chemical Kinetics (V 3 n 1 January 1943).—Mathematics (V 3 n 2 March 1943).

Princeton University. Industrial Relations Section:
Research Report No. 73—Wages Under National and Regional Collective Bargaining; Experience in Seven Industries.
...Selected Reference No. 11—Selection and Development of Executives.

Public Roads Administration and The Agricultural and Mechanical College of Texas. Steel Column Series. Progress Report:
Steel Columns; a Survey and Appraisal of Past Works, by A. A. Jakkula and Henson K. Stephenson. (A Report from the Project entitled The Cooperative Investigation of Bridge Types).

Quebec (Prov.) Dept. of Mines. Maps:
No. 630—Mining Properties in Western Quebec.—No. 625—Mining Properties in Chibougamau Area.

Research Council of Alberta:
Recent Work of the Research Council of Alberta, by Edgar Stansfield. (Contribution 10, October 1945).

University of Minnesota. Institute of Technology. Engineering Experiment Station. Technical Papers:
No. 56—Calculation of Bearing Capacities of Footings by Circular Arcs, by Paul Anderson.
...No. 55—Method for Measuring Tool Tip Temperature, by Bert A. Crowder.
...No. 54—Thermal Short Circuits in a Metal Wall, by R. M. Olsen.

PAMPHLETS, ETC.

"Carbowax" Compounds and Polyethylene Glycols:
New York, Carbide and Carbon Chemicals Corp., c1946.

Divided China:
Maxwell S. Stewart. Toronto, Canadian Institute of International Affairs. (Behind the Headlines, v 6 n 5 1946).

Education and Industry:
Henry H. Hewetson. Imperial Oil Ltd. (Address delivered at the Annual Convention of Canada and Newfoundland Education Association, Edmonton, August 1946).

Employee Organizations in the Public Service:
New York, National Civil Service League, 1946.

Institute of Industrial Administration:
Education in Industrial Administration.
...Selected Certificate Examination Papers, 1943, 1944.
.. Selected Examination Papers, 1945 (First Issue, Jan. 1946).

Intelligent Selfishness and Manufacturing:
James F. Lincoln. Cleveland, Lincoln Electric Co., c1943.

Report on the International Control of Atomic Energy:
U.S. Secretary of State's Committee on Atomic Energy. Wash., Gov't. Printing Office, 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.

BRITISH STANDARD SPECIFICATION FOR NON-FERROUS PIPES AND PIPING INSTALLATIONS FOR AND IN CONNECTION WITH LAND BOILERS. B.S. 1306 Part 1:
London, British Standards Institution, 1946. 2/-.

This standard is similar and complementary to B.S. 806—Ferrous Pipes and Piping Installations for and in Connection with Land Boilers. B.S. 1306 Part 1 applies to the general and detailed construction of the copper pipework connecting a land steam boiler to engine turbine or industrial plant, and to all auxiliary pipework in connection therewith, together with individual pipes and fittings forming parts of such installations. It lays down limits of pressure and temperature for the use of copper piping installations and bronze castings used in connection with such installations.

B.S. 1306 will be completed at an early date by the issue of Part 2—Seamless Copper Tubes with Plain and Screwed Ends for Steam Services.

BRITISH STANDARD SPECIFICATION FOR SYNTHETIC RESIN (AMINOPLASTIC) MOULDING MATERIALS AND MOULDINGS. B.S. 1322:1946:
London, British Standards Institution, 1946. 2/-.

Corresponding to the British Standard Specification for Synthetic Resin Moulding Powders of the Phenol Formaldehyde Tube. B.S. 1322:1946 standardises the methods of test and provides the technical information necessary to frame purchasing specifications for aminoplastic moulding materials and mouldings.

The specification defines two types of materials according to their properties and further types will be included later enabling a purchaser to quote B.S. 1322 or to build a specification for a special type of aminoplastic material or moulding, by fixing a special standard of performance and prescribing the standard tests.

PORTLAND CEMENT CONCRETE PAVEMENTS:
Chicago, American Public Works Association, 1946. Loose leaf, $1.50.

This completely revised standard specification for Portland Cement Concrete Pavements is Part F1-44 of the Association's Standard Specification for Public Works Construction. It comprises the latest developments recognized as good standard practice.

The specification makes provision for the use of air-entraining cement in locations in which its use is warranted because of ice or snow conditions. Also, it includes provisions for varying the water cement ratio to meet the requirements of economical construction in either northern or southern areas and provides for the use of vibratory methods of compaction.

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 PHOTOGRAMMETRY:
R. C. Anderson, 4th ed. C. E. Hayes, P.O. Box 882, Chattanooga 1, Tenn.; apply Edwards Brothers, Ann Arbor, Mich., 1946. 517 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

As in the previous editions of this book the object is to present a clear, simple, but accurate method of calculating tilt of the aerial photograph. In this new edition has been incorporated the material contained in two other books by the same author, "Rigorous Analysis of the Scale Point and Tilt Formulas" and "Tilt of the Aerial Photograph by Graphical Resection". The theory and demonstrations of the basic idea, the dropped perpendicular analogy, have been extended, with further derivations, to increase the accuracy of the result. Numerical examples and sample calculations have been used freely, adding to the practical value of the book.

ATMOSPHERIC POLLUTION IN LEICESTER: Atmospheric Pollution Research, Technical Paper No. 1:
Great Britain. Dept. of Scientific and Industrial Research. London, His Majesty's Stationery Office, 1945. 164 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, 3/-. (Obtainable from British Information Services, 30 Rockfeller Plaza, New York, $.90).

As a part of the program of research on atmospheric pollution of large towns, some 200,000 readings of gauges, filters and other apparatus were taken over a three-year period. The apparatus used is described with methods for accurate determinations. The results are summarized and discussed, and the practical aspects are emphasized with suggestions on smoke abatement, sulphur control and town planning.

ATOMIC ENERGY in COSMIC and HUMAN LIFE; Fifty Years of Radioactivity:
By G. Gamow. University Press, Cambridge, England; Macmillan Company, New York and Toronto 1946. 161 pp., illus., diagrs., charts, tables, 8¼ x 5¼ in., cloth, $3.25 (in Canada).

In the first section the author takes up the question of what is atomic energy, and describes the modern alchemy by which atomic transformations are brought about. In the second section he describes the way in which these transformations are used and produced by and in the stars, with extremely high temperatures as the producing mechanism. The final section discusses the problem of how man can use atomic energy, utilizing the method of neutron-multiplication and bombardment as described.

AUTOBIOGRAPHY OF SCIENCE:
Edited by F. R. Moulton and J. J. Schifferes. Garden City, N.Y., Doubleday, Doran; Toronto, McClelland & Stewart, 1945. 666 pp., tables, 8½ x 5¼ in., cloth, $4.00.

From the earliest records to the twentieth century, the great triumphs of science in all fields, are recorded in this volume in the original words of those who achieved them. The introductory notes by the authors immediately preceding the separate items provide brief information about the lives, activities and achievements of the men whose writings are presented. This unusual collection will be of interest to those who like their information first-hand, allowing for the necessity of translation from foreign languages.

DIESEL-ELECTRIC LOCOMOTIVE:
C. F. Foell and M. E. Thompson. Diesel Publications, New York, 1946. 688 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $7.00, U.S.A.; $8.00, foreign.

The early chapters of this book cover the history, development, advantages and classification of Diesel-electric locomotives. The remainder of the book deals with the constructional, engineering, operational and maintenance aspects of the subject in considerable detail and with many illustrative charts and diagrams. Two chapters of general engineering fundamentals are included, and Diesel-hydraulic and Diesel-mechanical locomotives are given brief consideration.

ELECTRIC MOTORS AND GENERATORS and Related Drives:
E. S. Lincoln. New York, Essential Books; Toronto, Collins, 1945. 381 pp., illus., diagrs., charts, tables, 8¼ x 5½ in., cloth, $3.50.

This practical volume describes all kinds of direct and alternating current motors and generators, with instructions for installation and operation. Tables are provided showing complete standardization of motor manufacture and use. A final chapter covers a variety of related drives: belting, gears, chain drives, variable speed transmission, couplings, clutches, etc.

ELECTRON and NUCLEAR COUNTERS, Theory and Use:
S. A. Korff. D. Van Nostrand Co., New York, 1946. 212 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $3.00.

This book first discusses the internal mechanism of the discharge in electron and nuclear counters. It then presents the constructional and operational features which are desirable and the best means for securing them, with discussion of the errors and corrections encountered in using the devices. Finally, the various electronic circuits which are the essential auxiliaries to successful operation are considered in some detail. Selectively sensitive and other special counters are covered as well as the conventional Geiger type.

ELECTRON OPTICS AND THE ELECTRON MICROSCOPE:
By V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier and A. W. Vance. John Wiley & Sons, New York; Chapman & Hall, London, 1945, 766 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $10.00.

Part I of this treatise offers a comprehensive description of the various types of electron microscopes, a non-mathematical discussion of electron optical theories on which they are based, and a practical guide for their effective operation. Part II contains a thorough coverage of the mathematical theory. Important topics considered include: the determination of potential distribution; electron trajectory tracing;

magnetic fields and electron motion; electron lenses, their aberrations and corrective measures; and image formation in the electron microscope. A list of references accompanies each chapter.

ENDLESS HORIZONS:

V. Bush, introduction by F. B. Jewett. Public Affairs Press, Washington, D.C., 1946. 182 pp., portrait, 9¼ x 6 in., cloth, $2.50.

Seventeen papers, ranging from the quietly humorous "The Inscrutable Past" to the practically suggestive "Science for World Service", demonstrates the versatility of Dr. Bush. The general tone of the whole group is forward-looking. In the varied fields under consideration, shortcomings are demonstrated, present achievements are assessed, and remedies and goals are proposed for the future.

ENGINEERING MECHANICS:

S. Fairman and C. S. Cutshall. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 267 pp., diagrs., tables, 9¼ x 5¾ in., cloth, $3.00.

The object of this book is to provide a self-contained course in fundamental mechanics which can readily be covered in the usual time allotted to the subject. A knowledge of calculus and general physics is assumed, and no attempt is made to include material which may properly be deferred to advanced strength of materials. Special attention has been paid to arranging the subject matter in the most logical and effective order within the two main sections, statics and kinetics.

HEATING and VENTILATING for ARCHITECTS and BUILDERS:

By R. K. Cornell. Paul Elek Publishers Ltd., 37-38 Hatton Garden, London, R.C.1, 1946. 56 pp., illus., diagrs., charts, tables, 10 x 7¼ in., cloth, 7s.6d.

The first two chapters of this practical book present the fundamental principles and the calculation of heat losses and heat requirements. Chapter III contains the classification and comparison of heating and water supply systems, the application of such apparatus, and water treatment. In chapter IV will be found furnace control, the combustion of fuel, and running costs of systems. The final chapter deals with the types and operation of equipment for ventilating and air conditioning.

HEATING of STEEL:

M. H. Mawhinney, Reinhold Publishing Corp., New York, 1945. 265 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $5.00.

The opening chapter discusses the oxidation, carburization and decarburization of steel when heated under various conditions. The succeeding six chapters deal with purposes for which steel is heated, and practical information concerning the heating methods, types of furnaces, and furnace tools which are important in obtaining the best results. Refractories and the relation between heat transfer and fuel economy are also covered.

INDUCTION HEATING:

H. B. Osborn, and others. American Society for Metals, Cleveland, Ohio, 1946. 172 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.00.

Five lectures presented at the 1946 National Metal Congress are combined in this book. They deal respectively with the principles and theory of high frequency heating; induction heating circuits and frequency generation; practical applications of the motor generator type of induction heating (up to 10,000 cycles); practical applications of high frequency induction heating (100,000 cycles and up); and a comparison of induction heating with other methods of heat treating.

MATERIALS-HANDLING EQUIPMENT, a Modern Manual:

M. W. Potts. Pitman Publishing Corp., New York and Chicago; Sir Isaac Pitman, Toronto, 1946. 172 pp., illus., 8¼ x 5½ in., cloth, $2.50.

This book is devoted to defining, describing and presenting the application of a number of standard types of materials-handling equipment. Earth-moving and other equipment used primarily by contractors and specialized units for certain industries have been omitted. Types covered are dealt with under the following section headings: conveyors, elevators, hand-operated equipment, hoisting machinery, trackless carriers, tractors and trailers, and miscellaneous equipment with general applications.

PLASTICS MOLD ENGINEERING, the Fundamentals of Plastics Mold Design and Construction:

J. H. DuBois and W. I. Pribble. Chicago, American Technical Society; Toronto, General Publishing, 1946. 494 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $9.75 (in Canada).

The early chapters describe types of molds, tool-making equipment and methods, materials for mold making, and plastics product design. The succeeding chapters are devoted to detailed description of individual molds and specific molding processes. The book is profusely illustrated by sketches, photographs, and working drawings, and some forty pages of useful reference tables are provided.

MODERN PLASTICS:

By H. Barron. John Wiley & Sons, New York; Chapman & Hall, London, 1945. 680 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $7.50.

The introduction discusses raw materials and the polymerization process. The succeeding parts deal respectively with: thermosetting resins and their plastics; cellulose plastics; vinyl plastics; other leading plastics, including casein; some important aspects of plastics, such as the use of high-frequency heating and physical testing methods. Processes and plastics are closely associated, as: molding and phenolics; injection molding and cellulose acetate; extrusion and polyvinyl chloride; fibers and nylon, etc.

NEW CITIES FOR OLD:

L. Justement. McGraw-Hill Book Co., New York and London, 1946. 232 pp., illus., diagrs., charts, tables, 10¼ x 7 in., cloth, $5.50.

Part I presents a study of urban growth and decay as a basis for city planning within the limitations of a system of private enterprise. It poses certain problems and suggests possible solutions. In Part II the city of Washington, D.C., is utilized as an example to demonstrate the kind of city planning put forth in this book. In Part III, with the political background as a frame of reference for urban reconstruction, the author outlines his conception of a workable, integrated solution of the problem discussed in Part I, including the financial and legal aspects.

PRINCIPLES and PRACTICE of HEAT TREATMENT:

By J. Winning. 2 ed. Emmott & Co., Ltd., Manchester and London, England, 1945. 108 pp., illus., diagrs., charts, tables, 7¼ x 4¾ in., paper, 3s.6d.

The first four chapters of this small volume deal with general principles, furnaces and equipment, casehardening, and hardening machines. The book devotes separate chapters to carbon and alloy steels, stainless and rustless steels, and non-ferrous alloys. Material on the inspection of heat treated parts is included, and there is a discussion of how to plan a heat treating program for any particular job.

RUBBER IN ENGINEERING:

Prepared under the direction of the Controller of Chemical Research of the Ministry of Supply and the Directors of Scientific Research of the Ministry of Aircraft Production and the Admiralty on the Basis of Research carried out by the Imperial Chemical Industries, Ltd. Chemical Publishing Co., Brooklyn, New York, 1946. 267 pp., illus., diagrs., charts, tables, 8¾ x 5½ in., cloth, $5.50.

Part I, describing the rubber-like state, and Part II, discussing the general properties of rubber, furnish engineers with a general survey of the information available on the theoretical aspects of the subject. Part III provides useful information on the compatibility and incompatibility of rubber properties in their relation to practical use, covers the bonding of rubber to metal, and discusses other aspects of rubber technology. Part IV deals at some length with the principles of the design of rubber engineering compounds for shock absorption, vibration insulation, etc.

WATER SUPPLY AND PURIFICATION:

W. A. Hardenbergh. 2 ed. International Textbook Co., Scranton, Pa., 1945. 488 pp., illus., diagrs., charts, tables, 8½ x 5¼ in., cloth, $4.50.

The theories underlying the collection, transportation, delivery and treatment of water are presented, including the determination of quantity of water available, pipe line calculations, design of distribution systems, and purification processes. Actual problems are used for illustrative purposes to bridge the gap between theory and practice. This second edition includes material concerning developments in water supply problems resulting from the War.

SIMPLIFIED PUNCH and DIE MAKING:

By J. Walker and C. C. Taylor. Macmillan Co., New York, Toronto, 1946. 235 pp., illus., diagrs., tables, 8½ x 5½ in., cloth, $5.50.

Each step in the design, construction and operation of dies and punches is clearly and fully explained in this book for the use of those without previous experience. All important types of dies and punches used today are covered, with detailed information on specifications, materials, methods, etc. There is a glossary of shop terms.

STATICALLY INDETERMINATE STRUCTURES:

By L. C. Maugh. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 338 pp., diagrs., charts, tables, 9¼ x 5¾ in., cloth, $5.00.

Following the classification and description of statically indeterminate structures, this book explains and illustrates methods of analysis of these structures with emphasis on methods of successive approximation. These methods are based on fundamental principles of structural mechanics that are applicable to the design of most frame structures. Special problems dealt with in the last chapter are frames with semi-rigid connections, the calculation of stresses in space frames, and shearing stresses in thin-walled closed sections.

(Continued on page 600)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

October 15th, 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 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 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

BENTALL—CHARLES, of Vancouver, B.C. Born at Felsted, England, June 16th, 1882. Educ.: Tech. School, Chelmsford; R.P.E., B.C.; 1908-12, structl. engr., J. Coughlan & Sons; 1912, (6 mos.), member firm Wilson, Lake & Bentall; with Dominion Construction Co., Ltd., Vancouver, as follows: 1912-14, engr., 1914 to date, genl. mgr., continuously engaged in design and constrn. of large structures.

References: E. A. Cleveland, T. Berry, G. W. Allan, W. O. Scott, J. N. Finlayson.

BURGESS—JOHN ALEXANDER, of Trail, B.C. Born at Edmonton, April 13th, 1923. Educ.: B.A.Sc., (Mech.), B.C., 1946; 1942-45, (summers), helper or operator with Consolidated Mining & Smelting Co., in foundry, electric shop, and metall. plants; dftsman, indicator cards on triple expansion steam engines, preliminary analyses, etc., West Coast Shipbuilders Ltd., Vancouver; and at present, jr. mech. engr., assistant to mtce. engr., Consolidated Mining & Smelting Co., Trail, B.C.

References: J. V. Rogers, S. C. Montgomery, E. Mason, A. C. Ridgers, A. H. W. Busby.

CREIGHTON—HUGH HERBERT LOWRY, of Ste. Therese, Que. Born at Mannville, Alta., June 19, 1918. Educ.: B.Sc., (Elect. Engrg.), Alberta, 1941; 1941-42, test engr., Canadian General Electric; 1942-45, elect. engr., Aluminum Co. of Canada; 1945 to date, elect. engr., A. D. Ross & Co., Ltd., Ste. Therese, Que.

References: A. D. Ross, J. W. Stafford, B. R. Perry, J. Morse, J. R. Auld, G. Kearney.

FUGLER—RONALD WILLIAM, of Shawinigan Falls, Que. Born at Toronto, Ont., Sept. 17th, 1919. Educ.: B.A.Sc., (Chem. Engrg.), Toronto, 1941; 1941-42, shift supvr., ammonia nitrate divn., 1942-43, synthetic ammon divn., Welland Chemical Works, Niagara Falls; 1943-46, Officer I/C Machine Shop, Canadian Armoured Troop Work Shop, responsible for mtce. & inspecn. artillery equipt., etc., R.C.E.M.E.; at present, mech. supvr. & mtce. engr., fabrication divn., Canadian Resins & Chemicals Ltd., Shawinigan Falls, Que.

References: C. R. Young.

HEATHERINGTON—KENNETH, of Grand'Mere, Que. Born at Newcastle-on-Tyne, England, Oct. 10th, 1919. Educ.: B.Sc., Sir George Williams Coll., 1945; 1938-41, dftsman, detail, dftg., checking, preparing bills of material, calculations in connection with constrn. elect. transmission lines, Aluminm Laboratories Ltd.; 1941-46, dftsman., (engrg. dept.), detail and arrangement drawings for reciprocating steam engines and boilers, etc., (marine dept.), worked on design and layout of piping systems on ships, steam, water, oil and sanitary piping, steam heating layouts and all piping in connection with pumps and other auxiliary equipt., selection and ordering of material, estimating and genl. engineering work, Canadian Vickers Ltd.; and at present, dftsman., plant and machinery, layouts, design and genl. engrg., Consolidated Paper Corporation Ltd., Grand'Mere, Que.

References: R. A. H. Hayes, J. E. Thicke, G. Agar, R. C. Flitton, V. Jepsen, G. R. Goring.

HERMANOWICZ—TADEUZE, of Sorel, Que. Born at Naklo-Kielce, Poland, March 27th, 1910; Metallurgical Engr., 1937, Mining Academy, (Metallurgical Faculty of the Univ. of Jagiello, Cracow, Poland), equivalent of degree from a recognized Canadian university; Member, Assn. Polish Engrs. in Canada, and educational qualifications guaranteed by the Assn.; 1937-39, asst. supt., heat-treating of all types steel goods, Baildon Steel Works, Upper Silisia; 1939-40, special assign., French Navy, to put in operation prod. of 220 m/m shells and alloy steels, Etab. National de la Mazine, Loire, France; 1940-42, directing own drawing office, geo. charts, tech. drawings, etc., Aix-les-Bains, Savoie, France; 1942 to date, chief metallurgist and director of labs, i/c melting dept. (carbon, alloy, tool steels and cast iron), heat treating dept., metall. control and inspecn. including patterns, labs. (physical testing, chemistry and metallography), Sorel Industries Limited, Sorel, Que.

References: H. Gendron, J. Pawlikowski, M. Weinreb, D. Goldwag, E. Gohier, M. Szymanski.

PERKINS—CHARLES LEE, of Toronto. Born at Woodstock, N.B., Feb. 8th, 1917. Educ.: B.Sc., (Elect. Engrg.), New Brunswick, 1937; R.P.E., Ontario; 1937-39, sr. asphalt plant inspector, Milton Hersey Co., Ltd.; 1939-40, costs and estimating, H. J. O'Connell Ltd.; 1940, instru'man., Foundation Co. of Canada; with R.C.E., as follows: 1941-43, O/C A Platoon Canadian Road Constrn., I/C various highway and airfield projects in U.K., 1943-44, setting up of plants for prod. bituminized Hessian surfacing for airfields and supervising of laying of material in India and Burma, 1944-45, O/C No. 2 Cdn. Mech. Equip. Pl. I/C various highway projects in Holland and Belgium, 1945, Mech. Equipt. Advisor to Chief Engr., British 30 Corps, I/C all mech. equipt. in Corps; Mech. Equipt. Advisor to Chief Engr., 1st /Cdn. Army, I/C all mech. equipt. (with the rank of Major); 1946 to date, res. engr., i/c staff working on correlation and correction of runway land and soil testing, Civil Aviation Br., Dept. of Transport, Toronto.

References: A. F. Baird, P. N. Gross, M. F. MacNaughton, E. O. Turner.

STARR—GRANT BONDY, of Nanaimo, B.C. Born at Ochre River, Man., May 23rd, 1910. Educ.: B.Sc., (Civil), Manitoba, 1934; (2 yrs.), Manitoba Public Works (highways); 1938, trans. line, Wpg. Electric Co.; 1938-39, Madsen Red Lake Gold Mines; 1940-42, survey work for trans. line from Beauharnois to Toronto and Burlington, then asst. to res. engr. in hydraulic dept. on constrn., prepared quantity estimates, various constrn. survey, canal rock exc., control gate erection, checking reinf. steel placing, genl. survey and dftng. in conjunction with work, H.E.P.C. of Ontario; 1943-44, (1 yr.) supervising constrn. of concrete bldg., as well genl. bldg., constrn., etc., Demerara Bauxite Co., British Guiana; 1944-45, transferred Cuyuni Goldfields Ltd., i/c mine develpt. and prod., making complete new map of property; 1945, constrn. for self; at present, civil engr., stream study erection fish counting fences, various tank contrn., genl. survey work for Pacific Biological Station, Nanaimo, B.C.

References: J. N. Finlayson, A. L. Malcolm, N. Malloch, B. W. W. McDougall, A. L. Martin, W. B. Korcheski.

TONKIN—CLARENCE, 16 Ruttsn St., Port Arthur, Ont. Born at St. Buryan, Cornwall, Eng., Sept. 5th, 1894. Educ. I.C.S. and private tuiton; 1912-15, chairman, G.T.P.Rly., Ft. Wm.; 1914-18, rodman, C.G.Rly.; with Canadian National Railways, as follows: 1918-26, dftsman., Fort Wm. and Port Arthur, 1926-27, transitman, Port Arthur, 1937-44, asst. divn. engr., Port Arthur to Winnipeg, two lines; 1944 to date, divn. engr., Port Arthur to Winnipeg. (Asking for admission as Affiliate.)

References: P. C. Perry, N. M. Waddell, H. G. O'Leary, J. W. Porter, R. W. Ross, F. Graham.

WHITE—HERBERT BRIAN, of Toronto, Ont. Born at Toronto, Sept. 18th, 1922. Educ.: B.S., (Civil), Toronto, 1944; R.P.E., Ontario; 1942, (summer, 4 mos.), geophysical survey for oil, Ivy Drilling Co.; 1943, (summer), jr. tool designer, Victory Aircraft, Malton, Ont.; 1944-45, Lt. Constructor, R.C.N.V.R.; at present, lecturer in statics, dynamics, strength of materials, 1st and 2nd yr. students at Ajax Division, University of Toronto.

References: T. R. Loudon, R. F. Legget, C. F. Morrison, M. W. Huggins, C. Herschfield.

WILEY—WALTER KENNETH, of Montreal, Que. Born at Missoula, Montana, July 29th, 1909. Educ.: B.Sc., (Elect. Engrg.), New Brunswick, 1931; 1934-44, meter reader, through various divisions of sales until 1940, when appointed industrial power consultant, contacting industrial customers on various applications of electricity for power, heating and lighting and in rate analysis; with Northern Electric, as follows: 1944-45, lighting engr., illumination dept., 1945 to date, industrial heating mgr., work along lines of industrial heating engr., solving heating problems, training personnel.

References: E. O. Turner, E. W. Jeffrey, E. S. Braddell, J. J. Miller, D. C. Borden.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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 for junior position in control department of large pulp and paper mill in Western Ontario. Paper experience preferred. Salary open. Apply to File No. 3593-V.

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to Fil.e 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 AND RESEARCH CHEMISTS with considerable experience required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CIVIL

TWO CIVIL ENGINEERS are required to act as senior and junior structural designers respectively with a steel company in Southern Ontario. Apply to File No. 3389-V.

ELECTRICAL

ELECTRICAL ENGINEER with experience in the design of electrical circuits required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3644-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.

MECHANICAL

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.

MECHANICAL DRAUGHTSMAN with experience in power house layouts required by an engineering firm in Toronto. Salary open. Apply to File No. 3630-V.

MECHANICAL ENGINEER, bilingual, with shop or automotive experience, required for equipment maintenance by a manufacturer in the Montreal area. Salary open. Apply to File No. 3631-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 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 DRAUGHTSMEN, graduates preferred, with experience in shop and field erection, required for design of coal and oil fired heating and steam systems by an industrial firm in Montreal. Salary open. Apply to File No. 3647-V.

MECHANICAL ENGINEER with knowledge of machine tools, age about 35, required in Montreal for work in connection with purchase, design, re-conversion and sale of machinery. Salary $300-$400. Apply to File No. 3648-V.

MECHANICAL SALES ENGINEER for office position with a firm in Montreal area manufacturing tools and machines, preferably bilingual and over 30. Salary open. Apply to File No. 3649-V.

METALLURGICAL

RESEARCH METALLURGIST, with at least five years post graduate experience, preferably in the field of ferrous physical metallurgy, needed in Toronto area. Salary $275-$325. Apply to File No. 3640-V.

MISCELLANEOUS

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.

ASSISTANT PROFESSORS AND INSTRUCTORS required for the staff of a technical college in New York State. Salary open. Apply to File No. 3600-V.

GRADUATE ENGINEER, bilingual, required for senior position on the Montreal sales staff of a firm manufacturing and installing mechanical equipment in buildings of all types. Veteran preferred. Salary open. Apply to File No. 3622-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER required as assistant to purchasing agent of a Montreal engineering firm. Salary open. Apply to File No. 3624-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.

SALES OR OFFICE MANAGER required by a firm manufacturing pumps and special equipment in Central Ontario. Salary open. Apply to File No. 3627-V.

SALES ENGINEER with knowledge of structures and heavy machinery, preferably bilingual with sales experience in Quebec, under 40, to take charge of Montreal office of a firm manufacturing cranes, hoists and other heavy mechanical equipment. Salary open. Apply to File No. 3628-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 heavy construction experience and thorough knowledge of Quebec market, preferably bilingual, car owner, required by manufacturer of technical products. Salary open. Apply to File No. 3629-V.

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.

SALES ENGINEER to call on Industrial and Municipal engineers and executives across Canada. Returned man, under 40 with knowledge of mill pipe layout practice preferred. Position with future in nationally known firm, headquarters Toronto. Salary and expenses. Apply to File No. 3636-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.

JUNIOR ENGINEERS, CIVIL, ELECTRICAL 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.

ENGINEERING DRAUGHTSMEN with survey experience for the lands department of a public utility with headquarters in Montreal. Salary open. Apply to File No. 3644-V.

EXPERIENCED INSTRUMENT MAN for field work required by an engineering company with headquarters in Montreal. Salary open. Apply to File No. 3644-V

CONSTRUCTION ENGINEER with experience in steel erection required as maintenance engineer for wireless stations in the Maritimes. Salary from $200. Apply to File No. 3645-V.

JUNIOR ENGINEERS, recent graduates up, required by an organization in Montreal, for the inspection of buildings for fire hazards, etc. Bilingual preferred. Salary about $200. Apply to File No. 3651-V.

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

CHEMICAL

CHEMICAL ENGINEER with some pulp and paper experience required for the technical department of a paper mill in Lake St. John. area. Apply to File No. 3470-V.

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. Salary open. Apply to File No. 3549-V.

JUNIOR CHEMICAL ENGINEERS OR CHEMISTS, preferably bilingual, for various paper plants in Quebec. Salary from $200 according to experience. Apply to File No. 3555-V.

CHEMICAL ENGINEER required by an industrial organization with headquarters in Montreal as assistant to chief chemist and control supervisor in a pulp and paper plant. Initiative to deal with unexpected problems essential. Salary from $250 according to experience. Apply to File No. 3555-V.

CHEMICAL ENGINEER, recent graduate up, required by a petroleum refining company in Montreal for process and design work. Salary about $200. Apply to File No. 3575-V.

CHEMICAL ENGINEERS, age 22-35, recent graduates up, are required by a Montreal firm for development work, maintenance, design and construction in explosives field. Sales and technical service representation to paper and textile industries. Salaries according to qualifications. Apply to File No. 3588-V.

CHEMICAL ENGINEER, Ph.D. or M.Sc. Specialized in physical chemistry, required by industrial organization in Montreal area as member of organic research team. Salary open. Apply to File No. 3596-V.

CHEMICAL ENGINEERS, recent graduates up, required as shift supervisors by an industrial chemical plant in the Montreal area. Salary from $200. Apply to File No. 3605-V.

CHEMICAL ENGINEER, under 30, required for the patent department of a large industrial organization in Montreal. Salary from $200. Apply to File No. 3609-V

CIVIL

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to File No. 3394-V.

CIVIL ENGINEER recent graduate, must be bilingual, required for work on general design, survey and construction of transmission lines in the Montreal area. Apply to File No. 3446-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 ENGINEER, recent graduate, required by a firm of consulting engineers in Montreal, to assist Engineer in charge of field work in Ont Salary $175 up. Apply File No. 3518-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 with experience as structural designers and draughtsmen are required by an engineering firm in Montreal. Salary from $300—$400 according to experience. Apply File No. 3520-V.

CIVIL ENGINEER to be superintendent of construction with a contractor in Montreal. Salary according to qualifications. Apply to File No. 3558-V.

CIVIL ENGINEER, recent graduate up, to be assistant to town engineer of a town in the Montreal area. Permanent position. Salary from $175 up. Apply to File No. 3569-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 considerable building experience, as construction superintendent with a firm of building contractors in Central Ontario. Salary open. Apply to File No. 3582-V.

CIVIL ENGINEER with 3 or more years' experience on design of industrial buildings, equipment, supports and foundation work, is required by a Montreal firm for structural design work in steel, timber and reinforced concrete. Salary $200 up. Apply to File No. 3588-V.

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.

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 ENGINEERS, age 30 to 40. 5 to 10 years experience, for estimating design and general engineering for large public utility in Toronto area. Apply to File No. 3429-V

ELECTRICAL DRAUGHTSMEN with experience in substation design, not necessary graduate engineers, required by a public utility in the Montreal area. Salary $200 to $225. Apply to File No. 3446-V.

ELECTRICAL DRAUGHTSMAN with considerable experience in industrial light, heat and power layouts is required by a consulting engineer in Montreal. Salary from $200 according to experience. Apply File No. 3528-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 power plant experience, must be bilingual, to take complete charge of power plants and distribution system for a N.B. town. Salary according to experience. Apply to File No. 3561-V.

ELECTRICAL ENGINEER for a junior position in the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-V.

ELECTRICAL ENGINEER DRAUGHTSMEN, preferably with pulp and paper experience, required by a paper company in Montreal. Salary open. Apply to File No. 3610-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.

MECHANICAL

MECHANICAL ENGINEER, graduate with 4 or 5 years' experience in heating and ventilating layouts is wanted by a consulting engineer in Montreal. Apply File No. 3243-V.

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.

JUNIOR MECHANICAL ENGINEER with some experience on mechanical design. Preference to ex-service men. Salary from $200 to $250. Location Quebec City Apply to File No. 3401-V.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Apply to File No. 3406-V.

MECHANICAL ENGINEER DRAUGHTSMAN with two or three years experience, is required for work with a paper company in the province of Quebec. Salary $250 to $275 a month. Apply to File No. 3424-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 considerable experience in plumbing, heating, ventilating, age 30-45, required for a permanent job as a designer with a Montreal architectural firm. Salary from $300. Apply to File No. 3473-V.

MECHANICAL ENGINEER, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

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

MECHANICAL ENGINEER with considerable industrial experience is required for the staff of a firm of consulting engineers in Montreal. Salary about $250 Apply File No. 3525-V.

MECHANICAL DRAUGHTSMAN with over five years experience in piping layout and similar work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-V.

MECHANICAL ENGINEER, recent graduate, for the engineering staff of a pulp manufacturer in Eastern Quebec. Apply to File No. 3547-V.

MECHANICAL ENGINEERS 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 at least five years' industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary $275-$325. Apply to File No. 3553-V.

MECHANICAL ENGINEER with considerable experience in heating and ventilation, etc., required by a firm of consulting engineers in Montreal. Salary open Apply to File No. 3565-V.

MECHANICAL ENGINEERS with experience in heating and ventilating or the pulp and paper industry or with general mechanical layout and design work are required by a firm of consulting engineers in Montreal. Salary from $250-$350 according to experience. Apply to File No. 3568-V.

MECHANICAL ENGINEER, recent graduate, for junior position in the design department of a firm in Central Ontario making special heavy duty mobile equipment. Apply to File No. 3572-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 some electrical experience for the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-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 ENGINEERING DRAUGHTSMAN, fully experienced in kraft and sulphite mills processes and modern design, required by a pulp and paper firm on the West Coast. Salary open. Apply to File No. 3586-V.

MECHANICAL ENGINEER, preferably with mining experience, age 25-35, required by a manufacturer in Montreal to do estimating or design work on mining equipment and assist in sales. Salary according to experience. Apply to File No. 3589-V.

MECHANICAL ENGINEER as production engineer for a sea food canning company in Eastern Canada. Duties would include plant design, production improvement and plant maintenance. Bilingual and experienced man preferred. Salary from $200-$300. according to qualifications. Apply to File No. 3592-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.

MECHANICAL ENGINEER with five to ten years' industrial experience and familiar with the layout and construction of chemical plants, required by a manufacturer in the Montreal area for plant design and construction. Salary from $300. Apply to File No. 3605-V.

MECHANICAL ENGINEER with experience in the automotive business and the maintenance of all types of internal combustion engines required by an oil company in the Montreal area. Salary open. Apply to File No. 3608-V.

MECHANICAL ENGINEER with at least five years industrial experience required by a textile firm with headquarters in Montreal. Salary open. Apply to File No. 3615-V.

COMBUSTION ENGINEER, MECHANICAL, preferably with five years industrial experience, required by a textile firm with headquarters in Montreal. Salary from $300. Apply to File No. 3615-V.

MECHANICAL ENGINEER with at least five years' experience of aluminum processing, plant design and operation, etc., required for Aluminum production organization in Australia. Limited contract. Salary open. Apply to File No. 3620-V

METALLURGICAL

METALLURGIST, age 25-30, veteran, experience in Metallurgical Laboratory or Mine Assay office and Mining Mill practice decided advantage, required by a Montreal firm to be trained for Sales Representative. Salary depending on experience. Apply to File No. 3588-V.

MISCELLANEOUS

STEAM PLANT SUPERINTENDENT with extensive experience is required to superintend the steam plant of a pulp and paper mill in Western Ontario. Salary would be $300 to $350. Apply to File No. 3227-V.

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual, with some practical experience, is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

CHIEF DRAUGHTSMAN, experienced in all types of structural work, required to take charge of a draughting office for a central Ontario city. Apply to File No. 3428-V giving all particulars including salary expected.

CHIEF DRAUGHTSMAN to take charge ofengineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. No.3443-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.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-V.

CHEMICAL OR MECHANICAL ENGINEER with construction experience in the chemical field, a knowledge of hydrocarbons and at least five years experience since graduation is required by a chemical firm in Western Ontario. Salary from $250. Apply to File No. 3502-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-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.

GRADUATE ENGINEERS with experience in mechanical and chemical process layouts are required by an engineering firm in Montreal. Salary from $300-400 according to experience. Apply to File No. 3520-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 qualificatons. Apply to File No. 3524-V.

DESIGN ENGINEER with several years experience in hydro-electric work is required by a firm of consulting engineers in Southern Ontario. Apply to File No. 3540-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.

CIVIL OR MECHANICAL ENGINEERS, preferably with pulp and paper experience, required for engineering and operating staff of a large Ontario corporation. Salary according to qualifications. Apply to File No. 3554-V.

CHEMICAL OR MECHANICAL ENGINEERS, age about 30, with at least five years' experience in the paper industry, required by an Ontario Company to train for executive positions. Salary open. Apply to File No. 3554-V.

CIVIL AND MECHANICAL ENGINEER, capable of detail work on compressor stations, piping layouts, surveying, etc., wanted by a gas producing and distributing utility in Southwestern Ontario. Preference to Service personnel. Good future for right man. Apply to File No. 3562-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.

CIVIL OR MECHANICAL ENGINEER with construction experience required by an Ontario firm manufacturing and installing building specialties for industrial plants. Salary open. Apply to File No. 3567-V.

SALES ENGINEER with experience to organize the sales and service or marine engines in the Prov. of Quebec. Must be bilingual. Headquarters Montreal. Salary $250 to start. Apply to File No. 3576-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.

ELECTRICAL OR MECHANICAL ENGINEERS, recent graduates, required for design work in the hydraulic side by a manufacturer in the Montreal area. Apply to File No. 3579-V.

MECHANICAL AND ELECTRICAL DRAUGHTSMEN required by a Montreal firm. Must have working knowledge of equipment layout, architectural, piping and design. Salary from $200 up. Apply to File No. 3588-V.

MECHANICAL AND ELECTRICAL ENGINEERS, from recent graduates up, are required for mechanical and electrical maintenance, also design phases of project engineering work, by a Montreal firm. Salaries according to qualifications. Apply to File No. 3588-V.

GRADUATE ENGINEERS required as Development Engineer and Assistant to Sales Manager by a Montreal firm. Industrial, also sales and administrative experience necessary. Salary $200 up according to experience. Apply to File No. 3588-V.

INDUSTRIAL ENGINEER, 5 years' experience industrial manufacturing or process work, required by a Montreal firm for study and co-ordination of plant work. Salary $295 up according to qualifications. Apply to File No. 3588-V.

CHIEF DRAUGHTSMAN, under 35, 5-12 years' experience in drawing office, Including year or more as squad boss, required by a Montreal firm. Salary $225 up. Apply to File No. 3588-V.

ELECTRICAL, MECHANICAL OR COMBUSTION ENGINEER required by an industrial firm in Montreal for estimating and supervising the installation of heating plants. Age over 35. Salary from $300 according to experience. Apply to File No. 3602-V.

DESIGN ENGINEER, capable of assuming responsibilities of designing structures and equipment layouts of steam plants, hydro-electric developments, etc., required by an industrial corporation in Montreal. Salary from $350 according to experience. Apply to File No. 3603-V.

HYDRAULIC ENGINEER, familiar with hydraulic machinery design, installation, stream functions and runoff computations, etc., required by an industrial corporation in Montreal. Salary from $300 according to experience. Apply to File No. 3603-V.

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.

RESIDENT ENGINEER with considerable construction experience, preferably bilingual, to take charge of the construction of a dam on the Upper Ottawa River. Salary from $300. Apply to File No. 3613-V.

CHIEF DRAUGHTSMAN with experience in design and controlling a design staff required for both structural and equipment work by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-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.

MACHINE DESIGNER with considerable experience required by a company in Southern Ontario. Experience on the designing of steel mill equipment or heavy machinery desirable but not essential. Salary according to qualifications. Apply to File No. 3617-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER, with transmission line experience, required for the engineering department of an industrial firm in Montreal. Salary from $225. Apply to File No. 3618-V.

SALES ENGINEERS

Textile Machinery

Superior line. Must have wide engineering experience. Good salary. Reply in detail.

Construction and Allied Equipment

Good earnings and opportunity for an aggressive man. Wide engineering experience necessary. Reply in detail.

•

Apply to File No. 3639-V.

Situations Wanted

CHEMICAL ENGINEER, graduate in 1939, Jr.E.I.C., veteran, considerable experience in development and process control and quality control as well as some experience in production work, desires change. Employment since graduation, except for time in the services, has been with a large chemical manufacturing company. Montreal or Toronto areas preferred. Apply to File No. 798-W.

ELECTRICAL ENGINEER, Jr.E.I.C., age 26, B.Sc. (Man.) '42, E.M.E. Canadian Army for 4 years, in charge of workshop units engaged in the maintenance and repair of precision optical and mechanical instruments. Position of responsibility desired in research, power, traction or mechanical line. Ontario or western area preferred. Apply to File No. 1537-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., age 28. Five years experience including plant layout and design; plant engineering and works and building maintenance; maintenance of trucks, tractors, cranes and small ships. Aircraft project and service engineer, design of modifications and failure investigation, power plant, engine, propeller, etc. Good organizer and ability to handle men. Engineering Officer, Royal Canadian Navy. Desires sales or plant engineering position in Montreal area. Available two weeks notice. Apply to File No. 1658-W.

SALES ENGINEER, Jr. E.I.C., P. Eng., Que., age 32, B. Eng. McGill in Mechanical, experience in sales, design and plant engineering. Married. Bilingual. Location immaterial. Veteran. Available on short notice. Apply to File No. 1692-W.

GRADUATE ENGINEER, B.Sc. (Civil), M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to File No 2440-W.

CHIEF DRAUGHTSMAN

Registered graduate engineer with five years draughting room and related engineering office experience, preferably in pulp and paper or process industries.

•

ASSISTANT ENGINEER

Registered graduate engineer experienced on estimates and specifications for industrial work.

•

MECHANICAL *and* STRUCTURAL DESIGNERS *and* DRAUGHTSMAN

Required at once for an operating pulp and paper mill in Port Arthur district.

ALL SALARIES OPEN

Applicants should include in first letter a summary of business experience and suitable references. Interviews will be arranged where possible. Apply to File No. 3653-V.

BRITISH COLUMBIA CIVIL SERVICE

WANTED

By Open Competition

COMBUSTION ENGINEER

Salary: $3,000 rising to $3,600 per annum.

Duties: To design and supervise heating and ventilation installations, etc., and boiler plants in connection with public buildings, under the direction of the Chief Architect.

Qualifications: Must be a member of the Association of Professional Engineers of British Columbia as a Mechanical Engineer specializing particularly in heating, ventilation and refrigeration, with a good record of successful experience.

Applicants must be British subjects, under 45 years of age. Preference is given ex-members of His Majesty's Forces.

Applications will be received immediately by the Chairman, Civil Service Commission, Parliament Buildings, Victoria, B.C.

ELECTRICAL ENGINEER, S.E.I.C., age 27, married, class of 1946, formerly a "Flight Engineer" in R.C.A.F., has approximately one and a half years' experience in mine and smelter electrical work. Position desired more along Mechanical line than Electrical. Will go anywhere, anytime. Apply to File No. 2631-W.

ELECTRICAL ENGINEER, Jr.E.I.C., graduate McGill University 1944, age 25, single. Experience in industrial, radio communications and as Radar officer in R.C.E.M.E. Interested in a position leading to sales engineering or industrial management. Services available on one month notice or less. Apply to File No. 2649-W.

MECHANICAL ENGINEER, S.E.I.C., B.Sc., Queen's 1945, age 24, married, veteran, one year experience in design of heavy machinery and draughting, course in Time and Motion Study at McGill. Interested in Industrial, Production or Maintenance Engineering. Prefer Montreal area or Ontario. Available on one-month notice. Apply to File No. 2715-W.

GRADUATE CHEMICAL ENGINEER, S.E.I.C., B.A.Sc., Toronto, 1946, available immediately. Interested in position with Consultant or in Production. Location preference: Hamilton, Ont. Apply to File No. 2721-W.

GRADUATE ELECTRICAL, TORONTO, 1932. M.E.I.C., P. Eng. Seeks responsible Administrative or Industrial Engineering position with Manufacturer, Supplier or User of Electrical Equipment and or Electrical or General Management, Engineering Services, preferably outside the Province of Quebec. Fourteen years' experience in Radio and Aviation Industries, including: four years radio development and manufacture, one year supervision of instruction radio trade school, six years supervision of installation, operation and maintenance of radio aids to air navigation, one year supervision of airline communications, two years equipment and sales engineering, aeronautical and railroad radio equipment. This included executive and administrative responsibility. Apply to File No. 2725-W.

GRADUATE FOREST ENGINEER, Jr. E.I.C., single, age 28, with six years' bush experience, in timber, improvement and operational surveys, operational planning and layout, construction and supervision, requires position as assistant logging superintendent or assistant logging engineer. Available immediately for service anywhere in Canada or British possessions. Details of experience and references furnished on request. Apply to File No. 2726-W.

PLANT ENGINEER, B.Eng., M.E.I.C., R.P.E. (Ont.), age 35, married, with 11 years' experience in design, construction and maintenance of electrical and mechanical installations and buildings. Aggressive, resourceful and co-operative Successful record in responsible supervisory position. Apply to File No. 2728-W.

COMMUNICATIONS ENGINEER. Engineering Physics (Hons.), Jr.E.I.C., Assoc. I.R.E., R.P.E. Ont., F.B.I.S., age 26. Summer employment with telephone manufacturer, Ontario Hydro, and as radio instructor. Three years with the Royal Navy as Radar Officer in complete charge of maintenance, installation and operation of radar equipment on board. One year field engineering with commercial FM radio equipment. Seeks position with opportunity for original work in electronic and allied fields. Available beginning 1947. Apply to File No. 2779-W.

CIVIL ENGINEER, age 39, M.E.I.C., R.P.E., etc., used to responsibility and control in Consultative, Public Authority and Governmental fields, seeks worthwhile professional or commercial opportunity in Southern Ontario. Apply to File No. 2790-W.

MECHANICAL ENGINEER, Sask., '46, with summer experience in highway surveying, time checking, a steel rolling mill, ship wiring, job planning and cost estimating, desires work, preferably in Vancouver area. Would prefer work including time and motion studies, cost control and estimating, and job evaluation. Available on short notice. Apply to File No. 2795-W.

LIBRARY NOTES (*Continued from page 595*)

Though not available in the Institute Library, inquiries concerning the following new books will be welcomed there or may be sent direct to the publishers.

ENCYCLOPEDIA OF CHEMICAL REACTIONS, Vol. 1:

Compiled and edited by C. A. Jacobson. Reinhold Publishing Corp., New York, 1946. 804 pp., 9¼ x 6 in., cloth, $10.00.

Volume I of this important new chemical reference series presents over 3,000 entries giving reactions involving aluminum, antimony, arsenic, barium, beryllium, bismuth, boron and bromine. The standardized form of entry has the formula of the reactant at the top, the symbols or fomulas of the reagents, a descriptive paragraph of the conditions governing the reaction, one or more balanced equations expressing the progress of the reaction, and a reference to the original source of the information. Two sets of indexes list alphabetically all reagents used and all compounds produced.

ROLL NECK BEARINGS; Part I, Design, Construction and Operation:

By L. R. Underwood. Iron and Steel Industrial Research Council, London, 1943. 220 pp., illus., diagrs., charts, tables, 9¾ x 6 in., cloth, 10s. 6d.

This report, which was prepared for the Rolling Mill Research Sub-Committee and is published with the approval of the Iron and Steel Industrial Research Council of Great Britain, embodies the results of a study of the literature, of discussions with manufacturers of various types of roll neck bearings, and with some experiences of users. The types of bearings in use are surveyed, and the economic and technical factors that govern the selection for a given application are reviewed. The theory of lubrication as applied to these bearings, and bearing metals are considered. Later chapters deal with the design, construction, installation and operation of plain, synthetic resin, fluid film, roller and needle bearings. A useful bibliography is included.

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 29 | MONTREAL, NOVEMBER 1946 | NUMBER 11

"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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THE ENGINEERING JOURNAL

VOLUME XXIX, No. 11 NOVEMBER, 1946

THE ENGINEERING INSTITUTE OF CANADA

LIST OF MEMBERS, 1946

Foreword

FOLLOWING the practice already established, and in order to conserve paper, the 1946 list of members of the Institute is published herewith as part of a regular issue of *The Engineering Journal*, in the place usually occupied by technical articles. The scarcity of paper has also made it necessary to depart from the usual standards, and print the list on whatever stock was available. The publication of a list of members is necessary for the conduct of the business of the Institute, and it is hoped that, in spite of its present physical characteristics, it may also prove useful and informative to the membership at large.

The names are listed both alphabetically and geographically. In the alphabetical list, the name is followed by the position held and business connection whenever available, the mailing address where it differs from the business address, and the year of election or transfer to the various grades of membership.

The abbreviations for the membership classifications are as follows:

Hon. M.—Honorary Member
M.—Member
A.M.—Associate Member (this classification was abandoned in 1940, when all Associate Members were transferred automatically to the grade of Member)
Jr.—Junior
S.—Student
Affil.—Affiliate

The geographical list which appears at the end contains the names of all resident members shown under the branch to which they belong. The non-residents are listed under the name of each country. In both cases, the classification is subdivided into localities and grades of membership.

The addresses given are, in most cases, those on record on September 15, 1946. Later returns, however, were incorporated wherever possible without causing delay and excessive increase in publication costs. Special attention was given to the listing of members being released from the armed forces, but up-to-date information regarding such members has not been received in many cases.

The alphabetical index is preceded by a list of officers and members of Council since the establishment of the Institute, showing the years in which office has been held. Honorary members are also listed separately at the beginning, in addition to being shown in the alphabetical and geographical lists.

Restrictions on Use of List

This list is issued for the personal use of members of The Engineering Institute of Canada in connection with Institute and professional affairs. Each member is requested not to permit his copy to be used as a basis for circularization or for other purposes not in the interest of the membership of the Institute.

LIST OF OFFICERS AND MEMBERS OF COUNCIL

Since the establishment of the Institute, showing the years during which office has been held.

NOTE: Names of deceased officers shown in light-face type.

PRESIDENTS

Anderson, W. P.	1904.
Beaubien, deG.	1944.
Blackwell, K. W.	1903.
Bovey, H. T.	1900.
Butler, M. J.	1914.
Cameron, K. M.	1943.
Camsell, C.	1932.
Challies, J. B.	1938.
Cleveland, E. A.	1936.
Decary, A. R.	1927.
Dennis, J. S.	1917.
Desbarats, G. J.	1937.
Duggan, G. H.	1916.
Fairbairn, J. M. R.	1921.
Fetherstonhaugh, E. P.	1945.
Francis, W. J.	1923–24.
Gaby, F. A.	1935.
Galbraith, J.	1908.
Gamble, F. C.	1915.
Gzowski, C. S.	1889–91.
Grant, A. J.	1930.
Hannaford, E. P.	1893.
Hayes, J. B.	1946.
Hogg, T. H.	1940.
Jennings, W. T.	1899.
Johnson, P.	1913.
Keating, E. H.	1901.
Keefer, S.	1888.
Keefer, T. C.	1887, 1897.
Kennedy, J.	1892.
Lefebvre, O. O.	1933.
Leonard, R. W.	1919.
Lumsden, H. D.	1906.
Mackenzie, C. J.	1941.
McKiel, H. W.	1939.
Marceau, E.	1905.
Mitchell, C. H.	1929.
Monro, T.	1895.
Mountain, G. A.	1909.
Murphy, M.	1902.
Peterson, P. A.	1894.
Porter, S. G.	1931.
Ross, R. A.	1920.
Rust, C. H.	1911.
Ruttan, H. N.	1910.
Shearwood, F. P.	1934.
Smith, Julian C.	1928.
St. Laurent, A.	1923.
Sullivan, J. G.	1922.
Surveyer, A.	1924–25.
Thompson, W. G. McN.	1898.
Tye, W. F.	1912.
Vaughan, H. H.	1918.
Walbank, W. McL.	1907.
Walkem, G. A.	1926.
Wallis, H.	1896.
Young, C. R.	1942.

VICE-PRESIDENTS

Acres, H. G.	1921–22.
Anderson, W. P.	1902.
Anson, C. M.	1946.
Armstrong, J. E.	1945–46.
Beaubien, deG.	1941–42.
Blackwell, K. W.	1898–99.
Bovey, H. T.	1896–97.
Bowman, F. A.	1924–25.
Brereton, W. P.	1943–44.
Brown, E.	1933–34.
Brydone-Jack, E. E.	1915.
Buchanan, E. V.	1938–39.
Butler, M. J.	1906–07.
Cameron, E. G.	1934–35.
Cameron, K. M.	1941–42.
Carpenter, H. S.	1937–38.
Carruthers, A. L.	1941–42.
Caton, E. V.	1935–36.
Chace, W. G.	1920–21.
Challies, J. B.	1924–25.
Cimon, H.	1942–43.
Condon, F. O.	1928–29.
Dawson, A. S.	1925–26.
Decary, A. R.	1924.
Dennis, J. S.	1907.
Desbarats, G. J.	1909.
Dickson, G. L.	1944–45.
Dobbin, R. L.	1936–37.
Dodwell, C. E. W.	1904, 1911.
DuBose, McN.	1940–41.
Duggan, G. H.	1900–03, 1908.
Dunsmore, R. L.	1938–39.
Fairbairn, J. M. R.	1917–18.
Faulkner, F. R.	1930–31.
Fleming, J. M.	1944–45.
Francis, W. J.	1919–23.
Gage, E. V.	1945.
Gamble, F. C.	1913–14.
Gillespie, P.	1926–27.
Grant, A. J.	1928–29.
Grant, L. F.	1943–44.
Gray, A.	1934–35.
Gzowski, C. S.	1887–88.
Hannaford, E. P.	1888–91.
Harkness, A. H.	1932–33.
Haultain, H. E. T.	1918–19.
Hayward, R. F.	1918–19.
Holgate, H.	1911–12.
Hunter, J. H.	1927–28.
Jennings, W. T.	1892–93, 1895, 1897.
Johnson, P.	1907.
Keating, E. H.	1899–00.
Keay, H. O.	1938–39.
Keefer, C. H.	1904–05.
Keith, J. C.	1940–41.
Kennedy, J.	1887, 1890–91.
Lang, J. L.	1942–43.
Layne, G. F.	1946.
Lefebvre, O. O.	1931–32.
Leonard, R. W.	1910.
Lewis, D. O.	1919–20.
Loudon, T. R.	1930–31.
Lumsden, H. D.	1898.
Lynch, F. J.	1891.
McCrory, J. A.	1937–38.
Macdonald, C.	1896.
MacDougall, A.	1894.
MacDougall, G. D.	1926–27.
Mackenzie, C. J.	1929–30.
McKiel, H. W.	1936–37.
McLeod, C. K.	1943–44.
MacLeod, G. R.	1929–30.
MacLeod, M. H.	1908.
Macpherson, D.	1905.
Manock, W. R.	1946.
Marceau, E.	1901–04.
Mifflen, S. C.	1932–33.
Mitchell, C. H.	1920–23.
Mitchell, W. G.	1926–31.
Monro, T.	1892–93.
Monsarrat, C. N.	1917.
Mountain, G. A.	1903, 1905.
Muckleston, H. B.	1931–32.
Muntz, E. P.	1940.
Murdoch, G. G.	1942–43.
Murphy, M.	1895.
Newell, F.	1939–40.
Normandin, A. B.	1932–37.
Perley, H. F.	1888–90.
Peterson, P. A.	1889, 1892–93.
Porter, S. G.	1927–28.
Pratley, P. L.	1935–36.
Ross, R. A.	1914–16.
Rust, C. H.	1901, 1910.
Ruttan, H. N.	1909.
Sauder, P. M.	1939–40.
Shanly, W.	1887.
Shearwood, F. P.	1923–25.
Sisson, C. E.	1945–46.
Smith, C. B.	1906.
Spencer, R. A.	1945–46.
St. George, P. W.	1894, 1898–00.
St. Laurent, A.	1910, 1916–17.
Sullivan, J. G.	1911–13.
Surveyer, A.	1922–23.
Thompson, W. G. McN.	1896–97.
Thornton, K. B.	1925–26.
Tye, W. F.	1908–10.
Vaughan, H. H.	1912–14.
Walbank, W. McL.	1906.
Walkem, G. A.	1923–24.
Wallis, H.	1894–95.
Wardle, E. B.	1944–45.
White, T. H.	1916–18.
Wilson, R. S. L.	1933–34.
Wilson, W. S.	1940–41.

COUNCILLORS

Abbott, H.	1888, 1894.
Adams, W. C.	1927–29.
Allan, L. M.	1930.
Ambrose, J. R. W.	1916–18.
Anderson, J. N.	1927.
Anderson, W. P.	1890–91, 1901.
Antonisen, J.	1927.
Armstrong, C. G. R.	1935–36.
Armstrong, J. E.	1942–44.
Archibald, P. S.	1894–95, 1901, 1911–13.
Arkley, L. M.	1926.
Askin, R. J.	1937–38.
Atkinson, M. B.	1928.
Attwood, C. H.	1930.
Baillairgé, C. P.	1902.
Baillairgé, G. F.	1889.
Baillairgé, W. D.	1913–15.
Baltzell, W. H.	1924–25.
Barclay, W. D.	1896.
Barltrop, I. C.	1938–39.
Barnett, J. D.	1889–96, 1898.
Barrington, Y. C.	1936–37.
Bayfield, H. A.	1909.
Bayne, B. E.	1938–39.
Bell, J. A.	1910.
Bennett, H. F.	1930.
Berry, A. E.	1941–42.
Bertram, A.	1919–21.
Bigwood, H. M.	1924.
Blackburn, R. N.	1923–25.
Blackett, V. C.	1930.
Blackwell, K. W.	1889–92, 1902.
Blanchard, A. C. D.	1920–23.
Boese, G. P. F.	1940–41.
Bonn, W. E.	1937–38.
Boswell, St. G. J.	1889, 1893, 1896–00, 1903–04.
Bovey, H. T.	1892–95.
Bowman, A. J. M.	1928.
Bowman, F. A.	1913–15, 1920–22.
Boyle, R. W.	1927, 1937–38.
Brakenridge, C.	1923–25.
Brandon, H. E.	1943–45.
Brazier, H. A.	1925.
Breithaupt, W. H.	1907–08.
Brereton, W. P.	1919–21.
Briggs, H. L.	1944–45.
Brooks, N. E.	1918–20.
Brophy, G. P.	1929.
Brown, C. B.	1915–17, 1934–36.
Brown, E.	1918–20.
Brown, F. B.	1920–25.
Brown, F. R. F.	1888–91, 1893.
Brown, G. S.	1929, 1936–37.
Brown, S. P.	1915–17.
Bryce, W. F. M.	1939–40.
Brydone-Jack, E. E.	1911–13.
Buchan, P. H.	1931–32, 1937–38.
Buchanan, E. V.	1926–27.
Bucke, W. A.	1914–16.
Buckley, I. W.	1940–41.
Burbidge, G. H.	1926, 1931–36.
Burchell, H. C.	1905.
Burwell, H. M.	1920–22.
Busfield, J. L.	1926–28, 1930–35, 1938–40.
Buss, P. E.	1937, 1946.
Busteed, F. F.	1908, 1911.
Butler, M. J.	1896–97, 1904–05.
Butler, W. R.	1896, 1901–04, 1908.
Calvert, D. G.	1930.
Cambie, H. J.	1892, 1896, 1901, 1904, 1910.
Cameron, A. E.	1944.
Cameron, E. G.	1931–33.
Cameron, K. M.	1924–25.
Campbell, A. W.	1910.
Campbell, J. M.	1940–41.
Camsell, C.	1929–30.
Carpenter, H. S.	1921–23.
Carruthers, A. L.	1939–41.
Carry, C. W.	1945–46.
Cartwright, C. E.	1912–14.
Caton, E. V.	1925–26.
Cauchon, J. E. N.	1930–31.
Chace, W. G.	1915–17.
Chadwick, K. M.	1931.
Challies, J. B.	1920–22.
Chambers, A. R.	1925.
Chambers, H. J. A.	1937–38.
Chandler, R. B.	1928, 1945–46.
Chanute, O.	1894.
Chapleau, S. J.	1913–15.
Chipman, W.	1899, 1901–02.
Christie, C. V.	1931–33.
Cimon, H.	1930–37.
Clark, F. W.	1924.
Clark, G. T.	1923–25.
Clarke, W. E.	1928.
Clendening, C. S.	1934–35, 1946.
Cleveland, E. A.	1927.
Cockburn, J. R.	1934–36.
Combe, F. A.	1929–31.
Condon, F. O.	1926.
Conway, G. R. G.	1914–16.
Copp, W. P.	1931–32.
Coste, J. L. N.	1898.
Coultis, S. G.	1942–43.
Cousineau, A.	1934–36.
Coutlee, C. R.	1909–13.
Craig, G. W.	1920–22.
Craig, H. B. R.	1920–21, 1924.
Craig, J. D.	1928–29.
Crealock, A. B.	1935–37.
Crookshank, A. R.	1931–32.
Crudge, H. J.	1933–35.
Cunningham, A.	1945–46.
Cunningham, G. C.	1889, 1893–97.
Currie, G. J.	1946.
D'Aeth, J. B.	1937–38.
Darling, E. H.	1930–31.
Davis, E.	1928.
Davy, R. F.	1929.
Dawson, K. L.	1927.
Dawson, W. R.	1896.
Decary, A. R.	1914–23, 1925.
deHart, J. B.	1932–33.
Dennis, J. S.	1906, 1911.
Desbarats, G. J.	1900, 1907, 1933–34.
Dickson, G. L.	1942–43.
Dickson, T. H.	1936–37.
Dingwall, R. M.	1937–38.
Dion, A. A.	1907–08, 1915–17.
Dixon, H. A.	1928–29.
Doane, F. W. W.	1909, 1911.
Doane, H. W. L.	1928, 1945.
Dobbin, R. L.	1921–22, 1924–35.
Dodge, G. B.	1921–23.
Dodwell, C. E. W.	1890–92, 1895, 1897–00, 1903, 1907, 1910.
Domville, C. K.	1893.
Donaldson, C. S.	1946.
Doncaster, P. E.	1939–40.
Donkin, H.	1891, 1894, 1916–18.
Doucet, A. E.	1905, 1908–14, 1916–18.
Dow, J.	1926.
Dubuc, A. E.	1923.
Duchastel, J. A.	1922–24.
Duff, W. A.	1913–15.
Duggan, G. H.	1894, 1896, 1898–99, 1904, 1907, 1912–14.
Dunbar, J. R.	1946.
Dunn, G. C.	1920–22.

Duperron, A.	1937–39.
Durley, R. J.	1905–08, 1910, 1913–15.
Dyer, A. F.	1933–34.
Eadie, R. S.	1944–46.
Edwards, C. P.	1923–25.
Elliot, L. B.	1918–21.
Ellis, D. S.	1929, 1941–42.
Fairbairn, J. M. R.	1910, 1913–16.
Farmer, J. T.	1925–27.
Farrell, J. W. D.	1944–45.
Faulkner, F. R.	1924.
Fellowes, C. L.	1911–14.
Fergie, C.	1906, 1909.
Ferguson, G. H.	1944–45.
Fetherstonhaugh, E. P.	1923–25.
Findlay, R. H.	1938–40.
Finlayson, J. N.	1945–46.
Finnie, O. S.	1926.
Fleming, J. M.	1941–42.
Flitton, R. C.	1945–46.
Flynn, A. E.	1945–46.
Ford, A. L.	1927.
Forrester, T. A. J.	1915–17.
Francis, W. J.	1910, 1913–18.
Fraser, I. M.	1941–42.
Fregeau, J. H.	1941–42.
Frigon, A.	1935–37.
Frost, S. R.	1946.
Gage, E. V.	1943–44.
Gagnon, P. E.	1944–45.
Galbraith, J.	1894–95, 1898–01, 1903, 1906.
Gale, G. G.	1919–21.
Gamble, F. C.	1892, 1898.
Garden, G. H.	1894.
Garrett, J.	1941–42.
Gates, A. B.	1936–40.
Gibault, J. E.	1919–24.
Gibb, R. J.	1928.
Gillespie, P.	1918–20.
Gilpin, E.	1889.
Gisborne, F. N.	1887–89, 1891–92.
Goodman, J. E.	1937–38.
Goodspeed, F. G.	1934–36.
Goodwin, L. F.	1933–36.
Grandmont, B.	1927–37.
Grant, L. F.	1927, 1938–40.
Gray, A.	1919–21.
Gray, E. R.	1920–22.
Gray, F. W.	1942–43.
Gray, S. W.	1941–42, 1946.
Gray-Donald, E. D.	1942–43.
Green, F. C.	1926, 1932–33.
Greig, A. R.	1919, 1922–24.
Gunn, A. S.	1929.
Gutelius, F. P.	1907–09.
Haddin, J.	1938–39.
Haddow, A. W.	1926.
Haimes, J.	1942–43.
Hall, J. G.	1940–42.
Hall, N. M.	1931.
Hannaford, E. P.	1887.
Hardman, J. E.	1906–07, 1910.
Harkness, A. H.	1920.
Harris, R. C.	1933–34.
Haskins, Wm.	1894.
Haultain, H. E. T.	1910–15.
Hay, A. K.	1936–37.
Hay, A. L.	1931.
Heartz, R. E.	1942–44.
Henderson, G. G.	1945–46.
Herdt, L. A.	1906, 1909–12.
Hering, E.	1900–01.
Hertzberg, C. S. L.	1933–35.
Hesketh, J. A.	1911–14.
Heward, F. S. B.	1936–38.
Hewson, E. G.	1924–26.
Hoare, E. A.	1891–92, 1902, 1906.
Hobson, J.	1888, 1891–92.
Hogg, S.	1939–40.
Holden, O.	1938–39.
Hole, H. W.	1946.
Holgate, H.	1906, 1908.
Houston, G. N.	1924, 1930–31.
Howard, S.	1899, 1902–03.
Hunt, W. G.	1941–43.
Hunter, J. H.	1925–26.
Irwin, H.	1896–97.
Izard, E. W.	1942–43.
Jackson, A.	1943–44.
Jackson, W.	1934–35.
Jamieson, J. A.	1907.
Jaquays, H. M.	1911–12.
Jemmett, D. M.	1931–32.
Jenkins, T. H.	1939–40.
Jennings, P. J.	1928.
Jennings, W. T.	1887–91.
Johnson, E. P.	1927.
Johnson, E. V.	1902, 1907.
Johnson, P.	1904–06, 1910–12.
Johnston, A. C.	1937–40.
Johnston, H. L.	1921–23.
Johnston, H. S.	1935–38.
Johnston, W. J.	1930, 1933–34.
Jones, A. R.	1946.
Kaye, J. R.	1942–43.
Keating, E. H.	1896–98.
Keefer, C. H.	1892–93, 1903.
Keefer, G. A.	1889–90, 1897, 1905, 1907.
Keefer, S.	1887.
Keeley, D. H.	1897.
Keith, F. S.	1928–30.
Keith, J. C.	1927.
Kelley, H. G.	1910–11, 1913.
Kelsch, R. S.	1908, 1910.
Kennedy, J.	1888–89, 1899–07.
Kennedy, J. C.	1911–13.
Kennedy, J. H.	1917–19.
Kennedy, W., Jr.	1908–09.
Ker, N. J.	1902, 1908–09, 1915–17.
Kerry, J. G. G.	1906, 1908.
Ketchum, H. G. C.	1890, 1892.
Kirby, C. C.	1921–23.
Kirby, G. H.	1935–36.
Krebser, E. M.	1941–42.
Lafleur, E. D.	1916–18.
Lalonde, J. A.	1943–45.
LaMothe, G. E.	1925, 1931–32.
Lang, J. L.	1938–41.
Larivière, A.	1938–41.
Laughlin, W. H. M.	1945–46.
Laurie, W. H.	1907.
Lavigne, E.	1945–46.
Lavoie, E.	1926.
Layne, G. F.	1927, 1933–34.
Lazier, F. S.	1925.
Lea, R. S.	1907, 1909.
LeBaron, K. S.	1938.
Lee, F.	1914–16.
Lees, T.	1930.
Lefebvre, O. O.	1925–26, 1928–30.
LeGrand, J. G.	1909, 1911–12.
Leonard, R. W.	1905, 1908–09.
Lesage, L.	1887–88.
Lewis, D. O.	1916–18.
Lewis, H. M.	1925.
Lindsay, C. C.	1945–46.
Linton, A. P.	1939–40.
Livingstone, R.	1928.
Longley, H.	1917–19.
Loucks, R. W. E.	1931.
Loudon, T. R.	1927–29.
Love, A.	1944–45.
Lovett, P. A.	1944–45.
Low, R. A.	1945–46.
Lumsden, H. A.	1938–39.
Lumsden, H. D.	1887, 1892–93, 1895.
Lumsden, J. F.	1929.
Macallum, A. F.	1927–28.
McCaghey, N. F.	1928.
McCannel, D. A. R.	1929–30, 1933–34.
McCarthy, G. A.	1917–19.
McCarthy, J. M.	1900, 1902.
McColl, R.	1906–08, 1911–12, 1914–16.
McConnell, B. D.	1889, 1901.
McCrory, J. A.	1930–35.
MacDougall, A.	1887–88, 1892–93, 1896–97.
McDougall, D. H.	1918–20.
MacDougall, G. D.	1923–25.
McElhanney, T. A.	1942–43.
McFaul, W. L.	1940–41.
McGillivray, A.	1927–28.
MacGillivray, A. M.	1943–44.
MacGregor, J. G.	1946.
McHenry, E. H.	1904.
Macintyre, R. W.	1919–20.
MacKay, H. M.	1914–16.
McKenzie, B. S.	1920.
MacKenzie, C. J.	1931–32.
MacKenzie, H. R.	1926–28.
MacKenzie, W. B.	1899, 1902–05, 1912–14.
McKergow, C. M.	1923–28.
Mackie, G. D.	1918–21.
McKiel, H. W.	1927.
McKnight, W. F.	1929.
McLaren, W. F.	1925–28.
McLean, D. L.	1926–27.
McLean, H. J.	1936–37.
McLean, W. A.	1919–21.
McLeish, J.	1932–33.
McLeod, C. K.	1940–42.
MacLeod, G. R.	1922–27.
MacLeod, H. A. F.	1888, 1894.
MacLeod, H. J.	1933–34.
MacLeod, M. H.	1906, 1918–19.
McMillan, J.	1944–45.
MacNab, I. P.	1939–40.
McNab, W.	1900, 1907.
MacNicol, N.	1942–43.
Macphail, A.	1922–24.
MacPherson, D.	1895, 1897–01, 1903–04, 1906–07, 1909–14.
Macpherson, G. L.	1945.
Macpherson, H. N.	1941–42.
McQueen, A. W. F.	1942–45.
Macredie, J. R. C.	1920–22.
MacRostie, N. B.	1943–44.
Main, T. C.	1936–37.
Malcolm, W. L.	1930.
Manock, W. R.	1938–41.
Marceau, E.	1897–00.
Martin, E. B.	1944–45.
Marr, N.	1946.
Massey, G. H.	1890.
Massue, H.	1939–41.
Matheson, E. G.	1918–20.
Matheson, W. G.	1896, 1902.
Medlar, G. E.	1943–44.
Meech, H. W.	1925.
Meldrum, W.	1944–45.
Mifflen, S. C.	1929–30, 1946.
Miller, W. C.	1927.
Mitchell, C. H.	1908–09.
Mitchell, G. B.	1925.
Mohun, E.	1893, 1903, 1906.
Monro, T.	1890–91, 1899–00.
Monsarrat, C. N.	1910, 1912–14.
Montgomery, S. C.	1946.
Moodie, W. T.	1924.
Mooney, J. P.	1943–44.
Morkill, J. T.	1911–12.
Morrisey, H. F.	1941–42.
Morrison, J. R.	1932–33.
Motley, P. B.	1929–31.
Mount, W. R.	1939–40.
Mountain, G. A.	1893, 1899–01.
Muirhead, J.	1926.
Munro, W. H.	1941–42.
Muntz, E. P.	1936–37.
Murdoch, G. G.	1925.
Murphy, E. P.	1936–37.
Murphy, J.	1918–20.
Murphy, M.	1888–89, 1897.
Musgrave, A. S. G.	1944–45.
Near, W. P.	1928–32.
Nelson, E.	1943–44.
Newell, F.	1932–34, 1936–38.
Normandin, A. B.	1924, 1926–29.
Odell, C. M.	1908.
O'Leary, H. G.	1943–44.
Oliver, S. S.	1921–23.
Owens, E. J.	1937–38.
Owens, R. B.	1904–05.
Oxley, J. M.	1926–28.
Paine, N. D.	1929.
Palmer, R. K.	1924, 1929.
Papineau, L. G.	1907.
Parent, P. E.	1911–13.
Parkin, J. H.	1940–41.
Patton, J. McD.	1945–46.
Paulin, F. W.	1932–35.
Peachey, C. A.	1945–46.
Pearce, W.	1917–20.
Perley, H. F.	1887.
Perry, B. R.	1939–41.
Peters, F. H.	1918–19, 1931–32.
Peters, H.	1887, 1894, 1897–98.
Peterson, P. A.	1887–88, 1890–91.
Pickering, A. E.	1930–35, 1942–43.
Pitts, C. M.	1934–35.
Pitts, G. McL.	1941–43.
Poitras, P. E.	1944–46.
Poole, H. S.	1887–88, 1893, 1901.
Porter, G. F.	1923.
Porter, J. B.	1904–06.
Porter, J. E.	1926.
Porter, J. W.	1932–33.
Porter, S. G.	1921–23.
Powell, W. H.	1928.
Pratley, P. L.	1927–29, 1932–34.
Preston, F. M.	1930.
Rannie, J. L.	1926–27.
Redpath, F. R.	1893.
Reid, K.	1946.
Reid, W. J. W.	1942–43.
Ridout, T.	1893.
Risley, W. C.	1926–27.
Robb, D. W.	1908.
Robertson, A. K.	1930.
Robertson, J.	1939–40.
Robertson, J. M.	1918–20.
Robinson, L. H.	1932–33.
Rogers, C. S. G.	1925.
Rogers, R. B.	1901–04.
Rolfson, O.	1933–34.
Ross, D. A.	1916–18, 1922–24.
Ross, J.	1900–01.
Ross, J. H.	1929.
Ross, R. A.	1903, 1906–07, 1909, 1916–19.
Ross, R. W.	1925, 1931–32.
Rounthwaite, C. H. E.	1922–27.
Russell, B.	1932–33.
Russell, J. A.	1944–45.
Rust, C. H.	1899–00, 1905, 1907.
Rutledge, L. T.	1928.
Ruttan, H. N.	1887–88, 1890–92, 1894–95, 1897–99, 1902, 1906.
Ryan, E. A.	1935–37.
Safford, H. R.	1916–18.
Sanderson, A. U.	1939–40.
Sanger, J. W.	1941–43.
Sauder, P. M.	1927, 1944–46.
Saunders, M. G.	1941–42.
Saunders, W. L.	1945–46.
Scheman, C. H.	1929–30.
Schreiber, C.	1887–88.
Schwitzer, J. E.	1908–09.
Scott, T. S.	1926.
Scott, W. M.	1921–23.
Scrymgeour, C.	1943–44.
Shanly, C. N.	1924, 1933–34.
Shanly, J. M.	1895, 1898, 1910–12.
Shearwood, F. P.	1909, 1921–23.
Silliman J. M.	1928.
Sills, H. R.	1940–45.
Sisson, C. E.	1940–41.
Smallwood, F.	1936–37.
Smith, C. B.	1898, 1901–04.
Smith, G. E.	1940–41.
Smith, H. B.	1895, 1921.
Smith, J. C.	1917–22.
Smyth, C. M.	1934–35.
Smythe, R. E.	1936.
Speer, C. H.	1929.
Spencer, R. A.	1937–38.
Sproule, W. J.	1895–96.
Stansfield, E.	1930.
Stead, G.	1927.
Stedman, E. W.	1935–36.
Steel, F. M.	1934–35.
Stenbol, C.	1944–46.
Stephens, D. M.	1946.
Stephens, J.	1928.
Stewart, A. F.	1911–13, 1922–24.
Stewart, D. A.	1896.
Stewart, W. J.	1911–12.
St. George, P. W.	1887–88, 1890–93, 1904–05.
Stirling, J. B.	1946.
St. Laurent, A.	1909.
Sullivan, J. G.	1910, 1918
Surtees, R.	1895.

Surveyer, A.	1915–21.
Swan, H. L.	1934–37.
Tapley, A. G.	1926.
Taunton, A. J.	1938–40.
Taylor, T.	1931–33.
Tennant, D. C.	1931–33.
Theuerkauf, A. P.	1938–39.
Thompson, W. G.	1895.
Thorne, B. L.	1923–25.
Thorne, H.	1929.
Thornton, K. B.	1921–23.
Thornton, L. A.	1918–20.
Torrens, G. C.	1931.
Tracy, T. H.	1900.
Traill, J. J.	1932–34.
Trowsdale, R. S.	1926, 1931.
Trutch, J. W.	1890–91.
Turnbull, A. A.	1946.
Turner, E. O.	1944–46.
Tye, W. F.	1905–07.
Uniacke, R. F.	1914–16.
Vallée, L. A.	1894–95, 1903, 1909.
Vance, J. A.	1933–46.
Vandervoort, G. A.	1935–36.
Vanier, J. E.	1889.
Vaughan, F. P.	1924.
Vaughan, H. H.	1910–11.
Vennes, H. J.	1939, 1941.
Vieus, E.	1938–39.
Vincent, Paul	1946.
Wainwright, J. G. R.	1928–30.
Wake, H. R.	1930.
Walbank, W. McL.	1898, 1903–04.
Walkem, G. A.	1921–22.
Wallis, H.	1887, 1900.
Wanklyn, F. L.	1909.
Ward, H. J.	1943–44.
Ward, J. W.	1943–44.
Wardle, E. B.	1939–40.
Watson, J. T.	1938–39.
Webb, C. E.	1943–44.
Webb, H. R.	1935–36.
Webster, G. H.	1906.
Weller, J. L.	1915–17.
West, A. E.	1931–32.
West, F. L.	1928.
Weston, S. R.	1929.
White, J.	1917–19.
White, T. H.	1913–15.
Wickenden, J. F.	1945–46.
Wicksteed, H. K.	1908, 1925–27.
Wilgar, W. P.	1925.
Wilmot, E. A.	1899.
Wilson, R. S. L.	1922–24, 1929.
Wilson, W. S.	1944–46.
Wolff, A. O.	1942.
Wootton, A. S.	1933–36.
Wragge, E.	1889–90.
Wright, C. H.	1926.
Wynne-Roberts, L. W.	1930–32.
Wynne-Roberts, R. O.	1922–24.
Young, C. R.	1921–23.
Young, R. B.	1929–31.
Young, S.	1935–36, 1946.
Young, W. B.	1929.

TREASURERS

Adams, W. C.	1931–32.
Beaubien, deG.	1938–40.
Bertram, A.	1919–26.
Blackwell, K. M.	1894–97.
Bovey, H. T.	1887.
Busfield, J. L.	1937.
Cape, E. G. M.	1942.
Chadwick, R. E.	1944–45.
Challies, J. B.	1933–36.
Christie, C. V.	1943.
Duchastel, J. A.	1938.
Irwin, H.	1898–1908.
Lalonde, J. A.	1946.
Marceau, E.	1909–19.
Mechin, F. C.	1944.
Pratley, P. L.	1933.
Shearwood, F. P.	1926–30.
Stadler, J.	1941.
Wallis, H.	1888–93.

SECRETARIES

Bovey, H. T.	1887–91.
Durley, R. J.	1925–38.
Keith, F. S.	1917–25.
McLeod, C. H.	1891–16.
Wright, L. A.	1938–46

HONORARY MEMBERS

Angus, R. W. (M.1921. Hon.M.1937)
Batt, Wm. L. (Hon.M.1943)
Bessborough The Right Hon., The Earl of (Hon.M.1931)
Clark, A. L. (Affil.1920. Hon.M.1922)
Doherty, R. E. (Hon.M.1944)
Gibb, Sir Alex. (M.1932. Hon.M.1937)
Howe, C. D. The Right Hon. (M.1922. Hon.M.1937)
Hungerford, S. J. (M.1919. Hon.M.1937)
Magrath, C. A. (M.1917. Hon.M.1938)
Mead, D. W. (Hon.M.1944)
Rabut, Jacques (Hon.M.1937)
Stirling, Grote The Hon. (M.1927. Hon.M.1937)
Wallace, R. C. (Hon.M.1941)
Webster, Frederic (Hon.M.1942)
Willingdon The Most Hon., The Marquess of. (Hon.M.1927)
Windsor H.R.H. the Duke of. (Hon.M.1919)

BRANCHES OF THE INSTITUTE

Border Cities
Calgary
Cape Breton
Cornwall
Edmonton
Halifax
Hamilton
Kingston
Kootenay
Lakehead
Lethbridge
London
Moncton
Montreal
Niagara Peninsula
Ottawa
Peterborough
Quebec
Saguenay
Saint John
Sarnia
Saskatchewan
Sault Ste. Marie
St. Maurice Valley
Toronto
Vancouver
Victoria
Winnipeg

SUMMARY OF MEMBERSHIP as at Sept. 15th, 1946.

Honorary Members	16
Members	4,692
Juniors	1,566
Students	1,725
Affiliates	96
TOTAL	8,095

ALPHABETICAL LIST OF MEMBERS

CORRECTED TO SEPTEMBER 15th, 1946

A

Abbott, Arthur C. Elec. Engr., Commercial & Distribution Dept., Shawinigan Water & Power Co., P.O. Box 6072, Montreal. (S.1923. A.M 1931. M.1940)

Abbott, Charles A. Little Priory, Shorne, Nr. Gravesend, England. (A.M.1903. M.1940)

Abbott, Harold F. Asst. Plant Supt., Beauharnois Light, Heat & Power Co., P.O. Box 100, Beauharnois, Que. (S.1926. A.M.1936. M.1940)

Abbott, W. H. Associated Textiles of Canada, Louiseville, Que. For mail: 1805 St. Luke St., Montreal. (A.M.1920. M.1940)

Abel, John K. 294 Overdale St., Winnipeg, Man. (S.1946)

Abell, John D. Mech. Engr., International Harvester Co. of Can. Ltd., Hamilton. For mail: 84 Proctor Blvd., Hamilton, Ont. (S.1940. Jr.1946)

Abells, H. B. Jr. Research Engr., National Research Council, Sussex St., Ottawa. (S.1944)

Aboud, Samuel J. Supervisor, Gauge Design & Dimensions Control, Electronics Division, Nortern Electric Co. Ltd., Montreal. For mail: 4940 Coronet Ave., Montreal 26. (M.1945)

Abraham, Earl M. Asst. on Geol. Survey, Dept of Mines of Ontario, Box 373, Larder Lake, Ont. For mail: Fraser House, Cobalt, Ont. (S.1944. Jr.1946)

Abramson, I. A. Survey Engr., Pioneer Timber Co. Ltd., Port McNeill, B.C. (Jr.1931)

Acheson, H. R. M. Plant Engr., Gaspesia Sulphite Co. Ltd., Chandler, Que. For mail: P.O. Box 160, Chandler, Que. (S.1926. Jr 1934. A.M.1939. M.1940)

Acker, S. E. 251 York St., Fredericton, N.B. (S.1943)

Ackerman, Paul 4584 Hampton Ave., Montreal 28. (A.M.1921. M.1940)

Ackhurst, W. H. Industrial Applications Engr., Canadian General Electric Co. Ltd., 214 King St, Toronto 15. (S.1938. Jr.1946)

Acres, H. D. Engrg. Dept., E. B. Eddy Co. Ltd., Ottawa, Ont. For mail: R.R. No. 1, Britannia Bay, Ont. (M.1944)

Adam, James Civil Engr. and Architect, 14 Metcalfe St., Ottawa, Ont. For mail: 263 MacLaren St, Ottawa. (A.M.1911. M.1940)

Adams, E. C. Design Engr., Defence Industries Ltd., 625 Dorchester St. W., Montreal. (M.1945)

Adams, G. C. Jr. Engr., Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal (S.1943)

Adams, G. D. Metal Inspector, Imperial Oil Co. Ltd., Montreal. For mail, 5715 Sherbrooke St. W., Montreal. (S.1944)

Adams, G. R. Field Engr., Foundation Co. of Ontario, Marathon, Ont. (S.1925. A.M.1934. M.1940)

Adams, Jack Lieut., No. 6 Coy, R.C.E.M.E., Officers' Mess, Halifax, N.S. (S.1943)

Adams, J. D. Lieut., R.C.E., 5960 Monkland Ave., Montreal. (S.1939. Jr.1941)

Adams, J. L. Dftsmn. Design Office, Dominion Bridge Co., Vancouver. For mail: 1391 West 33rd Ave., Vancouver, B.C. (S.1940. Jr.1946)

Adams, Philip E. Chief Engr., Canadian Bridge Co. Ltd., Walkerville, Ont. (M.1927)

Adams, W. Douglas Piling Engr., Algoma Steel Corp. Ltd., Sault Ste. Marie, Ont. For mail: 144 Leo Ave., Sault Ste. Marie, Ont. (S.1908. Jr.1912. A.M.1922. M.1936)

Adamson, W. B. 215 Cummings St., Fort William, Ont. (S.1937. Jr.1946)

Addie, George K. Consulting Engr. & Land Surveyor, 148 St. Cyrille St., Quebec. (S.1887. A.M 1898. M.1935)

Addison, J. H. Tropical Oil Co., Apartados Nacional No. 335, Bogota, Colombia, South America. (S.1932. Jr.1935. M.1940)

Adlam, A.E. Chief Dftsmn (Structural), Rapid Transit, Toronto Transportation Commission, Toronto. For mail: 173 Sunnyside Ave., Toronto. (Jr 1940)

Adlington, W. E. Bennett (Hyde) Ltd., Boston Mills, Hyde, Cheshire, England. (Jr.1928)

Aeberli, J. Adolf Engr., Hydro-Electric Power Commission, Toronto. For mail: 257 Kingswood Road, Toronto. (M.1921)

Affleck, Garnet Dist Engr., Dept. of Public Works of Manitoba, Winnipeg. For mail: 674 Fisher St., Winnipeg, Man. (S.1909. Jr.1912. A.M.1920. M.1940)

Agar, George Exec. Engr., Canadian Vickers Ltd., Montreal. For mail: 64 Nelson St., Montreal West 28. (A.M.1924. M.1940)

Agnew, Ellis A. Vice-Pres, Livingston Stoker Co. Ltd., Hamilton. For mail: 117 Charlton Ave. W., Hamilton, Ont. (M.1941)

Agnew, T. Charles Chief Engr., Minneapolis-Honeywell Regulator Co., Toronto 12. For mail: 52 Lyngrove Ave., Toronto 9. (S.1928. A M.1936. M.1940)

Ahearn, Wm. J. Sales Engr., Superheater Co. Ltd. For mail: 538 MacLaren St., Ottawa. (S.1935. Jr.1940)

Ahern, A. W. Mgr., Northeastern Paper Products Ltd., 10 Blvd. des Capucins, Quebec. (S 1920. A.M.1926. M.1940)

Ahern, P. C. Maritime Engineering Consultants, 75 Upper Water St., Halifax. For mail: P.O. Box 981, Halifax, N.S. (M.1946)

Ain, Joseph 227 Villeneuve St. W., Montreal. (Jr.1941)

Ainlay, A. Radio Design Dept., Canadian Westinghouse Co. Ltd., Hamilton, Ont. For mail: 153 John St. South, Hamilton, Ont. (Jr.1944)

Ainsworth, Vivian Arthur Divn. Supt., Maritime Electric Co. Ltd., 139 Grafton St., Charlottetown, P.E.I. (M.1942)

Aird, André co-owner, Modern Engrg. Industries & Laurentide Engrg. Industries Ltd., 7032-7034 Côte-des-Neiges, Montreal. (S.1936. Jr.1942)

Aitken, J. A. Divn. Engr., (Nfld.) Imperial Oil Ltd., 228 Water St., St. John's, Nfld. (M.1943)

Aitkens, J. C. Designing Engr., Ford Motor Co. of Canada Ltd., Windsor. For mail: 769 Hall Ave., Windsor, Ont. (S.1928. Jr.1934. A.M.1937. M.1940)

Akerley, William Burpee Sr. Highway Supt., Northwest Highway System, Department of National Defence (Army), Whitehorse, Yukon. (S.1932. Jr.1936. M.1940)

Aksim, V. E. 78 Wellington St., Kingston, Ont. (S.1946)

Alberts, Russell S. 22 Seventeenth St., New Toronto. (S.1946)

Alder, J. D. Chief Engr., Darling Bros. Ltd., Montreal. For mail: P.O. Box 187, Montreal. (M.1921)

Alder, Wm. R. Divn. Engr., Dept. of Highways of Ont., London. For mail: 963 Maitland St., London, Ont. (M.1944)

Alexander, A. P. 154 View St., Nanaimo, B.C. (S.1933. Jr.1943)

Alexander, David T. Asst. Operating Mgr., The Canadian Bridge Co. Ltd., P.O. Box 157, Walkerville, Ont. (M.1931)

Alexander, F. W. 70 Ethelbert St., Winnipeg, Man. (A.M.1907. M.1917)

Alexander, Gordon A. 27 Digby Ave., Winnipeg, Man. (S.1945)

Alexander, G. B. Dist. Engr., C.P.R., Moose Jaw, Sask. For mail: 30 Stadacona St. W., Moose Jaw, Sask. (M 1945)

Alexander, John A. Asst. Supt., McColl-Frontenac Oil Co. Ltd., Montreal East. For mail: 15 Marien St., Montreal 5. (S.1937. Jr.1946)

Alexander, Richard C. F. Sr. Office Engr., Engrg. Branch, Dept. of Transport, Ottawa. For mail: 370 Lewis St., Ottawa. (S.1897. A.M.1904. M.1940)

Alexander, S. J. 64 Regent St., Kingston, Ont. (S.1944)

Allaire, Alexander 927 Himes Ave., Tampa, Florida, U.S.A. (A.M.1910. M.1913. LifeM.1943)

Allaire, Lucien Asst. Engr., West Divn. Waterworks & Sewerage, City of Montreal. For mail: 5445-11th Ave., Rosemount, Montreal 36. (S.1936. Jr.1938. M.1943)

Allaire, Lucien L. Chem. Engr., Ecole Polytechnique, Montreal. For mail: Beloeil Station, Que. (S 1942. M.1945)

Allan, E. Blake Dist. Highway Engr., Dept. Public Works of N.B., P.O. Box 74, Bathurst, N.B. (S.1915. A.M.1920. M.1940)

Allan, George W. Pres., Canadian Sumner Iron Works Ltd., Vancouver. For mail: 3814 W. 14th Ave., Vancouver, B.C. (M.1942)

Allan, John A. Prof. of Geology & Consulting Geologist, University of Alberta, Edmonton, Alta. (M.1941)

Allan, J. C. Asst. Industrial Control Engr., Canadian General Electric Co. Ltd., Peterborough. For mail: 5 Fleming Place, Peterborough, Ont. (M.1943)

Allan, J. Lorn Engr., Town of Dartmouth, N.S. For mail: 69 Jamieson St., Dartmouth, N.S. (S 1899. A.M.1904. M.1913)

Allan, M. B. 29 McKenzie Ave., Toronto. (S.1946)

Allchurch, H. Checker, Mech. & Strl. Equipt., Dominion Bridge Co. Ltd., Lachine, Que. (A.M 1928. M.1940)

Allcut, E. A. Prof. & Head of Dept. of Mech. Engrg., University of Toronto, Toronto. (M.1926)

Allen, A. M. Gen. Plant Supt., Alberta Govt. Telephones, Edmonton. For mail: 26 Arlington Apts, Edmonton, Alta. (A.M.1937. M.1940)

Allen, C. A. Strl. Designer, Architect's Office, Bell Telephone Co. of Can., Montreal. For mail: 44 Lake Ave., Strathmore, Que. (A.M.1921. M.1940)

Allen, C. H. Apparatus Salesman, Canadian Westinghouse Co Ltd., Dominion Square Bldg., Montreal. (Affil.1942)

Allen, F. L. Mgr. of Mfg., Newsprint Divn., Canadian International Paper Co., Sun Life Bldg., Montreal. (M.1944)

Allen, John C. M. Jr. Engr., Dept. of National Defence, Eastern Air Command, Moncton. For mail: 38 Botsford St., Moncton, N.B. (Jr.1943)

Allen, James Lawrence Metal Mfg. Process Engr., Dominion Engineering Co., Lachine. For mail: 2088 Jeanne Mance, Montreal. (S.1943. Jr.1946)

Allen, Richard T. W. Engr., Gatineau Power Co., Ottawa. For mail: 611 Highland Ave., Ottawa. (S.1935. Jr.1943)

Allen, Robt. W. Asst. City Engr., Regina, Sask. (Jr.1919. A.M.1922. M.1936)

Allin, Arthur Daniel Jr. Engr., Hydro-Electric Power Commission of Ont., Toronto. For mail: 16 Oakview Ave., Toronto 9. (S.1943. Jr.1946)

Allingham, Ralph R. Gen. Constrn. Supt., Wilputte Coke Oven Corp., 40 Rector St., New York 6, U.S.A., (S.1914. Jr.1919. A M.1923. M.1940)

Allison, L. MacC. Engr., Dept. Public Works of Canada, Halifax, N.S. (M.1940)

Allison, Russell S. Transitman, Canadian Pacific Railway Co., London. For mail: 341 Princess Ave., London, Ont. (S.1946)

Allman, Ralph Jack 10530-125th St., Edmonton, Alta. (S.1946)

Allwright, Ernest G. Representative for J. C. Meadowcroft, Architect, P.O. Box 63, Long Branch, Ont. (Affil.1938)

Alport, Frederic Engr., Dept. of Public Works, Hunter Bldg.. Ottawa (M.1940)

Alton, Jack Engr. Western Bridge Co. Ltd., Vancouver, B C. (M.1941)

Alton, Wm. Overseas with Army. (Jr.1940)

Aman, T. F. Stewart Elec. & Gas Inspr., Dept. of Trade & Commerce, Hamilton, Ont. For mail: R.R. No. 1, Grimsby, Ont. (S.1934. Jr.1940)

Ambrose, J. R. W. 17 Coulson Ave., Toronto. (A.M.1911. M.1913)

Ames, Arthur John Mng. Dir., Instruments Ltd., Ottawa. For mail: 184 Holmwood Ave, Ottawa. (Affil.1922)

Ames, John W. Admin. Engr., Laister-Kauffmann Aircraft Corp., St. Louis, Mo. For mail: Route No. 1, Arnold, Missouri, U.S.A. (S.1941. Jr.1946)

Amiot, Jean Marie 1836 Valois St., Montreal (S.1944)

Amos, Arthur 3464 Ontario Ave., Montreal. (A.M.1899. M.1940)

Amos, L. A. Architect, L.A. & P.C. Amos, 133 West Commissioners, Montreal. (S.1893. A.M.1896. M.1915)

Amyot, Bruneau Sales Engr., Ferranti Electric Ltd., Tramway Bldg., Craig St., Montreal. (S.1945)

Amyot, J. Jean Fire protection engr., Canadian Underwriters Assn., Montreal. For mail: 6876 Beaulieu St., Montreal 20. (S.1938. Jr.1946)

Anderson, A. G. Chief Engr., Eastern Area, Bell Telephone Co. of Can., 1050 Beaver Hall Hill, Montreal. (M.1944)

Anderson, Clarence Arthur Capt.; Devlpt. Engr., Canadian Signals Research & Development Establishment, Ottawa. For mail: 618 Mulvey Ave., Winnipeg, Man. (S 1942. Jr.1945)

Anderson, Clarence Aubrey, Major, Dept. of National Defence, M.D. No. 6, Halifax. For mail: 54 Oakland Road, Halifax, N.S. (A.M.1932. M.1940)

Anderson, C. G. Canadian Westinghouse Co., Hamilton For mail: 163 Jackson St. W., Hamilton, Ont. (S.1944)

Anderson, Dan Elec. Engr., Southern Canada Power Co. Ltd., 355 St. James St. W., Montreal. (S.1919. Jr.1925. A M.1930. M.1940)

Anderson, Frederick 150 Metcalfe St., Ottawa. (M.1909)

Anderson, Glover 612 Lipton St., Winnipeg, Man. (S.1946)

Anderson, H. C. Asst. Chief Engr, Dept. Public Works of B.C., Victoria. For mail: 160 Beach Drive, Oak Bay, Victoria, B.C. (M.1941)

Anderson, Harold Olba Albert, Co. Albert, N.B. (S.1944)

Anderson, H. V. Director, Marine Services, Dept. of Transport, Ottawa. For mail: 250 Sherwood Drive, Ottawa. (M.1935)

Anderson, James D. Service Engr., Combustion Engineering Corp. Ltd., Dominion Square Bldg, Montreal. (S.1941. Jr.1946)

Anderson, J. Douglas Grad. Research Asst., University of Washington, Seattle, Wash. For mail: 4038 West 19th Ave., Vancouver, B.C. (S.1943)

Anderson, J. M. Dist. Engr., Dept. of Public Works of Alberta, Court House, Medicine Hat, Alta (A.M.1919. M.1940)

Anderson, John Noel Managing Director, Wm. N. O'Neil Co. (Victoria) Ltd., 551 Yates St., Victoria, B.C. (A.M.1919. M.1940)

Anderson, K. G. P O. Box 25, Glenboro, Man., (S.1945)

Anderson, O. V. Field Engr., Toronto Hydro Electric System. For mail: 68 Indian Road Cres., Toronto. (M.1936)

Anderson, Paul C. 68 Indian Road Crescent, Toronto. (S.1939 Jr.1946)
Anderson, Reidar Engrg. Asst., Bell Telephone Co. of Can., Montreal. For mail: 4795 LaSalle Blvd., Ville LaSalle, Que. (S.1945)
Anderson, R. G. 575 Victor St., Winnipeg, Man (S.1945)
Anderson, Roderick V. Civil Engr., Armstrong, Anderson & Co., Toronto. For mail: 358 Whitmore Ave., Toronto 10. (S.1928. Jr.1937. M.1943)
Anderson, S. C. Sales Engr., Sawyer-Massey Ltd., Hamilton. For mail: 56 Leinster Ave. S., Hamilton. (M.1946)
Anderson, T. Clifford Prod. Engr., Thunder Bay Paper Co. Ltd., Port Arthur. For mail: 76 College St., Port Arthur, Ont. (A.M.1936. M.1940)
Anderson, Thomas T. Supvsr. of Plant Dept., Alumina-Fluoride Divn., Aluminum Co. of Canada, Arvida For mail: 846-7th St., Arvida, Que. (Jr.1945)
Anderson, T. V. 459 Laurier Ave. East, Ottawa. (S.1900. A.M.1911. M.1940)
Anderson, Viggo Design Engr., Aluminum Co of Canada, Montreal. For mail: 4987 Earnscliffe Ave., Montreal 29. (Jr.1928. A.M.1939. M.1940)
Anderson, Wm. Indust. Commr., City of Calgary, Utilities Bldg., Calgary, Alta. (A.M.1924. M.1940)
Anderson, Wm. Box 74, Lynn Valley P O., B.C. (M.1913)
Anderson, W. J. Bell Telephone Co. of Can., Beaver Hall Bldg., Montreal. (S.1946)
Anderson. Walter R. H. 593 Johnson St., Kingston, Ont. (S.1946)
Anderson, Y. R. Plant Supt., Canada Firebrick Co. Ltd., Montreal. For mail: 4236 Royal Ave., Montreal 28. (A.M 1930. M.1940)
André, K. B. Field Engr., E.G.M. Cape & Co., P.O. Box 445, Halifax, N S. (S.1937. M1943)
Andrew, Fred J. 2116 West 22nd Ave., Vancouver, B.C. (S.1945)
Andrews, George T. L. Project Engr., Canadian Industries Ltd., Kingston, Ont (M.1945)
Andrews, R. H. Canada Wire & Cable Co., P.O. Box 340, Toronto. (A.M.1929. M.1940)
Andrews, S. W. Pres. H. G. Acres & Co., Niagara Falls. For mail: 2012 Corwin Ave., Niagara Falls, Ont. (M.1946)
Angel, Henry 2057 Maplewood Ave., Montreal. (S.1944)
Angel, John B. Mng. Dir., United Nail & Foundry Co. Ltd, St. John's, Nfld. For mail: 146 Hamilton Ave., St. John's, Nfld. (S.1935. Jr.1939)
Angell, H. G. Engrg. Admr. & Constrn. Supvr, Wartime Housing Ltd., Toronto, Ont. For mail: P.O. Box 355, Moncton, N.B. (Jr.1914. A.M.1922. M.1939)
Angerman, Jaroslav K. Cons. Elec. Engr., UNRRA Indust. Rehab. Divn. H.Q., Washington. For mail: 1916-17th St. N.W., Washington, D.C. (M.1945)
Anglin, D. G. Vice-pres., Ross & Anglin Ltd., Montreal. For mail: 11 Severn Ave., Westmount, Que. (S.1912. A.M 1920. M.1940)
Anglin, Thomas G Consulting Engr., Room 703, Dominion Square Bldg., Montreal 2. (S.1942. Jr.1944. M 1945)
Angus, F. Wm. R. 202 Senneville Road, Senneville, Que. (S.1929. A.M 1931. M.1940)
Angus, Harry H. Pres., H. H. Angus & Associates Ltd., 1221 Bay St., Toronto. (M 1940)
Angus, Leslie M. 118 Earl St., Kingston, Ont. S.1946)
Angus, Robt. W. Prof. Emeritus Mech. Engrg., University of Toronto, Toronto. (M.1921. Hon.M.1937)
Angus, W. F. Pres. & Mng. Dir., Dominion Bridge Co. Ltd., P O. Box 280, Montreal. (S.1895. A.M.1903. M.1913)
Annand, Chas. 91 Willow St., Truro, N.S. (S.1946)
Annett, F. A. Assoc. Editor, "Power", McGraw-Hill Publishing Co., New York. For mail: 143-72 Cherry Ave., Flushing, N.Y. (Affil.1927)
Ansley, Fred C. Field Engr.. Ford Motor Co. of Canada, Windsor For mail: 72 Prado Place, Riverside, Ont. (S.1937. M.1941)
Ansley, R. H. Winnipeg Hydro, Slave Falls, c/o Pointe du Bois, Man. (Jr.1944)
Anson, C. M. Gen. Mgr., Dominion Steel & Coal Corp., Sydney, N.S. (A.M.1931 M.1940)
Antenbring, C. V. Design Engr., Cowin & Co. Ltd., Winnipeg. For mail: 357 Overdale St., St. James, Man. (S.1924. A.M.1937 M.1940)
Antenbring, Gordon Arthur Mine Supt., Cochenour-Willans Gold Mine, McKenzie Island, Ont. (M.1944)
Antenbring, Stanley V. Mech. Dept., Imperial Oil Ltd., Sarnia, Ont. For mail: R.R. No. 3, Sarnia, Ont. (Jr 1940)
Antliff, J. C. 3791 Marlowe Ave., Montreal. (S.1923. A.M.1928. M.1940)
Antonisen, Joachim 431 St. Patrick Sq., Port Arthur, Ont. (A.M 1907. M.1921)
Anvik, Herlaug Efficiency Engr., Canadian International Paper Co., Temiskaming, Que. (M.1937)
Arbic, Pierre-Paul Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)
Archambault, Georges Louis Sales Mgr., L'Hoir Aluminum & Stainless Steel Co., 229 St. Laurent St., Lévis, Que. (S.1937. Jr.1942)
Archambault, J. B. 4248 Fabre St., Montreal 34. (S.1944)
Archambault, Jean H. Serv. Mgr., Lasalle Coke Co., 660 St. Catherine St. West., Montreal. (S.1940. Jr.1946)
Archambault, J. J. Apparatus Sales, Canadian General Electric Co., Toronto. For mail: 152 St. George St., Toronto. (S.1942. Jr.1946)
Archambault, J. U. Engr., Public Service Board of Quebec, Court House, Quebec. (S.1925. A.M.1931. M.1940)
Archambault, Jules Chief Engr., Montreal Tramways Co., 159 Craig West, Montreal. (M.1939)
Archambault, Raymond G. Divn. Engr., Roads Dept. of Quebec, Plessisville, Que. (M.1943)
Archer, J. E. Res. Engr., Civil Aviation Divn., Dept. of Transport, Port Arthur. For mail: 11 Machar Ave., Port Arthur, Ont. (M.1940)
Archer, Maurice Cons. Engr., Archer & Dufresne, 25 St. Louis, Quebec. (S.1933. Jr.1938)
Archer, R. G. Dept. of Works, City Hall, Toronto. (A.M.1939. M.1940)
Archibald, C. B. Mgr., Wabana Operations, Dominion Steel & Coal Corp., Wabana, Nfld. (S.1910. A.M.1917. M.1940)
Archibald, C. L. Canadian Car & Foundry Co. Ltd., Amherst. For mail: 31 Rupert St., Amherst, N.S. (M.1940)
Archibald, Ernest B. Contracting Vice-pres., Creaghan & Archibald Ltd., 1440 St. Catherine St. W., Montreal 2. (M.1945)
Archibald, George DeW. City Engr., City Hall, Saskatoon, Sask. (M.1938)
Archibald, G. H. 1537 St. Matthew St., Montreal 25. (M.1945)
Archibald, H. E. Asst. Engr., Proctor, Redfern & Laughlin, Toronto. For mail: 292 St. George St., Toronto 5. (S 1942. Jr.1945)
Archibald, Harry P. Bayfield & Archibald, 448 Seymour St., Vancouver, B.C. (A.M.1910. M.1940)
Archibald, John A. Asst. Supvr., Test Dept., Canadian General Electric Co., Peterborough. For mail: 4 Kirk St., Peterborough, Ont (Jr.1945)
Archibald, Lester J. Metals Inspr., Imperial Oil Ltd., P.O. Box 490, Dartmouth, N.S. (S.1940. M.1943)
Archibald, M. C. Asst. Purch. Agent, Montreal Engineering Co. Ltd. For mail: 5450 Trans Island Ave., Montreal. (S 1931. Jr.1939. M.1943)
Archibald, Rupert Douglas Div. Engr., Trinidad Government Railways, Port of Spain. For mail: 44 Picton St., Port of Spain, Trinidad, B.W.I. (S.1944)
Archibald, S. W. Cons. Engr., 456 Wellington St., London, Ont. (A.M.1928. M.1935)
Argo, J. W. Engr., Gore & Storrie, 1130 Bay St., Toronto. (M.1942)
Arklie, David G. Pine Hill Residence, Halifax, N.S. (S.1945)
Armbruster, Erhart Building Materials Control, Fraser Brace Ltd., Montreal. For mail: Deep River, Ont. (S.1941. Jr.1946)
Armstrong, A. V. Gen. Mgr., Amalgamated Electric Corp. Ltd., Toronto. For mail: 121 Cheritan Ave., Toronto. (S.1920. Jr.1929. A.M.1936. M.1938)
Armstrong, C. G. Russell Newman & Armstrong, Cons. Engrs. & Surveyors, 605 Bartlet Bldg, Windsor, Ont. (Jr.1921. A.M.1925. M.1940)
Armstrong, D. B. Design Engr., Dominion Bridge Co. Ltd., Montreal. For mail: 4196 Hingston Ave., Montreal. (A.M.1923. M.1940)
Armstrong, Geo. E. Elec. Mtce. Foreman, Hydro-Electric Power Commission of Ont., New Liskeard, Ont. (Jr.1945)
Armstrong, Gordon M. Surveyor, Dept. of Mines & Resources, Victoria Memorial Museum, Ottawa. (S.1944. Jr.1946)
Armstrong, H. E. Design Engr., Dept. of Reconstruction & Supply, Ottawa. For mail: 584 MacLaren St., Ottawa. (S.1940. M 1945)
Armstrong, H. M. Prov. Fire Marshal of N.B., P.O. Box 699, Fredericton, N.B. (M.1942)
Armstrong, H. V. Asst. Elec. Engr. on Station Design, Hydro-Electric Power Comm. of Ont., Toronto. For mail: 42 Lorindale Ave., Toronto. (A.M.1915. M.1940)
Armstrong, John E. Chief Engr., Canadian Pacific Railway Co., Windsor Station, Montreal. (A.M.1917. M.1940)
Armstrong, J. Lloyd Telph. Engr., Northern Electric Co Ltd., Montreal. For mail: 4630 Westmore Ave., Montreal. (S.1936. Jr.1940)
Armstrong, Owen F. C. 671 Logan St., St. Lambert, Que. (S.1926. A.M.1935. M.1940)
Armstrong, T. C. Instmn., Ontario Dept. of Highways, Port Arthur. For mail: 17 Carrie St., Port Arthur, Ont. (Affil.1940)
Armstrong, L. H. Asst. Engr., Transm. & Equipt. Dept., Brazilian Telephone Co., Rio de Janeiro, Brazil, S.A. (S.1919. A.M.1930. M.1940)
Arnason, Einar Sales Engr., Power & Mine Supply Co. Ltd., 123 Princess St., Winnipeg, Man. (S.1937. M.1941)
Arnason, F. M. 594 Alverstone, Winnipeg, Man. (S.1945)
Arnold, W. B. 3042 Trafalgar Ave., Montreal. (S.1946)
Arnsdorf, Hans R.C.N., Overseas (S.1944)
Arpin, Jean Victor Canadian Arsenals Ltd., St. Paul L'Ermite, Que. For mail: 95 Jean Talon St. E., Montreal. (Jr.1941. M.1945)
Arsenault, Wm. Alexander Town Engr., P.O. Box 31, Springhill, N.S. (M.1944)
Arthey, G. Clayton, Mgr., Canadian Liquid Air Co. Ltd.. Halifax. For mail: 7 Dutch Village Road, Halifax, N.S. (S. 1934. M.1944)
Ashford, A. G. Civil Engr., Port of Bristol Authority, England. For mail: 14 Cotham Lawn Road, Bristol, England. (A.M.1930. M.1940)
Ashton, Ernest Transitman, Dauphin Divn., Canadian National Railways. For mail: P.O. Box 530, Dauphin, Man. (Affil.1939)
Ashton, Hugh W. Asst. Mgr., Ashton Potter Ltd., 1 Phoebe St., Toronto. (S.1943. Jr.1946)
Askin, R. J. Mgr. of Mills, Abitibi Power & Paper Co. Ltd., Toronto. For mail: 2 Brule Terrace, Toronto 3. (S.1922. A.M.1926. M.1937)
Askwith, Frank Chatham Commsr. of Works & City Engr., Ottawa. For mail: 222 Powell Ave., Ottawa. (S.1910. Jr.1913. A.M.1919. M.1940)
Askwith, L. G. R.C.N.V.R., Overseas. (S.1938. Jr.1946)
Askwith, Winston M. Federal District Commission, 291 Carling Ave., Ottawa. (Jr 1937)
Asplin, A. G. Asst. Chief Dfsmn., Horton Steel Works Ltd., Fort Erie. For mail: P.O. Box 695, Fort Erie North, Ont. (S.1937. M.1946)
Asquith, A. R. Devlmt. Engr., Aluminum Goods Ltd., 158 Stirling Road, Toronto. (S.1938. Jr.1946)
Assaly, J. A. Lachute, Que. (S.1944)
Asselin, André Jr. Engr., Dominion Engrg. Works, Ltd., Lachine. For mail: 6074 Briand St., Montreal 20. (S.1945)
Asselin, Hector Engr., Arthur Surveyer & Co., Montreal. For mail. 3117 Tremblay St., Montreal. (S.1937. Jr.1942)
Asselin, Jean Asst. to Dir. of Public Works, City of Montreal. For mail: 6666 St. Denis St., Montreal 10. (A.M. 1934. M.1940)
Asselin, Louis Chief Chemist, Industrial Steel & Fibre Co., Terrebonne, Que. For mail: 7080-a Chambord St., Montreal. (M.1946)
Asseltine, S. H. Lab. Tech., Canada Packers Ltd., Edmonton. For mail: 11507-96th St., Edmonton, Alta. (S.1944)
Astels, Fletcher, Engr., Foundation Co. of Can. Ltd., Montreal. For mail: 255 Nepean St., Ottawa. (A.M.1937. M.1940)
Athey, Frank A. P. Nylon Plant Mgr., "Ducilo", Buenos Aires, Argentina. For mail: c/o J. M. Quinn, Foreign Relations Dept., E. I. DuPont de Nemours & Co. Inc., Wilmington 98, Del., U.S.A. (S.1937. M.1944)
Atkinson, A. L. C. Asst. Prof. Mech. & Civil Engrg., University of Saskatchewan, Saskatoon, Sask. (M.1943)
Atkinson, C. C. Supt. Pulpwood Operations, Fraser Companies Ltd., Box 131, Edmundston, N.B. (M.1940)
Atkinson, Donald M. Talbot Street, Blenheim, Ont. (S.1946)
Atkinson, F. Pres. & Gen. Mgr., Atwood Ltd., 660 St. Catherine St. W., Montreal. (Affil. 1925)
Atkinson, M. Brodie Asst. Sup. Engr., Welland Canals, Dept. of Transport, Yate St., St. Catharines, Ont. (S.1904. A.M.1909. M.1918)
Attenborough, Ernest A. Devlpmt. Engr., A. C. Wickman (Canada) Ltd., Queensway, Etobicoke, Ont. For mail: 39 Ardagh Ave., Toronto. (Jr.1936)
Attwood, C. H. Director of Water Resources, Dept. of Mines & Natural Resources, Parliament Bldgs., Winnipeg, Man. (A.M.1915. M.1940)
Aubert, Marcel A. Prof. Montreal Technical School, Montreal. For mail. 7438 Chateaubriand St., Montreal. (M.1943)
Aubry, Gérard Asst. Dist. Engr., Dept. of Public Works of Que., Montreal. For mail: 2132 Bordeaux St., Montreal. (S.1939. Jr.1943)
Auclair, Chas. A. Contracting Engr., Auclair & Bayard, 2270 Pie IX Blvd., Montreal. (S.1939. Jr.1942. M.1945)
Audet, Henri Engr., Canadian Broadcasting Corporation, Montreal. For mail: 734 Wiseman Ave., Outremont, Que. (S.1940. M.1945)
Audy, René 57 Lasot Ave., Quebec, Que. (S.1945)
Auger, J. B. Gérard Aluminum Co. of Can. Ltd., Shawinigan Falls. For mail: 560—18th St., Almaville-en-haut, Que. (Affil.1942)
Auger, Roland A. Utilities Engr., Shell Oil Co. of Canada, Montreal East. For mail: 3555 Cote Ste. Catherine Rd., Montreal 26. (S.1941. Jr.1945)
Augustine, W. P. Head, Dftg. Dept., W. D. Lowe Vocational School, Windsor, Ont. For mail: 1955 Oneida Court, Walkerville, Ont. (A.M.1939. M.1940)
Auld, F. M. R.C.E.M.E., Overseas. (S.1942. Jr.1944)

Auld, Jas. R. Elec. Engr., Canadian Industries Ltd., P.O. Box 10, Montreal. (Jr.1929. A.M.1939. M.1940)
Auld, W. F. Lincoln Electric Co. of Canada, Leaside, Ont. For mail. 42 Indian Road Crescent, Toronto. (Jr.1929. A.M.1936. M.1940)
Aumont, C. E. 4614 Garnier St., Montreal 34. (S.1945. Jr.1946)
Avery, Eric Owner-Mgr., Watson Construction Co., 921—8th Ave. W., Calgary, Alta. (A.M.1935. M.1940)
Ayer, T. H. 5480 Trans Island Ave., Montreal. (S.1930. A.M. 1938. M.1940)
Ayers, F. E. Transitman, Canadian National Railways, Division Engineer's Office, Port Arthur, Ont. (Jr.1945)
Ayers, Ralph E. Test Engr., Canadian General Electric Co., Lynn, Mass. For mail: 26 North Franklin St., Lynn, Mass., U.S.A. (S.1943)

B

Babbitt, A. R. Constrn. Engr., Dept. of Highways, N.B., Fredericton. For mail: 311 University Ave., Fredericton, N.B. (A.M.1924. M.1940)
Babbitt, S. W. Civil & Mining Engr., Minto Coal Co. Ltd., Minto, N.B. (A.M.1929. M.1940)
Babcock, H. A. Partner, Margison & Babcock, 137 Wellington St. W., Toronto. (A.M.1922. M.1940)
Babey, W. J. Elfros, Sask., (S.1944)
Babin, A. Town Engr. & Mgr., Baie Comeau, Que. (S.1905. A.M.1910. M.1940)
Babineau, Guy Elec. Engr., Quebec Power Co., 229 St. Joseph St., Quebec, Que. (S.1945)
Babington, Harold Ormond Bell Telephone Co. of Canada, Room 729, Beaver Hall Bldg., Montreal. (S.1946)
Baburek, C. S. Electrolux (Canada) Ltd., Montreal. For mail: 791 Desmarchais Blvd., Verdun, Que. (S.1941. Jr.1946)
Bach, J. R. Pres. Bach-Simpson Ltd., 71 Carling St., London, Ont. (M.1944)
Bachynski, Nicholas Pine Falls, Man. (S.1945)
Backer, Geo. Ernest Mech. Dept., Wayagamack Divn., Consolidated Paper Corp., Three Rivers, Que. For mail: Grand'Mère, Que. (S.1943. Jr.1946)
Backler, Irving S. Cons. Engr., 303 St. Paul St. W., Montreal. For mail: 1915 Barclay Road, Montreal. (S.1930. Jr.1937. M.1942)
Bacon, Thos. H. Chief Inspr., Special Hazards Dept., Canadian Underwriters Assn., Montreal. For mail: 16 Brunet Ave., Pointe-Claire, Que. (S.1910. Jr.1913. A.M.1921. M.1940)
Bader, Alfred Robt. Research Work, National Research Council, Queen's University, Kingston, Ont. For mail: 442 Argyle Ave., Westmount, Que. (S.1943)
Badgley, L. A. Dept. of Bldgs., City of Toronto. For mail: 106 Lawrence Ave. East, Toronto. (Jr.1914. A.M.1924. M.1940)
Baggs, W. C. Chief Engr., Bathurst Power & Paper Co. Ltd., Bathurst, N.B. (S.1935. M.1941)
Bailey, Alex. Librarian-in-charge & Prof., Montreal Technical School. For mail. Cercle Universitaire, 515 Sherbrooke St. E., Montreal. (M.1940)
Bailey, Charles D. Asst. Chief Engr., John Inglis Co. Ltd., Toronto. For mail: 285 Kennedy Ave., Toronto. (A.M.1935. M.1940)
Bailey, Edward T. W. Combustion Engr., Steel Co. of Canada Ltd., Hamilton. For mail: 176 Sterling Road, Hamilton, Ont. (M.1944)
Bailey, Harold Milton City Engr., Yorkton, Sask. (A.M.1922. M.1940)
Bailey, Loring W. Supt., N.B. System, Gatineau Power Co., Grand Falls, N.B. (S.1922. A.M.1937. M.1940)
Bailey, Robt. T. 8 Parkside Drive, Dundas, Ont. (S.1945)
Bailey, J. C. Canadian General Electric Co., 212 King St. W., Toronto. (S.1942. Jr.1946)
Baillargeon, Robt. A. 12200 Valmont St., Montreal. (S.1942. Jr.1946)
Baillie, E. L. Dist. Mgr., Imperial Oil Ltd., Halifax, N.S. (Jr.1926. A.M.1931. M.1940)
Bain, A. M. i/c Design, Combustion Engrg., Dominion Bridge Co. Ltd., Lachine. For mail: 4301 Benny Ave., Montreal 28. (S.1925. Jr.1930. A.M.1938. M.1940)
Bain, F. A. 130 S. College Ave., Sarnia, Ont. (S.1942)
Bain, Wm. A. Res. Engr., B.C. Pulp & Paper Co. Ltd., Woodfibre, B.C. (A.M.1934. M.1940)
Baines, Wm. D. 10946—81st St., Edmonton, Alta. (S.1945)
Baird, A. F. Dean, Faculty of Applied Science University of New Brunswick, Fredericton, N.B. (A.M.1922. M.1927)
Baird, E. M. Engr., Township of Scarboro, Ont. For mail: 1683 Kingston Road, Toronto 13. (Jr.1925)
Baird, John A. Chief, Gas Measurement Dept., Union Gas Co. of Canada Ltd., Fifth St., Chatham, Ont. (M.1926)
Baird, J. Boyd Secretary, Newfoundland Board of Fire Underwriters, Bank of Nova Scotia Bldg., Water St., St. John's, Nfld. (S.1908. A.M.1913. M.1940)
Baird, Malcolm F. Bell Telephone Co. of Canada, Montreal. For mail: 6185 Hudson Road, Montreal. (S.1937. Jr.1941)
Baird, R. G. Dist. Engr., New Brunswick Electric Power Commission, Saint John. For mail: P.O. Box 86, Saint John, N.B. (S.1942. Jr.1946)
Baird, S. L. 50 Ruby St., Winnipeg, Man. (S.1946)
Baker, Ben O. Asst. Gen. Engr., Canadian General Electric, Peterborough. For mail: 577 McCannan Ave., Peterborough, Ont. (S.1940. Jr.1946)
Baker, Charles N. Chem. Engr., Research & Develpt. Sec., Norton Co., Chippawa, Ont. for mail: R.R. No. 2, St. Catharines, Ont. (S.1943. Jr.1946)
Baker, D. Blair Plant Engr., Johnson & Johnson Ltd., Montreal. For mail: 7338 Sherbrooke St. W., Montreal (S.1943. Jr.1946)
Baker, F. B. 4703—7th Ave. W., Vancouver, B.C. (S.1946)
Baker, G. C. Army Overseas. (S.1939)
Baker, John A. Inspr., Canadian Underwriters Assn., Toronto. For mail: 177 Donlea Drive, Toronto 12. (S.1930. Jr.1938. M.1943)
Baker, J. D. 35 Fairleigh Crescent, Toronto. (S.1946)
Baker, Lorne P. Asst. Trade & Industrial Commissioner, Ontario House, 13 Charles II St. London S.W.1, England. (M.1946)
Baker, Maxwell C. Lecturer, Civil Engrg., Dept., McGill University, Montreal. For mail: 4419 Jeanne D'Arc St., Montreal. (S.1942. Jr.1946)
Baker, Max L. Asst. Prof., Mech. Engrg., Nova Scotia Technical College, Halifax, N.S. (M.1945)
Baker, W. Gordon 4560 St. Catherine St. W., Montreal (S.1937. Jr.1946)
Bakewell, David R. Victoria Lumber Co. Ltd., Nanaimo, B.C. For mail. 3531 West 33rd Ave., Vancouver, B.C. (S.1944)
Bakhmeteff, His Excellency Boris A. Prof., Columbia University, and Consulting Engr., 250 West 57th St., New York, N.Y. (M.1917)
Balcom, Alfred B. R.C.N.V.R., For mail: 59 Maple Ave., Shawinigan Falls, Que. (S.1939. M.1946)
Bald, Karl I. 840 Eglinton Ave. W., Toronto 10. (S. 1945)
Balderson, Kenneth K. Field Elec. Engr., Trinidad Leaseholds Ltd., Forest Reserve, Trinidad, B.W.I. (S.1939. Jr.1942)
Balderson, Wm. T. Dial Equipt. Engr., Northern Electric Co., Montreal. For mail: 1441 Drummond St. Montreal 25. (S.1946. Jr.1946)
Baldry, G. E. Chief Engr., Baldry Engrg. & Constrn. Co. Ltd., 235 Garry St., Winnipeg, Man. (Affil.1936)
Baldry, Geo. S. Industrial Hygienist, Medical Arts Bldg., Winnipeg. For mail: 810 Wolseley Ave., Winnipeg, Man. (S.1931. Jr.1941)
Baldwin, O. L. Res. Engr., Dept. of Public Works of N.B. For mail: St. George, N.B. (Jr.1940)
Baldwin, Wm. A. Supt., High Falls Generating Station, Maclaren Quebec Power Co., via Buckingham, Que. (S.1929. M.1941)
Bales, Robt. Phillip Tech. Supt., Dominion Rubber Co., St. Jerome, Que. (Jr.1940)
Balfour, R. H. Windsor Hotel, Montreal. (S.1899. A.M.1903. M.1940)
Balkwill, J. Keith 941 Pelissier St., Windsor, Ont. (S.1946)
Ball, Alfred N. Chief Engr., E. B. Eddy Co., Hull, Que. (A.M.1919. M.1936)
Ball, E. L. Engr., Dept. Public Works of Canada, 115 Prince William St., Saint John, N.B. (Jr.1939. M.1945)
Ball, Frank C. Sewer & Bridge Engr., City of London, Ont. For mail: 214 Ridout St. S., London, Ont. (S.1920. A.M.1926. M.1940)
Ball, J. Stewart Refinery Engr., Shell Oil Co. of B.C. Ltd., 475 Howe St., Vancouver, B.C. (M.1945)
Ball, Spencer Prof. of Civil Engrg., Nova Scotia Technical College, Halifax, N.S. (S.1915. Jr.1920. M.1932)
Ball, W. H. Jr. Engr., Dept. Mines & Resources. For mail: Box 98, Banff, Alta. (S.1940. Jr.1946)
Ball, W. H. Warren 607 Huron St., Toronto. (S.1944. Jr.1946)
Ball, W. L. (A.M. 1921. M.1940)
Ballantyne, A. G. Jr. Engr., Dept. of Agriculture (P.F.R.A.), Room 418, Public Bldg., Calgary, Alta., (Jr.1945)
Ballantyne, Norman F. 110 Hawthorne Ave., Ottawa. (A.M.1906. M.1940)
Ballantyne, Thos. B. Dist. Engr., Canadian Pacific Railway, Union Station, Toronto. For mail: 215 High Park Ave., Toronto. (S.1908. A.M.1913. M.1940)
Ballard, B. G. Asst. Dir. i/c Elec. Engrg. & Radio Research Div. of Elec. Engrg., National Research Council, Sussex St., Ottawa Ont. (A.M.1931. M.1940)
Balleny, James L. Sales Engr., Canadian General Electric Co. Ltd., 212 King St. West, Toronto 1. (S.1922. A.M.1931. M.1940)
Ballou, F. H. Chief Engr., B.C. Sugar Refining Co. Ltd., Canadian Sugar Factories, Ltd., & Ozama Sugar Co. Ltd. For mail: B.C. Sugar Refining Co. Ltd., Ft. Rogers St., Vancouver, B.C. (M.1937)
Balls, Matthew Mgr. Water Resources & Statistical Dept., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (A.M.1919. M.1940)
Balmforth, Harold 3234 Dominion St., New Westminster, B.C. (A.M.1936. M.1940)
Balshaw, F. E. Waterworks Engr., Calgary Power Co. Ltd., 504 Insurance Exchange Bldg., Calgary, Alta. (Jr.1946)
Baltzer, C. E. Engr., Fuels & Combustion, Fuel Research Laboratories, Bureau of Mines, Ottawa. For mail: 13 St. Francis St., Ottawa, Ont. (S.1919. A.M.1925. M.1940)
Bamford, A. B. Asst. Operator, Seismic Survey, Imperial Oil Ltd., Edmonton. (S.1944)
Bancroft, Gilbert H. Chief Engr., Engineering & Machinery Ltd., 736 Granville St., Vancouver, B.C. (A.M.1936. M.1940)
Bandiera, Leo J. (S.1943)
Bangs, Raymond Gardner Economic Statistician, Dominion Bureau of Statistics, Ottawa. For mail: 191 Somerset St. W., Ottawa. (S.1916. A.M.1919. M.1940)
Banks, S. R. Aluminium Laboratories Ltd., 1800 Sun Life Bldg., Montreal. (Jr.1930. A.M.1934. M.1940)
Banting, C. G. Equipt. Design, Gruman Aircraft Engrg. Corp., Bethpage, N.Y. For mail: White Gates Apts., Babylon, L.I., N.Y., U.S.A. (S.1940. Jr.1941)
Barbeau, A. 4890 Hutchison St., Montreal 8. (S.1945)
Barber, Wm. Pres. & Mgr., Barber Construction Ltd., 315 Eglinton Ave. West, Toronto. (A.M.1911. M.1940)
Barber-Starkey, Joseph W. M. Diesel Engr., B.C. Power Commission, Duncan, B.C. (Jr.1945)
Barbour, C. A. Mgr. & Dist. Engr., D. M. Fraser Ltd., 603 Belmont St., Montreal. (S.1930 Jr.1935. A.M.1939. M.1940)
Barbour, Frank A. Cons. Engr., 1119 Tremont Bldg., Boston, Mass., U.S.A. (M.1904)
Barbour, Robt. Constrn. Engr., Currie Products Ltd., Hamilton, Ont. For mail: 60 Orchard St., London, Ont. (M.1944)
Barchard, F. M. Diesel Engrg., Union Tractor & Equiptment Co. Ltd., 10581—107 St., Edmonton, Alta. (M.1946)
Barchard, P. W. Chem. Engr., B.C. Electric Railway Co., Vancouver, B.C. (M.1945)
Barchyn, D. E. Engrg. Service Dept., Canadian General Electric Co. Ltd., 129 Hollis St., Halifax, N.S. (S.1942. Jr.1946)
Barclay, J. B. Supt., Northern Constrn. Co., & J. W. Stewart Ltd., Vancouver, B.C. For mail: 5480 Collingwood St., Vancouver, B.C. (A.M.1936. M.1940)
Barclay, Noel M. Asst Engr., Engrg. Divn., City of Montreal. For mail: 506 Grosvenor Ave., Westmount, Que. (A.M.1914. M.1940)
Bardsley, Leonard W. Elec Engr., Rolling Stock Dept., Toronto Transportation Commission. For mail: 124 Mavety St., Toronto. (Jr.1946)
Barends, Howard A. Operations Mgr., MacLaren-Quebec Power Co., Buckingham. For mail: P.O. Box 389, Buckingham, Que. (M.1945)
Barrette, Raymond 5389 Brodeur Ave., Montreal 28. (S.1944)
Baribeau, Benoit, Asst. Res. Engr., Arthur Surveyer & Co., Quebec. For mail: 1 Turnbull Ave., Quebec. (S.1940. M.1945)
Baril, Romain P.O. Box 557, La Tuque, Que. (S. 1939. M.1945)
Baril, R. G. St. Hilaire, Que. (S.1942)
Barker, Frederick G. Asst. Supt., Fluoride Divn., Aluminum Co. of Canada Ltd., Arvida, Que. (Jr.1945)
Barker, Peter 24 Willcocks St., Toronto 5. (S.1946)
Barkwell, Stewart Design Engr., Power Trans., Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto. (S.1939. Jr.1943)
Barltrop, I. C. Asst. Supt., Motor Carrier Br., Public Utilities Commission of B.C., Vancouver. For mail: 4582 W. 3rd Ave., Vancouver, B.C. (A.M.1923. M.1940)
Barnecut, R. Engr., Dominion Bridge Co. Ltd., Calgary. For mail: 1230—16th Ave. N.W., Calgary, Alta. (A.M.1931. M.1940)
Barnes, Chiles M. Strl. Designer, Lummus Co., New York. For mail: 3542—73rd St., Jackson Heights, N.Y., U.S.A. (Jr.1917. A.M.1922. M.1940)
Barnes, Chas. T. Strl. Designer, Winnipeg Hydro-Electric System, Winnipeg. For mail: 343 Dubuc St., Norwood, Man. (Jr.1920. A.M.1923. M.1940)
Barnes, Frank H. Supvr., Canadian Industries Ltd., Brownsburg, Que. (A.M.1928. M.1940)
Barnes, H. F. 5 Shorncliffe Ave., Toronto 12. (A.M.1916. M.1924)
Barnes, Howard T. (M.1924)
Barnes, John, Mech. Designer, Canadian General Electric Co., Peterborough. For mail: 5 Cottesmore Ave., Peterborough, Ont. (A.M.1921. M.1940)
Barnes, J. C. Asst. Resch. Engr., National Research Council, Ottawa. For mail: 328 Second Ave., Ottawa, Ont. (M.1945)
Barnett, Harold E. Partner & Constrn. Engr., H.G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (Jr.1921. A.M.1931. M.1940)
Barnett, Thos. A. Supt. of Constrn., Angus Robertson Ltd., Quebec. For mail: 2408 Stanley St., Niagara Falls, Ont. (A.M. 1922. M.1940)

Barnhill, B. E. Chief Engr., Foley Bros. Inc., Pasadena, Calif. For mail: 246 W. Camino Real, Arcadia, Calif., U.S.A. (A.M.1907. M.1921)
Barnhouse, F. W. Mgr., Supply Dept., Wire & Cable Sec., Canadian General Electric Co., Toronto. For mail: 392 Old Orchard Grove, Toronto. (S.1933. Jr. 1938. M.1943)
Barnsley, Frank R. Mgr., Supply Divn., Canadian General Electric Co., Vancouver. For mail: 1192 Nanton Ave., Vancouver, B.C. (S.1924. A.M.1938. M.1940)
Barr, F. G. F. Dist. Traffic Supt., Bell Telephone Co. of Canada, Kitchener. For mail: 139 Union Blvd., Kitchener, Ont. (S.1926. A.M.1937. M.1940)
Barratt, E. F. County Engr. & Road Supt., County of Wentworth, Court House, Hamilton, Ont. (M.1942)
Barratt, P. S. Asst. Supt., Constrn. & Mtce., Sullivan Mine, Consolidated Mining & Smelting Co., Kimberley, B.C. (M.1945)
Barrett, A. G. Strl. & Mech. Engr., Yukon Consolidated Gold Corp. Ltd., Dawson, Y.T. (S.1921. Jr.1925. A.M.1931. M.1940)
Barrett, F. J. Plant Engr., Canadian Gypsum Co. Ltd., Hillsborough, N.B. (S.1943)
Barrett, G. F. W. 2800 Notre Dame St., Lachine, Que. (S.1945)
Barrett, M. J. Mech. Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 9626 LaSalle Road, Ville LaSalle, Que. (Jr.1938)
Barrick, J. B. Elec. Instr., Kelvin Technical High School, Winnipeg. For mail: 267 Beaverbrook Ave., Winnipeg, Man. (Jr.1943)
Barrie, A. O. With African Frontier Force, Overseas. (A.M. 1939. M.1940)
Barrière, Jacques 2366 Gouin Blvd. W., Cartierville, Que. (S.1945)
Barrington, Yorke C. Town Engr., P.O. Box 629 Sydney Mines, N.S. (A.M. 1923. M.1940)
Barron, J. Leonard. 221 Clarke Ave., Westmount, Que. (S.1945)
Barron, L. J. Constrn. Supt., Foundation Co. of Canada, 1900 Sherbrooke St. W., Montreal. (M.1943)
Barry, D. B. R.C.N.V.R. For mail: 5410 Cote St. Luc Road, Montreal. (M.1944)
Barry, Oswald Canadian Pacific Railway Montreal. For mail: 5-36th Ave., Lachine, Que. (S.1936. M.1940)
Barry, W. H. Chief Engr., Worth Bros. Inc., Los Angeles, Calif. For mail: 8178 N. Chestnut Ave., South Gate, Los Angeles, Calif., U.S.A. (A.M.1924. M.1940)
Bartlet, A. Wm. 2933 Foul Bay Road, Victoria, B.C. (S.1946)
Bartlett, E. H. Engr., Newfoundland Light & Power Co. Ltd., St. John's. For mail: 10 Victoria St., St. John's, Nfld. (S. 1939. Jr.1946)
Bartlett, O. W. Design Engr., Fraser-Brace Engrg. Co. Ltd., Montreal. For mail: 590 Cote St. Antoine Rd., Westmount, Que. (M.1946)
Bartlett, R. L. Heaps Engrg. Co., New Westminster, B.C. For mail: 10 Boundary Road S., Vancouver, B.C. (Affil.1940)
Bartlett Wm. W. 86 Courcelette Road, Toronto 13. (S.1946)
Bartley, E. J. Elec Engr., Robt. A. Rankin & Co., Cornwall. For mail: 46 Baldwin Ave., Cornwall, Ont. (M.1944)
Barton, Harold M. 31 Broadway Ave., Ottawa. (A.M.1921. M.1940)
Barton, Robt. Arthur. Municipal Engr., District of Penticton, Box 1198, Penticton, B.C. (A.M.1910. M.1940)
Barwick, Oliver A. Architect, 557 Notre Dame Ave., St. Lambert, Que. (A.M.1923. M.1940)
Bash, K. W. Chief Engr., Loblaw Groceterias Co. Ltd., Fleet & Bathurst Sts., Toronto. (M.1944)
Bastable, Ross W. Supt. of Bldgs., Eastern Area, Bell Telephone Co. of Canada, Montreal. For mail: 386—44th Ave., Lachine, Que. (S.1920. A.M.1930. M.1940)
Bastien, Jean Engr., Mtl. Divn., Dept. of Roads of Quebec, Montreal. For mail: 6241 Louis-Hebert, Montreal. (M.1943)
Bastien, Jean-Pierre 6915 Christophe-Colomb St., Montreal 34. (S.1944)
Bastien, Paul Asst. Chief Engr., J. M. Eugène Guay Inc., Rm. 742, Dominion Square Bldg., Montreal. (M.1946)
Bate, Chas. Benjamin, Major, Dept. of National Defence. For mail: 181 Fraser St., Quebec. (A.M. 1919. M.1940)
Bate, Thomas Edward Asst. Engr., Engrg. Dept., Canadian National Railways, Winnipeg, Man. (M.1946)
Bateman, John Lincoln Asst. Toll Plans Engr., Bell Telephone Co. of Canada, Montreal. For mail: 2260 Regent Ave., Montreal 28. (S.1943)
Bateman, Leonard A. Elec. Design, Winnipeg Hydro-Electric System, 55 Princess St., Winnipeg, Man. (S.1941. Jr.1943)
Bateman, W. A. 4187 W. 16th Ave., Vancouver, B.C. (S.1946)
Bates, A. John C. 26 East Drive, Toronto. (S.1943)
Bates, Chas. L. Savary Island, B.C. (A.M.1907. M.1936)
Bates, H. C. County Engr., Perth County, Court House, Stratford, Ont. (S.1916. Jr.1920. M.1942)
Bates, John S. Mgr., Price & Pierce Ltd., 1058 Sun Life Bldg., Montreal 2. (A.M.1915. M.1940)
Batey, Alan Cons. Engr., Atwood Ltd., Montreal. For mail: 35 Balfour Ave., Town of Mount Royal, Que. (M.1945)
Bath, Duncan T. Test Course, Canadian General Electric, 270 Monaghan Road, Peterborough, Ont. (Jr.1946)
Batt, Wm. L. Pres., SKF Industries Inc., Front St. & Erie Ave., P.O. Box 6731, Philadelphia 32, Pa., U.S.A. (Hon.M.1943)
Baty, Edward, Divn. Plant Engr., Bell Telephone Co. of Canada, Montreal. For mail: 4588 Michel Bibaud, Montreal. (A.M. 1931. M.1940)
Batzold, J. C. Mng. Dir., Sprostons Ltd., Georgetown, Demerara, British Guiana, South America. (M. 1945)
Bauman, Bert E. Constrn. Engr., Aluminum Co. of Canada, Arvida. For mail: 924 Coulombe St., Arvida, Que. (S.1927. A.M.1936. M.1940)
Bauman, D. A. Buckingham, Que. (S.1944)
Baxendale, Lawrence R. Hanna, Alta. (S.1946)
Baxter, Andrew, Engr., Dominion Bridge Co., Riverside Iron Works, Calgary. For mail: General Delivery, Calgary, Alta. (M.1946)
Baxter, Gordon Bruce Asst. Elec. Supt., Canadian International Paper Co., Three Rivers, Quebec. (S.1924. Jr.1929. M.1942)
Baxter, John F. Jr. Refinery Engr., Tropical Oil Co. Refinery, Barrancabermeja, Colombia, South America. (S.1941. Jr.1945)
Bayley, Allan K. Sales Serv. Engr., Aeron. & Rwy. Radio, Northern Electric Co., Montreal. For mail: 6050 Darlington Ave., Montreal. (M.1945)
Bayne, B. E. Maintainer, Unit Cars, Canadian National Railway, Moncton. For mail: 51 Cameron St., Moncton, N.B. (Jr.1920. A.M.1927. M.1940)
Bayne, Geo. M. Heating Engrg. Divn., Canadian Westinghouse Co., Hamilton. For mail: 186 Roslyn Ave. S., Hamilton, Ont. (A.M.1922. M.1940)
Beach, Floyd K. Engr., Petroleum & Natural Gas Conservation Board, Calgary. For mail: 1914-5a St. West, Calgary Alta. (S.1910. A.M.1913. M.1935)
Beach, J. E. Asst. Engr., Trinidad Leaseholds Ltd., Pointe-à-Pierre, Trinidad, B.W.I., (S.1935. Jr.1941)
Beale, A. M. Dominion Water & Power Bureau, Dept. of Mines & Resources, Laurentian Club Bldg., Ottawa. (S.1907. A.M.1912. M.1940)
Beam, Donald C. Strl. Engr., Carter Construction Co. Ltd., 419 Cherry St., Toronto, Ont. (S.1926. Jr.1927. A.M.1935. M.1940)
Beament, G. Edwin Barrister and Partner, Beament & Beament, 56 Sparks St., Ottawa, Ont. (Jr.1932)
Beamish, James E. Agric. Engr., Dept. of Agriculture of B.C., Parliament Bldgs., Victoria, B.C. (S.1939. Jr.1940)
Beamish, Vincent A. Elec. Insln., Canadian General Electric Co., 212 King St., Toronto, Ont. (S.1944)
Beaney, Sydney W. Mgr. Sydney W. Beaney, Toronto. For mail: 129 Yonge Blvd., Toronto. (Affil.1936)
Beard, George F. Metallurgist, Canada Metal Co., Toronto. For mail: 65 Oakmount Road, Toronto. (Jr.1940)
Beaton, Neville Res. Mgr., Brompton Pulp & Paper Co. Ltd., Red Rock, Ont. (A.M.1935. M.1940)
Beaton, W. H. 3484 Westmore Ave., Montreal. (S.1942)
Beattie, Ira M. Asst. Prof. of Civil Engrg., University of New Brunswick, Fredericton, N.B. (S.1943)
Beatty, James Edward (A.M.1905. M.1915)
Beaubien, deGaspé Cons. Engr., deGaspé Beaubien & Co., 660 St. Catherine St. West, Montreal. (S.1903. A.M.1908. M.1921)
Beauchamp, Gaston 5318 Berri St., Montreal 34. (S.1945)
Beauchemin, Gendron 141 Pagnuelo Ave., Montreal 8. (S.1944)
Beauchemin, Jules A. Chief Engr., Provincial Electricity Board, Montreal. For mail: 4969 Grosvenor Ave., Montreal 6. (A.M.1919. M.1940)
Beauchemin, Roger O. 4969 Grosvenor Ave., Montreal 6. (S.1944)
Beauchesne, Louis-Alfred Elec. Engrg. & Radio Branch, National Research Council, Ottawa. For mail: 5 Somerset East, Ottawa. (S.1944. Jr.1946)
Beaudet, Guy Mgr., Montreal Br., Central Mortgage & Housing Corpn., Sun Life Bldg., Montreal. (S.1936. Jr.1939)
Beaudet, P. Jacques 1438 Galt Ave., Montreal. (S.1945)
Beaudoin, Bernard Shawinigan Water & Power Co., Montreal. For mail: 3783 Botrel, Montreal. (S.1942)
Beaudoin, Hector O. Owner, Granby Electrical Winding & Repair Shop, Granby. For mail: 37-a Queen St., Granby, Que. (Affil.1942)
Beaudoin, Maurice Divn. Engr., Dept. of Roads of Quebec, St. Lambert. For mail: 81 Guillaume St., Longueuil, Que. (M.1943)
Beaudry, André 8076 Drolet St., Montreal 10. (S. 1944)
Beaudry, Louis Port Mgr. & Chief Engr., Quebec Harbour, National Harbours Board. (S.1919. A.M.1926. M.1940)
Beaudry, Marcel Candn. Underwriters Assn., Montreal. For mail: 4953 Lafontaine St., Montreal. (S.1939. Jr.1946)
Beaudry, Maurice Henri Asst. Supvr., Canadian Industries Limited, Shawinigan Falls. For mail: Cascade Inn, Shawinigan Falls, Que. (S.1945)
Beaudry, P. F. Cons. Engr., 765 Dunlop Ave., Montreal 8. (M.1945)
Beaudry, Roger J. Sound Mtce. & Research, National Film Board, John St., Ottawa. For mail: 25 Mutchmor Road, Ottawa. (S.1944. Jr.1945)
Beaulieu, Gérard O. Cons. Engr. & Lecturer in Strl. Engrg. & Bridges at Ecole Polytechnique, Montreal. For mail: 6210 Somerled Ave., Montreal 29. (S.1935. Jr.1940. M.1945)
Beaulieu, J. Roland Mgr., City of Rivière du Loup, City Hall, Rivière du Loup, Que. (M.1946)
Beaupré, Bernard Engr., Divn. of Indust. Hygiene, Quebec Dept. of Health, Montreal. For mail: 5809 Boileau St., Montreal 5. (S.1939. M.1945)
Beaupré, Louis 34 Hazelwood Ave., Outremont, Que. (S.1942)
Beaver, Sir Hugh Mng. Director, Arthur Guinness Son & Co., Park Royal Brewery, London N.W.10, England. (M.1937)
Beck, Edward H. E. G .M. Cape & Co., New Birks Bldg., Montreal. (M.1939)
Beck, Humphrey C. Asst. to Chief Elec. Engr., Southern Railway, England. For mail: Heydon, Norwich, Norfolk, England. (A.M.1934. M.1940)
Beck, R. V. 1 Aberdeen Terrace, Halifax, N.S. (S.1946)
Becker, Fred A., Sales Engr., Canadian General Electric Co. Ltd., 212 King St. W., Toronto. (Jr.1928. A.M.1931. M.1940)
Becker, Howard W. Design Engr., Standard Chemical Co. Ltd., Toronto. For mail: 31 Sykes Ave., Weston, Ont. (Jr.1935)
Becker, Sidney J. Engr., J. Becker Inc., 282 Villeneuve St. W., Montreal 8. (S.1937. Jr.1944. M.1945)
Beckett, Donald R. Asst. Res. Engr., Nishin Lake, Spruce Falls Power & Paper Co. Ltd., Kapuskasing. For mail: 327 S. Marks St., Fort William, Ont. (S.1942)
Beckett, R. M. Elecn. i/c, National Harbours Board, Churchill, Man. For mail: 327 S. Marks St., Fort William, Ont. (Affil.1939)
Beckett, W. Douglas Res. Engr., Dept. of Highways of Ontario, 44 Toronto St., Barrie Ont. (S.1944)
Becks, D. E. c/o A. J. Wagg, Mindemoya, Ont. (S.1945)
Bédard, Claude 56 Hotel-Dieu St., Chicoutimi, Que. (S.1943)
Bédard, Jacques, Chief Engr., Dominion Shuttle Co. Ltd., Lachute Mills, Que. For mail: Lachute, Que. (S.1941)
Bedford-Jones, Charles Edward Dist. Mgr., F. S. B. Heward & Co. Ltd., Montreal. For mail: 351 Brock Ave. N., Montreal West, Que. (S.1932. M.1943)
Bedwin, T. West Sales Engr., Building Products Ltd., Montreal. For mail: 158 Main St., Truro, N.S. (M.1946)
Beecher, K. D. Patent Examiner, Patent Office, Ottawa. For mail: 270 Arlington Ave., Ottawa. (Jr.1946)
Beecroft, George W. Indus. Relations, Imperial Oil Ltd., Toronto. For mail: 37 Brookdale Ave., Toronto. (M.1943)
Beedham, G. H. Mech. Engr., Loblaw Groceterias Co. Ltd., Fleet & Bathurst St., Toronto, Ont. (M.1943)
Beer, A. N. Canadian Vickers Co. Ltd. For mail: 3821 Draper Ave., Montreal. (A.M.1915. M.1940)
Beer, W. G. 284 Inglewood Drive, Toronto. (S.1946)
Beetham, Hugh Stanley, Prop., Beetham Machine Works, Winnipeg. For mail: 66 Claremont Ave., Norwood Grove P.O., Man. (A.M.1921. M.1940)
Begg, James M. 4 Whinfield Road, Prestwick, Scotland. (A.M.1913. M.1928)
Begg, Robt. Arthur Dftsmn., Dominion Bridge Co. Ltd., Lachine. For mail: 625—44th Ave., Lachine, Que. (S.1943. Jr.1946)
Béique, Charles 9085 LaSalle Road, Ville LaSalle, Montreal 32. (S.1944)
Béique, Henri F. Supt., Power Divn., Quebec Power Co., Quebec. For mail: 24 rue Raymond Casgrain, Quebec. (S.1936. Jr.1938. M.1945)
Béique, Jean Asst. to Paul A. Béique, 477 St. François Xavier St., Montreal. (M.1940)
Béique, Jean-C. City Manager, City Hall, 5th Ave., Grand'Mère, Que. (M.1945)
Béique, Paul A. Cons. Engr., 477 St. François Xavier St., Montreal, Que. (S.1904. A.M.1913. M.1940)
Béland, Jean A. 807 Wilder Ave., Outremont, Que. (S.1942. Jr.1946)
Bélanger, A. A. 2360 Girouard St., St. Hyacinthe, Que. (S.1899. A.M.1907. M.1940)

Bélanger, Fernard, 687 Ave. Royale, Beauport, Que. (S.1946)
Bélanger, Cécilien 312 St. Jean, Quebec. (S.1944)
Bélanger, Lucien Res. Indus. Engr., Wallace G. Rouse & Co., Montreal. For mail: 249 St. Catherine Road, Montreal 8. (S.1940. Jr.1942. M.1945)
Bélanger, Maurice Engr., Dept. of Public Works, City of Montreal, 3161 Joseph St., Verdun, Que. (S.1938. Jr.1940. M.1945)
Bélanger, Raphaël Constrn. Engr., 47 Jacques-Cartier St., Valleyfield, Que. (S.1921. A.M.1927. M.1940)
Bélanger, René Supt., Quebec Pulp & Paper Corp. For mail: 53 Price St., Chicoutimi, Que. (A.M.1935. M.1940)
Belding, A. F. Bridge Engr.'s Office, Dept. of Public Works, Fredericton, N.B. (M.1942)
Belford, Richard B. Strl. Steel Dftsmn., Dominion Bridge Co. Ltd., Toronto. For mail: 13 Wilgar Road, Toronto. (S.1944. Jr.1946)
Béliveau, Lucien-Conrad Mine Supt., Sullivan Consolidated Mines Ltd., Sullivan, Que. (M.1945)
Bell, Charles E. Babcock-Wilcox & Goldie-McCulloch Co., Galt. For mail: 124 St. Andrew St., Galt, Ont. (S.1945)
Bell, Clarence W. Constrn. Engr., Currie Products Ltd., 15 Birch Ave., Toronto. (M.1942)
Bell, Frederick A. County Engr. County of Elgin, & Cons. Engr., Court House, St. Thomas, Ont. (S.1906. A.M.1913. M.1940)
Bell, Fred A. Engr., Housing Research Section, Manufacturers Life Insurance Co., 200 Bloor St. E., Toronto. (S.1941. Jr.1946)
Bell, F. Jno Mgr., C. A. Parsons of Canada Ltd., Royal Bank Bldg., Toronto 1. (M.1918)
Bell, George Edward Delegate Director, Deloro Stellite Ltd., Highlands Road, Shirley, Birmingham, England. (S.1901. A.M.1908. M.1914)
Bell, Harry H. Engr. on special studies, Montreal Engineering Co., 244 St. James St. West, Montreal. (S.1928. Jr.1931. A.M.1934. M.1940)
Bell, Norman Teaching, Chem. Engrg. Dept., University of Pittsburgh, 107 State Hall, Pittsburgh, Pa., U.S.A. (M.1945)
Bell, R. Clifford Res. Engr., Civil Aviation, Dept. of Transport, Lethbridge. For mail: 130-15th St. N., Lethbridge, Alta. (M.1941)
Bell, R. T. 403 Monaghan Road, Peterborough, Ont. (M.1928)
Bellamy, Franklin Joseph Ley House, St. Neot, Liskeard, Cornwall, England. (M.1910)
Bellamy, K. L. Elec. Contr., 2548 Taylor St., Niagara Falls, Ont. (S.1934. Jr.1941)
Bellefeuille, Marcel Inventions Board, National Research Council, National Research Bldg, Ottawa, Ont. (S.1943)
Belle-Isle, J. G. Gérard Plant Engr. Commun. & Constrn., Bell Telephone Co. of Canada, Montreal. For mail: 507 Pine Ave., St. Lambert, Que. (S.1938. Jr.1943. M.1945)
Bell-Irving R. 1st Vice-Pres., Powell River Co. Ltd., 1204 Standard Bank Bldg., Vancouver, B.C. (A.M.1920. M.1936)
Belliveau, John Edmund Chief Engr., Dept. of Highways & Public Works of N.S. For mail: 3 Woodlawn Terrace, Halifax, N.S. (A.M.1918. M.1940)
Belliveau, J. G. Asst. Mgr., Civil Engrg. & Mtce. for Atlantic Coast, R.C.N., Halifax. For mail: 3 Woodlawn Terrace, Halifax, N.S. (M.1941)
Belnap, LaMonte J. Pres., Consolidated Paper Corp. Ltd., 1615 Sun Life Bldg., Montreal. (M.1939)
Belyea, James L. R.C.N.V.R. For mail: 262 Duke St., Saint John, N.B. (S.1942. Jr.1946)
Bendt, Joseph P. Engr., Smith, Hichman & Grylls, Detroit, Mich. For mail: 4861 Bedford Road, Detroit 24, Mich., U.S.A. (M.1944)
Benett, C. M. 49 Chesterfield Ave., Westmount, Que. (A.M.1934. M.1940)
Benjafield, P. Grant Field Engrg., International Nickel Co. of Canada Ltd. For mail: 3 Park St. E., Copper Cliff, Ont. (S.1928. Jr.1938. M.1942)
Benjafield, J. F. Travelling Supt., Foundation Co. of Canada, Montreal. For mail: 4607 Hampton Ave., Montreal. (S.1933. Jr.1938. M.1944)
Benjamin, Abraham Planning Supt., Canadian Marconi Co., Town of Mount Royal, Que. For mail: 935 Davaar Ave., Outremont, Que. (S.1921. Jr.1928. A.M.1935. M.1940)
Benjamin, Archie Elec. Engr., Distribution Engrg. Divn., Quebec Hydro-Electric Commission, 107 Craig St. West, Montreal. (S.1926. Jr.1933. A.M.1939. M.1940)
Benjamin, Frederick Remby Engrg. Dftsmn., Price Bros. & Co. Ltd., Riverbend, Que. (M.1945)
Bennett, Arthur J. Plant Mgr., English Electric Co. of Canada. St. Catharines. For mail: 12 Queen Mary Drive, St. Catharines, Ont. (S.1925. A.M.1935. M.1940)
Bennett, Aldran R. Asst. Engr., Canadian National Railways, Moncton. For mail: 179 Bonaccord St., Moncton, N.B. (M.1942)
Bennett, Graham A. 32 Rosebank Ave., Halifax, N.S. (S.1945)
Bennett, G. Frank C. Mng. Dir. Foulis & Bennett Electric Co. Ltd., P.O. Box 414, Capitol Bldg., Halifax, N.S. (S.1929. Jr.1936. M.1941)
Bennett, J. E., Dist. Engr., Dept of Highways, Weyburn, Sask. (A.M.1938. M.1940)
Bennett, James M. Campbellford, Ont. (S.1944)
Bennett, J. Robt. G. Asst. Transm. Engr., Canadian Pacific Railway, Communications Dept., Montreal. For mail: 155 Westminster Ave., Montreal West, Que. (S.1942. M.1945)
Bennett, L. Maxwell, Jr. Engr., John H. Ross, Toronto. For mail: 68 Rosehill Ave., Toronto, Ont. (S.1946)
Bennett, R. D. Devlpt. Supt., Nylon Division, Canadian Industries Ltd., P.O. Box 210 Kingston, Ont. (S.1930. A.M.1938. M.1940)
Bennett, S. G. Vice-pres., Beardmore & Co. Ltd., 37 Front St. East, Toronto, Ont. (A.M.1926. M.1940)
Bennett, Weston T. Chief Engr., Newsprint Divn., Canadian International Paper Co., Sun Life Bldg., Montreal. (M.1945)
Benny, Walter Wilfred 85 Bellwood Ave., Ottawa. (S.1899. A.M.1904. M.1940)
Benoit, André P. Sales Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 1465 Bernard Ave., Outremont, Que. (S.1933. Jr.1940. M.1945)
Benoit, Jacques Emmanuel Dist. Sales Mgr., Wallace & Tiernan Ltd., 1502 St. Catherine St. W., Montreal. (S.1933. Jr.1938. M.1942)
Benoit, Marc Plastic Engr., Die-Plast Co. Ltd., Outremont, Que. For mail: 7368 De Normanville, Montreal. (S.1944. M.1945)
Benson, W. M. Hoyle Mining Co. Ltd., Pamour, Ont. (S.1935. Jr.1944)
Bentall, R. G. Exec.-Engr., Dominion Construction Co. Ltd., Vancouver. For mail: 1531 Davie St., Vancouver, B.C. (S.1944. Jr.1946)
Bentley, K. E. Refinery Foreman, Imperial Oil Ltd., Box 490, Dartmouth, N.S. (S.1934. Jr.1939. M.1941)
Bentley, Wm. A. Sales Engr., Dominion Bridge Co. Ltd., 1139 Shaw St., Toronto. (M.1942)
Bentley, W. J. Tel. Engr., Dept. of Telephones of Sask., Regina. For mail: 198 Angus Crescent, Regina, Sask. (A.M.1938. M.1940)
Berbrayer, A. M. 570 Lansdowne Ave., Winnipeg, Man. (S.1942. Jr.1946)
Berenstein, Leslie Strl. Engr., Louis Pickard & Co. Inc., 2070 Papineau Ave., Montreal. (S.1929. M.1941)
Beresford, M. M. Army Overseas (S.1942. Jr.1946)
Bereskin, A. I. Controller of Surveys, Dept. of Natural Resources of Sask., Regina. For mail: 2630 Albert St., Regina, Sask. (S.1925. Jr.1931. A.M.1939. M.1940)
Bergenstein, E. G. Test Course, Canadian General Electric Co. For mail: 54 Noble Ave., Winnipeg, Man. (S.1945)
Berger, B. A. Cons. Mech. Engr., 5415 Randall Ave., Montreal 29. (S.1928. Jr.1936. M.1944)
Berger, Stephen E. Mfr., Toronto Toy & Novelty Mfg. Co., Toronto. For mail: 234 St. George St., Toronto. (M.1946)
Bergeron, Claude 2072 Valois St., Montreal. (S.1945)
Bergeron, J. Roch 10667 Chambord St., Montreal 12. (S.1944)
Bergman, P. R. 1444 Wellington Crescent, Winnipeg, Man. (S.1946)
Berlinguet, F. X. T. Cons. Engr., 747 Laviolette Ave., Three Rivers, Que. (A.M.1887. M.1890)
Bernard, Gerald W. Jr. Engr., Davis, Ripley & Associates, 207 Williamson Bldg., Edmonton, Alta. (S.1943)
Bernard, Marcel (S.1944)
Bernardi, Aldo (S.1944)
Bernier, Chas. 39 St. Eustache St., Quebec. (S.1946)
Bernier, Roger 6 Montcalm, Lévis, Que., (S.1945)
Bernstein, Saul 4057 Esplanade Ave., Montreal 18. (S.1942. Jr.1946)
Berringer, O. B. Army Overseas (S.1933. Jr.1938)
Berry, Albert E. Dir., Sanitary Engrg. Divn., Ontario Dept. of Health, Toronto. For mail: 235 Gainsborough Road, Toronto. (A.M.1921. M.1934)
Berry, Arthur H. Mfng. Engr.'s Dept., Northern Electric Co. Ltd., Montreal. For mail: 82 Lorne Ave., St. Lambert, Que. (S.1943. Jr.1946)
Berry, Arthur Lawrence 8915-100th St., Edmonton, Alta. (S.1946)
Berry, E. D. Chief Dftsmn., E.B. Eddy Co. Ltd., Hull, Que. For mail: 56 Glen Ave., Ottawa. (A.M.1933. M.1940)
Berry, Melville Douglas Owner, Berry Engineering Co. For mail: 160 Palmer St., Guelph, Ont. (S.1928. Jr.1936. M.1944)
Berry, Theodore, V. Treas., Greater Vancouver Water District, and Sec.-treas., Vancouver & Districts Joint Sewerage & Drainage Board. For mail: 3007 West 36th Ave., Vancouver, B.C. (A.M.1934. M.1940)
Berry, V. H. 3440 Walkley Ave., Montreal 28. (S.1943. Jr.1946)
Berry, Wm. M. Jr. Engr., P.F.R.A., Dept. of Agriculture of Sask., Regina. For mail: 241 Harbison Ave., Winnipeg, Man. (S.1941. Jr.1945)
Berthiaume, J. A. Contrecoeur, Que. (S.1941. Jr.1946)
Bertram, H. Graham Pres. & Gen. Mgr., John Bertram & Sons Co. Ltd., Dundas, Ont. (M.1920)
Bertrand, G. 178 Daumesnil, Paris 12, France. (S.1928)
Bertrand, J. Edouard Sec. Treas. & Engr., Dufresne Engrg. Ltd. & Dufresne Construction Ltd., Montreal. For mail: 31 Maplewood Ave., Outremont, Que. (M.1945)
Bertrand, Pierre, 119 Wicksteed Ave., Town of Mount Royal, Montreal 16. (S.1944)
Bertrand, René Engr., Division of Streets, City of Montreal. For mail: 4544 Pontiac St., Montreal. (M.1945)
Bessant, W. E. Metalgst., Aluminum Goods Ltd., Toronto. For mail: 388 Jane St. Toronto, Ont. (S.1943. Jr.1946)
Bessborough His Excellency, The Right Honourable, The Earl of Stanstead Park, Rowlands Castle, Sussex, England. (Hon.M.1931)
Bessette, Fernand Marieville, Que. (S.1944)
Bessette, O. City Engr., City Hall, Drummondville, Que. (M.1943)
Bestwick, Frank S. Application Engr., English Electric Co. of Canada, St. Catharines. For mail: 93 George St., St. Catharines, Ont. (S.1940. Jr.1946)
Bethel, Vincent W. Major, Chief Instr., A-36, Canadian Radar Training Centre, Barriefield Camp, Ont. (S.1939. Jr.1946)
Bethune, Robt. J. Divn. Engr., Dept. of Highways & Public Works of Nova Scotia, New Glasgow, N.S. (M.1940)
Betnesky, David Mech. & Strl. Dftsmn., Dominion Bridge Co. Ltd., Lachine. For mail: 3921 Drolet St., Montreal. (S.1943)
Betts, Victor A. Chem. Engr., Research Dept., Carborundum Co., Niagara Falls, N.Y. For mail: 1197 Jepson St., Niagara Falls, Ont. (S.1946)
Beugler, Edwin J. Retired Cons. Engr., South Main St., Cheshire, Conn., U.S.A. (M.1907)
Bevan, W. H. B. Divn. Engr., Canadian National Railways, Union Station, Ottawa. (A.M.1921. M.1940)
Beverly, I. W. West. Sales Mgr., Sangamo Co. Ltd., 900 Electric Railway Chambers, Winnipeg, Man. (A.M.1939. M.1940)
Beverly, W. M. 326 Waverly St., Winnipeg, Man. (S.1945)
Bews, D. W. Dftg. Instr., Belleville Technical School. For mail: 152 Dufferin Ave., Belleville, Ont. (Jr.1916. A.M.1921. M.1940)
Bialik, George J. M. 115 Elm St. South, Timmins, Ont. (S.1946)
Biard, Gordon 3592 University St., Montreal 2. (S.1945)
Bibeau, Jules Ecole Polytechnique, 1430 St. Denis St., Montreal, Que. (S.1945)
Bickell, W. A. Public Works Contractor, 5930 Blenheim St., Vancouver, B.C. (M.1944)
Bickerdike, Robert Henderson, King & Charland Ltd., 485 McGill St., Montreal. (S.1888. A.M.1895. M.1900)
Bickers, C. W. Asst. Chief Engr., Kaiser-Frazer Corp., Willow Run, Mich. For mail: 51151 Old Michigan Ave., R.1, Belleville, Mich., U.S.A. (M.1944)
Bickle, W. P. Pres., Acadia Construction Co. Ltd., Bridgewater, N.S. (A.M.1930. M.1940)
Bicknell, A. Bertram Gen. Purch. Agent, Canadian Gypsum Co. Ltd., 170 Bloor St., Toronto. (M.1943)
Biedermann, O., Mgr., Oerlikon-Canada Ltd., 1514 University Tower, Montreal. (A.M.1936. M.1940)
Bieler, Jacques L. Dir. Indust. Devlpt. Divn., Robt. A. Rankin & Co., 1420 Sherbrooke St. W., Montreal. (S.1920. Jr.1928. M.1936)
Biesenthal, C. Gordon Chief Engr., Alex. Fleck Ltd., 416 Wellington St., Ottawa. (S.1935. Jr.1938)
Bigham, Ronald H. Test Course, Canadian General Electric Co., Peterborough. For mail: 276 John St., Peterborough, Ont. (S.1946)
Bigg, Robt. Lindsay, Hydraulic Engr., P.F.R.A., Dept. of Agriculture, Regina. For mail: Davidson, Sask. (M.1942)
Billie, Frank R. Pres. & Gen. Mgr., Billie Construction Co. Ltd., Box 1185, Smiths Falls, Ont. (S.1927. A.M.1936. M.1940)
Billings, A. W. K. Vice-pres., Brazilian Traction & Subsidiaries. For mail: c/o Mr. L. H. Warner, 21 E. 90th St., New York, U.S.A. (M.1930)
Billings, G. M. Army Overseas (S.1936. Jr.1946)
Billinkoff, Louis 355 Notre Dame Ave., Winnipeg, Man. (S.1945)
Bilodeau, Francis Jas. Donald. Appn. Engr. & Sales, Canadian Ingersoll-Rand Co., Montreal. For mail: 256 Wood Ave., Westmount, Que. (S.1944)
Bilodeau, Leo J. 256 Wood Ave., Westmount, Que. (S.1946)
Bingeman, J. B. Tech. Control Dept., B. F. Goodrich Rubber Co., Kitchener, Ont. For mail: R.R. No. 1, Waterloo, Ont. (S.1946)

Bing-Wo, Reginald, Asst. Hydraulic Engr., P.F.R.A., Dominion Dept. of Agriculture, Regina. For mail: 2043 Cameron St., Regina, Sask. (S.1941. Jr.1943)

Binks, Wyman R. Civil Engr., Soils Br., Dept. of Highways of Ont. For mail: 121 Belgravia Ave., Toronto. (S.1940. Jr.1944)

Binnie, Robt. Frederick Transitman, Shawinigan Engrg. Co., P.O. Box 65, Shalalth, B.C. (S.1943)

Binns, Frank Instrctr., Engrg. Drawing, Mount Allison University, Sackville. For mail: P.O. Box 47, Mount Allison Univ., Sackville, N.B. (A.M.1938. M.1940)

Birbrager, Jake Bienfait, Sask. (S.1943)

Bird, David A. G. Purchg., Delamere & Williams Ltd., Toronto. For mail: 7 Powell Ave., Toronto. (M.1946)

Bird, Frederick George, Chief Supt. of Lands, Imperial Oil Ltd., 56 Church St., Toronto, Ont. (A.M.1920. M.1940)

Bird, Gordon Asst. Engr., Geodetic Survey, Dept. of Mines & Resources, Ottawa. For mail: 443 Holland Ave., Ottawa, Ont. (S.1945)

Bird, H. J. Pres. & Gen. Mgr., Bird Construction Co. Ltd., Winnipeg. For mail: 626 South Drive, Fort Garry, Man. (A.M.1929. M.1940)

Bird, J. M. 1664 East 11th Ave., Vancouver, B.C. (S.1946)

Bird, R. A. 626 South Drive, Winnipeg, Man. (S.1946)

Bird, Wm. H. S. Engrg. Planner, Trans-Canada Airlines, P.O. Box 2973, Winnipeg, Man. (A.M.1939. M.1940)

Bird, W. L. Vice-pres. & Mgr., Kaministiquia Power Co. Ltd., Syndicate & Mary Sts., Fort William, Ont. (M.1939)

Birkett, L. H. Sales Mgr., Combustion Engineering Corp. Ltd., Dominion Square Bldg., Montreal. (A.M.1927. M.1940)

Birks, W. R. Engrg. Asst., Canadian Industries Ltd., Nylon Divn., Kingston. For mail: 41 Union St., Kingston, Ont. (S.1944)

Birt, Thomas Wm. Sales Engr., Northern Electric Co., Montreal. For mail: 23 Murray Ave., Greenfield Park, Que. (S.1939. (M.1945)

Bisaillon, G. A. British Overseas Airways Corp., Montreal. For mail: 1956 Rachel St. East, Montreal. (S.1942)

Bisaillon, R. J. 849 Hartland Ave., Outremont, Montreal 8. (S.1945)

Bishop, A. L. Pres., Coniagas Mines Ltd., Toronto. For mail: 69 Forest Hill Road, Toronto. (Jr.1919. A.M.1924. M.1936)

Bishop, E. R. Canadian Westinghouse Co. Ltd., Hamilton. For mail: 24 Fairleigh Crescent, Hamilton, Ont. (A.M.1939. M.1940)

Bishop, J. G. i/c tech. work, Station CHSJ, New Brunswick Broadcasting Co. For mail: 13 Pine St., Saint John, N.B. (M.1942)

Bishop, John M. Jr. 785 Upper Belmont Ave., Westmount, Montreal 6. (S.1946)

Bishop, K. C. Engr., Super Service Stations Ltd., Halifax. For mail: 40 Brenton St., Halifax, N.S. (S.1945)

Bishop, P. W. Transitman, Canadian Pacific Railway, Victoria, B.C. (S.1940. Jr.1945)

Bishop, Wm. J. 405 Elgin St., Ottawa, Ont. (S.1909. A.M.1911. M.1940)

Bissett, E. E. Cons. Mech. Engr., 1901 W. Georgia St., Vancouver, B.C. (M.1944)

Bissett, J. R. Sr. Asst. Engr., Dominion Water Power Bureau, Dept. Mines & Resources, Ottawa. (A.M.1916. M.1940)

Bisson, J. L. Supt. Engr., Dept. of Public Works, 824 Hunter Bldg., Ottawa. (M.1944)

Bitondo, Domenic 177 King St., Welland, Ont. (S.1946)

Bizier, J. L. National Harbours Board, Port of Quebec, Que. (A.M.1931. M.1940)

Bjarnason, B. S. Chief Engr., Instrument Division, Hans Lundberg, Geologists and Geophysicists, Toronto. For mail: 177 Davisville Ave., Toronto. (M.1943)

Bjarnason, Johannes Tech. Dir., Okra Ltd., Iceland. For mail: Lindargata 9, Reykjavik, Iceland. (Jr.1946)

Bjerring, K. H. Project Engr., Canadian Industries Ltd., Montreal. For mail: 5616 McLynn Ave., Montreal 29. (M.1943)

Blachford, H. E. Inspection Board, U.K. & Canada, Montreal. For mail: 2422 Mariette Ave., Montreal. (S.1930. Jr.1938)

Black, Frank Signal Fitter, Canadian Pacific Railways, Calgary. For mail: 725 Riverdale Ave., Calgary, Alta. (S.1946)

Black, F. L. Dist. Engr., Transmission Sec., Hydro-Electric Power Comm. of Ont., Toronto. For mail: 57 Spencer Ave., Toronto. (S.1930. Jr.1934. M.1943)

Black, Gerald M. Campbellton, N.B. (S.1945)

Black, H. K. 2310 College Ave., Regina, Sask. (M.1941)

Black, Hugh M. Mgr., Ont. Divn., Dominion Engineering Co. Ltd., 67 Yonge St., Toronto, Ont. (S.1921. A.M.1930. M.1940)

Black, J. S. Accountancy, J. S. Black & Co., 414 Water St., Peterborough, Ont. (S.1943)

Black, James Wm. Sr. Lab. Asst., National Research Council, Ottawa. For mail: 168 Dufferin Road, Ottawa. (S.1944. Jr.1945)

Black, Maurice W. Mgr., Canada Construction Co. Ltd., Royal Bank Bldg., Fredericton, N.B. (S.1907. Jr.1912. A.M.1916. M.1922)

Black, Raymond E. Campbellton, N.B. (S.1945)

Black, Robert, Naval Arch., Davie Shipbuilding & Repairing Co. Ltd., Lévis. For mail: 109 Fraser St., Quebec. (A.M.1939. M.1940)

Black, Roy L. Res. Engr., Dept. of Transport, Calgary, Alta. (M.1941)

Black, S. W. B. Asst. Engr., Hydraulic Dept., Hydro Electric Power Commission of Ont., 620 University Ave., Toronto, Ont. (A.M.1920. M.1940)

Black, W. D. Pres., Otis-Fensom Elevator Co. Ltd., Hamilton. For mail: Braeheid Farms, Waterdown, Ont. (S.1908. A.M.1912. M.1928)

Black, Wm. S. Design Engr., R. A. Hanright, Cons. Engrs., Toronto. For mail: 29 Don Valley Drive, Toronto 6. (Jr.1939. M.1943)

Blackburn, G. A. Regnl. Rep., Research & Devpt., Dept. of Reconstruction, P.O. Box 713, Hollis Street, Halifax, N.S. (M.1946)

Blackett, Robt. L. Jr. Engr., Tropical Oil Co., Barranca Bermeja, Colombia, S.A., (S.1939. Jr.1944)

Blackett, Victor St. Clair Asst. Engr., Canadian National Railways, Moncton, N.B. (A.M.1921. M.1940)

Blackman, L. W. 635 Warsaw Ave., Winnipeg, Man. (S.1946)

Blackmore, R. H. 3673 Park Ave., Montreal. (S.1946)

Blackstock, W. J. Dept. of Transport, Grande Prairie, Alta. (S.1941)

Bladon, J. B. Engr. Consultant, Darling Bros. Ltd., Montreal. For mail: 85 Holton Ave., Westmount, Que. (M.1922)

Blaine, D. S. (S.1934. Jr.1946)

Blair, Donald Strl. Engr., Dept. of National Defence, Ottawa. For mail: 173 Daly Ave., Ottawa. (A.M.1934 M.1940)

Blair, D. E. Vice-Pres. & Gen. Mgr., Montreal Tramways Co., Craig St. W., Montreal (A.M.1904. M.1927)

Blair, David W. Jr. Engr., Dept. Research & Devlpt., Canadian National Railways, 360 McGill St., Montreal. (S.1946)

Blair, Desmond Res. Engr., on Mun. work, Armstrong, Anderson & Co., Toronto. For mail: 21 Langford Ave., Toronto. (S.1946)

Blair, F. J. Chief Engr., Toronto Harbour Commissioners Administration Bldg., Toronto. (A.M.1921. M.1940)

Blair, James Major, R.C.E., Engrg. Research, U.S. War Dept., 2222 "S" N.W., Washington 8, D.C., U.S.A. (S.1931. M.1940)

Blair, R. T. Asst. Bldg. Inspr., City Hall, Vancouver, B.C. (A.M.1921. M.1940)

Blais, Robt. Asst. Chief Engr., Dept. of Public Works, Hunter Bldg., Ottawa. (M.1943)

Blake, D. H. R. 1949 Beach Drive, Victoria, B.C. (S.1943. Jr.1946)

Blake, Jas. H. Marine & Constrn. Engr., Dept. of Lands & Forests, Victoria, B.C. For mail: 605 Victoria Ave., Victoria, B.C. (A.M.1923. M.1940)

Blake, W. E. 151 Earl St., Kingston, Ont. (S.1940)

Blake, W. H. Lieut.-Col., 151 Earl St., Kingston, Ont. (A.M.1931. M.1940)

Blakely, N. W. Gen. Engrg., Steel Co. of Canada, Hamilton. For mail: Fruitland P.O., Ont. (S.1943. Jr.1946)

Blanchard, Arthur C. D. Hydraulic Engr., Montreal Engineering Co., 244 St. James St. W., Montreal. (S.1901. A.M.1904. M.1911)

Blanchard, Chas. H. Box 170, R.R. No. 1, Winnipeg Man. (A.M.1919. M.1940)

Blanchard, John R. Sulphite Chemist, Canadian International Paper Co., Temiskaming. For mail: Box 223, Temiskaming, Que. (S.1940. Jr.1945)

Blanchard, Murray E. 268 Main St., Kentville, N.S. (S.1946)

Bland, Percy N. Chief Engr., Canadian Sumner Iron Works Ltd., Vancouver. For mail: 3528 Point Grey Road, Vancouver. (M.1944)

Blaylock, Peter W. Asst. Dir., Chem. Devlpt. Dept., Shawinigan Chemicals Ltd., P.O. Box 4072, Montreal. (M.1944)

Blayney, James Porter Jr. Engr. (Mtce), Dow Chemical of Canada Ltd., Sarnia, Ont. (Jr.1945)

Bleackley, Robt. Scott Asst. Engr., Bell Telephone Co. of Canada, Engrg. Dept., 76 Adelaide St. W., Toronto, Ont. (Jr.1940)

Bleaken, Maynard D. 74 Simpson Ave., Toronto. (M.1946)

Bleau, J. M. A. Mining Engr., Quebec Dept. of Mines, Quebec. For mail: 490 St. Cyrille St., Quebec. (M.1946)

Blezard, Roy J. Jr. Engr., Link Belt Ltd., Toronto. For mail: 15 Mountalan Ave., Toronto 6. (S.1943)

Block, Frank Designing Engr., Dominion Bridge Co. Ltd., Lachine. For mail: 239 Brock Ave. N., Montreal West, Que. (M.1945)

Block J. Ben 4054 Dorchester St. West, Montreal 6. (S.1937. Jr.1946)

Bloom, David Builder, 4935 Queen Mary Road, Montreal. (Jr.1940)

Bloom, Chas. A. 6116 Durocher Ave., Outremont, Que. (S.1943. Jr.1946)

Bloomberg, Allan D. Quality Control Engr., Burgess Battery Co., Niagara Falls. For mail: 472 Second Ave., Niagara Falls, Ont. (S.1944. Jr.1946)

Blowey, J. F. G. Supvr., Trade School, Ford Motor Co., of Can., Windsor. For mail: 2337 Windermere Road, Walkerville, Ont. (M.1940)

Bloxham, Horace W. Constrn. Dept., Dept. of Munitions & Supply, Room 125, Bldg. No. 2, Ottawa. (A.M.1938. M.1940)

Blue, A. C. Foster Wheeler Ltd. For mail: 140 Iroquois Ave., London, Ont. (S.1920. Jr.1927. A.M.1932. M.1940)

Blue, Walter, Mgr. of Devlpt., Gatineau Power Co., Ottawa. For mail: 196 Cobourg St., Ottawa. (S.1910. Jr.1913. A.M.1919. M.1940)

Blumenthal, Samuel Asst. Engr., Chief Engr.'s Office, C.P.R., Room 401, Windsor Station, Montreal. (S.1903. A.M.1909. M.1940)

Boal, A. R. Res. Engr., Dept. of Highways of Sask. For mail: 1864 Retallack St., Regina, Sask. (S.1946)

Boast, Chester W. Chief Engr., Spruce Falls Power & Paper Co. Ltd., Kapuskasing. For mail: P.O. Box 11, Kapuskasing, Ont. (S.1917. A.M.1922. M.1940)

Bobyn, E. J. Lieut., Research Scientist, C.A.R.D.E., P.O. Box 1427, Quebec, Que. (S.1943)

Bodwell, G. L. Army Overseas (S.1935. Jr.1946)

Bodwell, John C. 182 Merritt St., Ingersoll, Ont. (S.1946)

Boese, G. Philip F. Chief Engr., Dept. of Natural Resources, C.P.R., Calgary, Alta. (S.1909. A.M.1919. M.1940)

Boese, P. Raymond New York Central Railway, 914-466 Lexington Ave., New York, N.Y. (S.1909. Jr.1914. A.M.1922. M.1940)

Bogert, Frank B. 242 Beaverbrook St., Winnipeg, Man. (S.1942. Jr.1946)

Boggs, W. Brenton Group Leader, Engrg. Dept., Trans-Canada Air Lines, Dorval Airport, Que. (Jr.1945)

Bogle, Roy T. Asst. Engr., A.C./D.C. Engrg. Divn., Canadian General Electric Co., Peterborough. For mail: 430 Park St. N., Peterborough, Ont. (S.1941. Jr.1944)

Bohraus, Werner Designing Elec. Engr., Ontario Paper Co. Ltd., Thorold. For mail: 18 Sullivan Ave., Thorold, Ont. (M.1945)

Boileau, Chas. Antoine Engr., Atlas Construction Co., Montreal. For mail: 3870 St. Hubert St., Montreal. (S.1940. M.1945)

Boisclair, Robert Engr. & Director, La Salle Paving Co. Ltd., Victoriaville, Que. (S.1938. Jr.1942. M.1945)

Boismenu, Roméo County Engr., Mtce. & Construction, Prescott & Russell Counties, L'Orignal, Ont. (A.M.1937. M.1940)

Boisvert, Chas. Chief Engr., Provincial Transportation & Communication Board, Court House, Quebec. (Jr.1927. A.M.1932. M.1940)

Boisvert, Maurice 46 Aberdeen St., Quebec. (S.1946)

Boivin, Louis Georges Begin Ave., Chicoutimi, Que. (S.1944)

Boivin, Philip P. J. Engrg. Asst., Bell Telephone Co., Toronto. For mail: 135 Simpson Ave., Toronto 6. (S.1946)

Boivin, Thos. J. Chief Dftsmn. & Designer, Eastern Canada Steel & Iron Works Ltd., Lesage Ave., Quebec. (A.M.1929. M.1940)

Bolduc, Armand Res. Engr., Dept. of Roads of Quebec. For mail: 207 Sir G. E. Cartier Square, Montreal. (S.1936. M.1940)

Bolger, E. J. Mine Mgr., Eldorado Mining & Refining Ltd., Port Radium, N.W.T. (S.1904. Jr.1911. A.M.1915. M.1940)

Bolduc, Raymond Tech. Agent, French Mining Mission, 1322—18th St., Washington, D.C. (S.1943. Jr.1946)

Bolton, G. H. 1206 Wolseley Ave., Winnipeg, Man. (S.1942. Jr.1946)

Bonaventure, Claude 3877 Van Horne Ave., Montreal 8. (S.1944)

Bonaventure, J. E. Dist. Engr., Dept. Public Works of Canada, 1254 Bishop St., Montreal. (M.1943)

Bond, George W. Plant Engr., Canada Cement Co., Plant No. 1, Montreal East. For mail: 3677 Park Ave. Montreal. (S.1944)

Bone, A. Turner Vice-Pres., J. L. E. Price & Co. Ltd., 680 Sherbrooke St. W., Montreal. (A.M.1922. M.1940)

Bonenfant, Edmond i/c ore- dressing lab., Nepheline Products Ltd., Lakefield, Ont. (Affil.1940)

Bonenfant, Joseph La Sarre, Co. Abitibi, Que. (Affil.1940)

Bonham, Tobert L. Supt. of Operations, Creosoting Divn., Dominion Tar & Chemical Co. Ltd., Montreal. For mail: 225 Dufferin Road, Hampstead, Montreal. (Jr.1921. A.M.1930. M.1940)

Bonin, Robert 1590 Visitation St., Montreal. (S.1946)

Bonn, W. E. Chief Engr., Canadian Dredge & Dock Co. Ltd., 302 Harbour Commission Bldg., Toronto. (Jr.1914. A.M.1918. M.1935)

Bonneau, L. P. Mining Engr., Canadian Johns-Manville Co. Ltd., Asbestos. For mail: P.O. Box 42, Asbestos, Que. (M.1945)

Bonnell, A. R. Sussex, N.B. (S.1935. Jr.1938 M.1941)

Bonney, Albert J. Chief Engr., Quaker Oats Co. of Canada, Peterborough. For mail. 162-B Park Hill Road, Peterborough, Ont. (S.1935. Jr.1940)

Bonnycastle, Wm. Robinson Consulting Engr., 1950 Robson St., Vancouver, B.C. (M.1917)
Booker, G. Ernest Res. Engr., Design & Supvn. of Constrn. & Equipt., Howard Smith Paper Mills, Winnipeg. For mail: 3 Wilson Ave., Toronto 3. (A.M.1918. M.1940)
Boone, H. P. Canadian Westinghouse Co. Ltd., Hamilton. For mail: 166 Prospect St. S., Hamilton, Ont. (S.1937. Jr.1941)
Boone, W. E. R. Plant Engrg. Dept., Colgate-Palmolive-Peet Co., 295 Laird Drive North, Toronto. For mail: Leaside, Ont. (S.1940. Jr.1946)
Booth, Frank M. 4585 Harvard Ave., Montreal. (Jr.1940)
Booth, John N. Jr. Engr., British-American Oil Co. Ltd., Toronto. For mail: 1185 Dufferin St. Toronto. (S.1946)
Booth, K. A. Elec. Engr., Price Bros. & Co. Ltd., Kenogami, Que. (S.1936. Jr.1938. M.1941)
Booth, Mark W. Steam Engr., Dominion Steel & Coal Corp., Sydney. For mail: 160 Whitney Ave., Sydney, N.S. (A.M.1921. M.1926)
Booth, Wm. Lawrence Jr. Engr., Longlac Pulp & Paper Co. Ltd., Terrace, Ont. For mail: 365 Dovercourt Road, Toronto. (S.1946)
Booz, Fred B. Dist. Mgr., Horton Steel Works Ltd., University Tower Bldg., Montreal. (M.1939)
Borbey, John P. Sales Engr., Dominion Bridge Co., Lachine, Que. (Jr.1937. M.1944)
Borden, Douglas C. Dept. Mgr., Northern Electric Co. Ltd., 1620 Notre Dame St. W., Montreal. (M.1946)
Borduas, Henri, Strl. Designer, Dominion Bridge Co. Ltd., Lachine. For mail: 665 16th Ave., Lachine Que. (M.1945)
Bornett, Kurt Herbert, 504 Mountain Ave., Westmount, Montreal. (S.1946)
Borrowman, M. L. Foreman, Constrn. & Mtce., Central Divn., McColl-Frontenac Oil Co., Toronto. For mail: 9 Coxwell Blvd., Toronto. (M.1946)
Borrowman, R. W. Engr. Planner, Metropolitan Plan, Greater Winnipeg. For mail: 76 Sunset Blvd., St. Vital, Man. (S.1941. M.1944)
Borth, Laurence A. 200 Kent Ave., Kitchener, Ont. (S.1946)
Borts, Robt. B. 1565 Van Horne Ave., Outremont, Montreal 8. (S.1945)
Bostock, W. N. Brig., c/o Canadian Embassy, Shanghai, China. (S.1925. A.M.1935. M.1940)
Boswell, E. J. 270 Poplar Plains Road, Toronto. (S.1897. A.M.1900. M.1940)
Both, John Mgr., Diamond Construction & Engineering Co., 18 Gordon St., Belleville, Ont. (Affil.1942)
Bothwell, Wm. Thos. Chem. Control Engr., Imperial Oil Ltd., Regina. For mail: 3008 Victoria Ave., Regina, Sask. (Jr.1946)
Bouchard, E. André Prof. of Elec. Engrg., Faculty of Science, Laval University, Quebec. (M.1944)
Bouchard, Jean, Wartime Housing Ltd., Montreal. For mail: 11347 De Londres St. Montreal 9. (A.M.1937. M.1940)
Bouchard, Leo Joseph Northern Electric Co., Montreal. For mail 6425 Clark St., Montreal. (S.1946)
Boucher, Fernand R. Salesman, Aluminum Co. of Can., Shawinigan Falls. For mail: 108 Lévis St., Shawinigan Falls, Que. (S.1944. Jr.1946)
Boucher, Jean-Paul Field Engr., J. A. Lalonde & Co. Ltd., Cons. Engrs., 958 Dunlop Ave., Montreal 8. (S.1942)
Boucher, Omer 6204—3rd Ave., Rosemount, Que. (Jr.1940)
Boucher, Raymond Associate Prof. of Hydraulics, Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1932. Jr.1934. M.1941)
Boucley, Roger P. 4314 Bourbonnière Ave., Montreal 36. (S.1944)
Boudreau, Maurice G. Engr., River St. Lawrence Ship Channel, Dept. of Transport, New Customs Bldg., Youville Sq., Montreal. (M.1945)
Boulay, J. P. Robt. A. Rankin & Co. Ltd., Montreal. For mail: 157 Sherbrooke St. E., Montreal. (S.1944)
Boulet, Lionel 104 Bougainville St., Quebec. (S.1942. Jr.1946)
Boultbee, J. G. (Jr.1943)
Boulton, Beverley K. Pres., Wartime Housing Ltd.. Toronto. For mail: 600 University Ave., Toronto (S.1923. Jr.1930. M.1931)
Boulton, C. A. Dist. Mgr., Housing Enterprises of Canada, Regina. For mail: P.O. Box 156, Regina, Sask (S.1916. Jr.1919. M.1945)
Boulva, Charles Staff Engr., Quebec Rural Electrification Bureau, Montreal. For mail: 2539 Sherbrooke St. E., Montreal. (S.1938. Jr.1946)
Boulva, Francis Chief Designer, Brouillet & Carmel Co., Montreal. For mail: 824 Cherrier St., Montreal. (S.1942. Jr.1946)
Bourassa, Jean, 1615 Bernard Ave., Outremont, Que. (S.1942)
Bourbeau, Albert 86 Panet St., Nicolet, Que. (S.1944)
Bourbeau, Joseph 22 1st Ave. W., Longueuil, Que. (S.1944)
Bourbonnais, George Valois, Cons. Engr., Zachée Langlais Co., Cons. Engrs., 105 Mountain Hill, Quebec. (S.1938. Jr.1943)
Bourgault, Gérard A. Office of Vice-Pres., Sorel Industries Ltd., Sorel. For mail: 100 Rivard St., St. Joseph de Sorel, Que. (S.1944)
Bourgault, L. Alexandre Traffic Engr., Bell Telephone Co. of Canada, 78 O'Connor St., Ottawa. (S.1943. Jr.1946)
Bourgeois, Claude Dominion Containers Ltd., 6240 Park Ave., Montreal 8. (S.1939. Jr.1942. M.1945)
Bourgeois, J. A. A. Paul Bédard Co. Ltd., 168-192 rue St-Jacques, L'Assomption, Que. (M.1942)
Bourgeois, Patrick O. International Water Supply Ltd., 660 St. Catherine St. W., Montreal. (S.1943. Jr.1945)
Bourget, Maurice Zachée Langlais Co., Cons. Engrs., 105 Mountain Hill, Quebec. (A.M.1936. M.1940)
Bourgoin, Louis Director, Research Centre, Ecole Polytechnique, 1430 St. Denis St., Montreal. (M.1946)
Bourke, G. M. 774 Upper Landsowne Ave., Montreal 6. (S.1946)
Bourke, R. G. Engr. & Supt., T. C. Gorman Constrn. Co. Ltd., Montreal. For mail: 3433 Montclair Ave., Montreal 28. (M.1945)
Bourne, Herbert F. Asst. Dist. Engr., Dept. of Public Works of B.C. For mail: Ste. 202, 15 Wallace St., Nanaimo, B.C. (A.M.1925. M.1940)
Bourne, J. D. (S.1937. Jr.1946)
Bourne, Obre B. Res. Engr., Angus Robertson Ltd., 6 St. Andrew St., Quebec. (M.1946)
Bousquet, Paul 26 Broad St., Marlboro, Mass., U.S.A. (S.1938. Jr.1944)
Bouthillette, Roland Asst. Prof., Ecole Polytechnique, Montreal. For mail: 1899 Leclaire St., Montreal 4. (S.1942)
Bouthillier, J. P. Engrg. Asst., Bell Telephone Co. of Canada, Montreal. For mail: 8541 Hochelaga St., Montreal 5. (S.1941)
Boutilier, A. P. Plant Supt., Maritime Industries Ltd., Amherst, N.S. (Jr.1939. M.1943)
Boutilier, F. T. Asst. Aluminum Plant Supt., Aluminum Co. of Canada, Arvida. For mail: 128 Castner St., Arvida, Que. (S.1928. A.M.1937. M.1940)
Boutilier, T. T. Engr., Northern Electric Co., Montreal. For mail: 1499 Bishop St., Montreal. (S.1937. M.1940)
Boux, J. Francis 450 St. Jean Baptiste St., St. Boniface, Man. (Jr.1940)
Boux, John W. 450 St. Jean Baptiste St., St. Boniface, Man. (Jr.1943)
Bowden, A. Earl Met. Engr., Steel Co. of Canada Ltd., Montreal. For mail: 1649 Lincoln Ave., Montreal 25. (M.1945)
Bowden, Donald A. H. G. Acres & Co., Niagara Falls, Ont. (S.1944)
Bowden, H. A. Instrumn., Canadian National Railways, Edmonton, Alta. (A.M.1920. M.1940)
Bowden, Henry J. Chief Chemist, Abrasive Co. of Canada, Arvida. For mail: 822 Seventh St., Arvida, Que. (M.1945)
Bowen, H. B. Chief of Motive Power & Rolling Stock, Canadian Pacific Railway, Room 1000, Windsor Station, Montreal. (M.1935)
Bowen, J. A. C. Hydraulics Designer, Hydro-Electric Power Comm., Toronto. For mail: 70—36th St., Long Branch, Toronto 14. (S.1932. Jr 1934. A.M.1936. M.1940)
Bowen, Sydney Designing Engr., Exolon Co. Ltd. For mail: 91 Gothic Ave., Toronto. (A.M. 1919. M.1940)
Bower, J. H. W. Supt., Hospital for Sick Children, Toronto. For mail: 41 Glengowan Road, Toronto. (A M.1923. M.1940)
Bowering, Reginald Director, Divn. of Public Health Engrg., Board of Health of B.C., Parliament Bldgs., Victoria, B.C. (S.1936. M.1942)
Bowes, Wm. H. Associate Prof. of Engrg., Dalhousie University, Halifax, N.S. (S.1943. Jr.1946)
Bowie, Ralph A. Builder & Contractor, 632—18th Ave., Lachine, Que. (S.1942. Jr.1946)
Bowles, W. S. Time Study Engr., Canadian Vickers Ltd, Cartierville. For mail: 225 Stanstead Road, Town of Mount Royal, Que. (S.1929. Jr.1935)
Bowlin, D. C. Spencer Apartments, Weldon St., Moncton, N.B. (M.1942)
Bowman, E. P. Civil Engr. & Ontario Land Surveyor, 30 Douglas St., Guelph, Ont. (A.M.1912. M.1940)
Bowman, Fred Erection Engr., Dominion Bridge Co., Box 280, Montreal. (S.1911. Jr.1916. A.M.1923. M.1940)
Bowman, Nelson Dominion Linseed Oil Co. Ltd., Owen Sound. For mail: 726—5th Ave. East, Owen Sound, Ont. (S.1920. Jr.1922. A.M.1927. M.1940)
Bowman, R. F. Patrick Divn. Engr., Canadian Pacific Railway, Brandon, Man. (S.1926. Jr.1930. A.M.1935 M.1940)
Bowman, W. A. Designing Engr., C. D. Howe Co. Ltd., Port Arthur. For mail: 32 Ray Blvd., Port Arthur, Ont. (S.1941. Jr.1946)
Bown, Wm. Edmund Gen. Mgr., Canadian Tube & Steel Prod. Divn., Dominion Steel & Coal Corp. Ltd., 5765 Hamilton St., Montreal. (S.1921. A.M 1930. M.1940)
Bowness, E. W. Chairman of the Boards of Calgary Gas Co., Northwestern Utilities, and Canadian Utilities, 215—6th Ave. W., Calgary, Alta. (S.1908. A.M.1910. M 1926)
Bowness, Frank Chief Dftsmn., Canadian General Electric, Peterborough. For mail: 273 Rubidge St., Peterborough, Ont. (A.M.1922. M.1940)
Bowser, R. B. Mount Allison University, Sackville, N.B. (S.1945)
Bowyer, J. E. Engr.-in-Training, Hydro-Electric Power Comn. of Ont., Toronto. For mail: 107 Winchester St., Toronto. (S.1946)
Boyd, C. S. Chief Dftsmn., Horton Steel Works, Ltd., Fort Erie. For mail: Box 209, Fort Erie North, Ont. (S.1917. A.M.1921. M.1940)
Boyd, David Works Mgr., Gen. Engrg. Divn., John Inglis Co. Ltd., 14 Strachan Ave., Toronto. (A.M.1935. M.1940)
Boyd, H. C. T. Canadian National Railways, Montreal. For mail: 1407 Laird Blvd, Town of Mount Royal, Montreal 16. (A.M.1932. M.1940)
Boyd, Robt. A. Relay Engr., Quebec Hydro-Electric Comm., Montreal. For mail: 7605 Christophe Colomb St., Montreal 10. (S.1940. Jr.1946)
Boyer, Marc Registrar, Corporation of Professional Engineers of Quebec, 354 St. Catherine St. E., Montreal 18. (M.1945)
Boyle, John Edward Staff Engr., Stevenson & Kellogg Ltd., Montreal. For mail: 1640 Sherbrooke St. W., Montreal. (M.1945)
Boyle, Lionel, R.C.N. Overseas. For mail: 585 Lisgar St., Ottawa (S.1944)
Boyle, Robt. Wm. Director, Divn. of Physics & Elec. Engrg., National Research Council, Sussex St., Ottawa. (M.1924)
Boyle, T. J. Engrg. Dept., Canadian Pacific Railway, Windsor Station, Montreal. (Jr.1939)
Boyle, W. E. Teacher, Regina College, Regina, Sask. (S.1943. Jr.1946)
Brace, James H. Pres., Fraser-Brace Engrg. Co. Ltd., 360 St. James St. W., Montreal. (M.1916)
Bracken, W. D. Vice-Pres. & Supt., Canadian Niagara Power Co. Ltd., Niagara Falls. For mail: 2088 Corwin Ave., Niagara Falls, Ont. (S.1922. A.M.1933. M.1940)
Brackinreid, T. W. Pres. & Mng. Dir., Phillips Electric Works Ltd., Brockville, Ont. (M.1939)
Bradbeer, W. S. 40 Longwood Road South, Hamilton, Ont. (S.1946)
Braddell, Eber S. P. Power Apparatus Engr., Northern Electric Co. Ltd., 1620 Notre Dame St. W., Montreal 3. (S.1931. Jr.1937. A.M.1939. M.1940)
Bradford, G. A. Plant Engr., Bakelite Plastics Divn., Carbide & Carbon Chemicals Ltd., 163 Dufferin St., Toronto. (Jr.1937. M.1943)
Bradford, James Walter Strl. Designer, Bridge Engrg. Dept., Canadian National Railways (Central Region) Toronto. For mail: 17 Morton Road, Toronto. (S.1946)
Bradley, Bruce R. 147 Ordnance St., Kingston, Ont. (S.1946)
Bradley, C. J. (S.1943. Jr.1946)
Bradley, James Harrison Engr., Holcroft & Co., 6545 Epworth Blvd., Detroit, Mich., U S.A. (A.M.1917. M.1940)
Bradley, Norman A. Engr. & Supt., Doncaster Construction Co. Ltd., Edmonton. For mail: 11024—81st Ave., Edmonton, Alta. (M.1941)
Bradley, N. Hilburn Dist. Engr., Dept. of Public Works of Alberta, 216—5th St. South, Lethbridge, Alta. (A M.1922. M.1940)
Bradley Robert A. Chief Engr., Civil Aviation Division, Gander, Newfoundland. (Jr.1927. A.M.1930. M.1940)
Bradley, W. J. 38 Creighton St., Ottawa. (S.1939)
Bradley, Whitney L. Mun. Engr., Town Hall, Waterloo, Ont. (S.1941. Jr.1946)
Bradshaw, Frederick W. Chief Engr., Consolidated Paper Corp. Ltd., Grand'Mere, Que. (S.1920. Jr.1925. A.M.1929 M.1940)
Bradshaw, T. E. 4437 Grand Blvd., Montreal 28. (S.1941. Jr.1946)
Brain, Cecil International Power & Paper Co., Gatineau, Que. (S.1927. Jr.1929. A.M.1936 M.1940)
Brais, J. Pierre Asst. to Paul de Guise, Cons. Engr., Montreal. For mail: 127 Chambly Road, Longueuil, Que. (S.1942. Jr. 1946)
Brakenridge, Chas. 3450 West 3rd Ave., Vancouver, B C. (A.M.1915. M.1919)
Branch, Alex J. Asst. Engr., Lethbridge Northern Irrigation District. For mail: Diamond City, Alta. (A.M.1925. M.1940)
Branchaud, Henri L. Export Sales Mgr., Canadian Liquid Air Co., 1111 Beaver Hall Hill, Montreal. (S.1935. Jr 1940)
Brandley, Reinard W. Graduate School of Engineering, Pierce Hall, Harvard Engineering School, Cambridge 38 Mass., U.S.A. (S.1943)
Brandlmayr, John, Jr. 2475 West 3rd Ave., Vancouver, B.C. (S.1944)
Brandon, H. E. Hydro-Electric Power Comm. of Ont., Toronto. For mail: 447 Blythwood Road, Toronto. (A.M.1926. M.1940)

Brannen, E. R. Dist. Meter & Relay Engr., Hydro-Electric Power Comm. of Ont., Niagara Falls. For mail: 2405 Lundy's Lane, Niagara Falls, Ont. (S.1935. Jr.1940)

Brant, Cecil Mornington Controller of Aero. Radio, Nfld. Govt., Civil Aviation Division, Gander Newfoundland. (A.M.1939. M.1940)

Braslof, Reuben Isaac Mech. Engr., Robert A. Rankin & Co., Montreal. For mail: 5617 Jeanne Mance St., Montreal. (S 1942. Jr.1946)

Bratty, Lewis G. 194 O'Connor Drive, Toronto. (S.1946)

Brault, Paul G. A. Designer, Dominion Bridge Co. Ltd., Lachine, Que. (S.1920. A.M.1927. M.1940)

Braun, J. F. Aluminum Co. of Canada Ltd., Arvida. For mail: 838—2nd St., Arvida, Que. (M.1945)

Brazeau, Lucien R. Constrn. Engr., J. E. Brazeau, 4159 Harvard Ave., Montreal. (S.1940. Jr.1946)

Brazier, Henry A. Pres., H. A. Brazier Constrn. Co. 888 St. Clair Ave. W., Toronto 10. (A.M.1915. M.1922)

Brazier, J. H. Canadair, Ltd., Cartierville. For mail: 3157 Maplewood Ave., Montreal 26. (Jr.1944)

Breakey, James Lubrication Sales Engr., Imperial Oil Ltd., Toronto. For mail: 43 Seventh Ave., Timmins, Ont. (Jr.1931. A.M.1935. M.1940)

Breau, C. Gerard 59 Morris St., Halifax, N.S. (S.1945)

Brebner, K. A. Designing & Estimating Engr., Brompton Pulp & Paper Co., East Angus, Que. (A.M.1940. M.1940)

Breed, C. B. Head, Dept. Civil & Sanitary Engrg., Massachusetts Institute of Technology, Cambridge, Mass. (M.1930)

Breen, Joseph M. Chief of Tech. Staff, Canada Cement Co. Ltd., 803 Northern Ont. Bldg., Toronto. (A.M.1924. M.1940)

Breen, L. S. 72-11th St., New Toronto. (S.1946)

Breese, Rupert W. 245 Elm Ave., Westmount, Que. (Affil.1943)

Breeze, J. E. Section Head, Research Projects, Elec. Engrg. & Radio Branch, National Research Council, Ottawa. For mail: 865 Browson Ave., Ottawa. (S.1939. M.1944).

Bregman, Asher 5381 Esplanade Ave., Montreal. (S.1943)

Brehaut, H. B. 168 Sherburn St., Winnipeg, Man. (S.1927. A.M.1928. M.1940)

Brehler, Robert J. Perdue, Sask. (S.1946).

Breithaupt, Carl L. Tech. Sales, Prior Chemical Corp, 2238 Tudor Drive, Cleveland 6, Ohio, U.S.A. (S.1921. A.M.1925. M.1940)

Brekke, Hans Constrn. Supt., Winnipeg Hydro-Electric System. For mail: 62 Fulham Ave., Winnipeg, Man. (M.1941)

Bremner, Douglas Pres., Douglas Bremner Constrn. Ltd., 2049 McGill College Ave., Montreal. (S.1914. A.M.1917. M.1928).

Brenan, Norman W. Strl. Engr., Canadian Breweries Ltd., Toronto. For mail: 431 Jarvis St., Toronto 5. (M.1942).

Brenan, Wm. M. Dftsmn, D. O. Turnbull, Cons. Engr. Saint John. For mail: 215 Germain St. Saint John, N.B. (S.1941)

Brennan, F. Hugh Devlpt Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 1671 Sherbrooke St. W., Montreal (S.1944. Jr.1946)

Brereton, C. H. Engrg Prod. Dept., R.C.A. Victor Co. Ltd., 1001 Lenoir St., Montreal 30. (M.1943)

Brereton, W. P. 274 Ashland Ave., Winnipeg, Man. (A.M.1908. M.1918)

Breslin, Wm. J. Asst. County Engr., Okanogan County, Okanogan, Wash., U.S.A. (S.1943. Jr.1946)

Brett, John Edward Cons Engr., 4180 Melrose Ave., Montreal. (S.1942. Jr.1945. M.1945)

Brett, J. F. Divn Engr., Montreal Water Board, 3161 Joseph St., Verdun, Que. (S.1914. Jr. 1919. A.M.1920. M.1940)

Brewer, Douglas J. Rcs. Engr., Dept. of Public Works, Highways Divn., P.O. Box 951, Fredericton, N.B. (S.1935. M.1942).

Brewer, Harold Hyron Prod. Mgr., Canadian Industries Ltd., Montreal. For mail: 5740 Coolbrook Ave., Hampstead, Que. (Jr.1930).

Brews, Robt. W. Partner & Sales Engr., R. L. Brews & Son, 304-11th Ave. E., Calgary, Alta. (S.1936. Jr.1940. M.1944)

Briceland, Emmett V. Mng. Engr., Elevator Specialty Co. Ltd., Toronto. For mail: 15 Grassmere Road, Toronto 9. (S.1937. Jr.1946)

Brickenden, Frederick M. 82 Cordova St., Winnipeg, Man. (S.1910. Jr.1913. A.M.1918. M 1940)

Briden, L. D. Engr., Newfoundland Light & Power Co. Ltd., St. John's Nfld. (Jr.1944)

Bridge, David E. Director i/c training, Hamilton Technical Institute. For mail: 120 Haddon Cres., Hamilton, Ont. (S.1930. Jr.1937)

Bridge, J. F. Supt. International Salt Co., Watkins Glen, N.Y., U.S.A. (A.M.1934. M.1940)

Bridges, Ernest T. 290 High Park Ave., Toronto. (A.M.1921. M.1940).

Bridgewater, Albert W., Strl. Designer, Office of Chief Engr., Canadian Pacific Railway, Windsor Station, Montreal (Jr.1941. M.1946)

Brien, Francois Project Engr., Rolland Paper Co., St. Jerome, Que. For mail: 380 O'Shea St., St. Jerome, Que. (S.1939. Jr.1944).

Briercliffe, H. C. D. Gen. Supt., Vulcan Iron Works Ltd. Winnipeg. For mail: 201 Ash St., Winnipeg, Man. (A.M.1919. M.1940).

Brière, Roger Jr. Engr., Dept. of Transport, Montreal. For mail: 332 Mousseau St, Montreal. (Jr.1944)

Brierley, J. P. Tech. Dir., Lever Brothers Ltd., Toronto. For mail: 299 Eastern Ave., Toronto. (M.1943)

Briggs, Herbert Lee, Chief Engr., Winnipeg Hydro-Electric System, Winnipeg. For mail: 333 Queenston St., Winnipeg, Man. (S.1926. A.M.1931. M.1940)

Bright, W. J. Major, Directorate of Military Training, National Defence H.Q., Ottawa. (M.1944)

Brisbane, J. S., Engr. i/c Estimating & Constrn., G. M. Gest Ltd., 386 Murray St., Montreal 3. (M.1945)

Brison, R. J. 164 Barrie St., Kingston, Ont. (S.1945)

Brissette, L. J. J. A. Y. Bouchard Inc., 97 Cote d'Abraham, Quebec. (S.1942)

Brissette, Paul 2549 Chapleau St., Montreal. (S.1942)

Britnell, C. B. 77 Pleasant Blvd., Toronto 5. (M.1943)

Brittain, Norman W. Private Practice, Civil & Mining, Minto, N.B. (S.1932. A.M.1938. M.1940)

Broad, Robt. L. Mgr., Combustion Service Dept., Rochester & Pittsburgh Coal Co. (Canada) Ltd., 320 Bay St., Toronto. (M.1944)

Broadhurst, Eric B. Mtce. Engr., Lead Smelter, Consolidated Mining & Smelting Co. Ltd., Tadanac, B.C. For mail: 11 Forrest Drive, Trail, B.C. (M.1946)

Brochu, Blaise, i/c Tech. Service, LaSalle Builders Supply Ltd., Montreal. For mail: 140 Somerville St., Montreal 12. (Jr.1944)

Brock, H. B. 738 Bloomfield Ave., Outremont, Que. (S.1944)

Brock, Thomas L. i/c Publications Divn., Aluminium Laboratories Ltd., P.O. Box 84, Kingston, Ont. (M.1945)

Brockhurst, B. N. 1528 Charles St., Vancouver, B.C. (Jr.1945)

Brockhurst, Donald N. Douglas Hall, 3851 University St., Montreal. (S.1946)

Broda, Jos. George, Reinf. Conc. Design, Dominion Bridge Co., Winnipeg. For mail: 231 Stella Ave., Winnipeg Man. (M.1944)

Brodeur, Paul Sales Engr., Imperial Oil Ltd., Montreal. For mail: 4958 Grosvenor Ave., Montreal, Que. (M.1946)

Brodie, LeSueur, Divn. Sales Mgr., Bell Telephone Co., Toronto 1. (M.1943)

Brodylo, S. Stanley, Prod. Asst. to Gen. Mgr., Standard Publishing Co., 276 St. James St. W., Montreal. (S.1944)

Broe, Kenneth L., Test Course, Canadian General Electric Co., Peterborough. For mail: 426 Park St., Peterborough, Ont. (S.1946).

Bromley, George Cons. Engr., Kearns & Bromley, Montreal. For mail: 4875 Maplewood Ave., Montreal. (M.1946)

Bronson, Frederick E. Mng Dir., The Bronson Co., 150 Middle St., Ottawa. (S.1908. A.M.1913. M.1925)

Brooke, John Hervey Junction, Que. (A.M.1899. M.1940)

Brooks, Charles L. Gen. Traffic Mgr., Bell Telephone Co. of Canada, Montreal. For Mail: 4025 Dorchester St., W., Westmount, Que. (S.1921. A.M.1930. M.1940)

Brooks, D. A., University of Toronto, Ajax Divn., 732 Queen's Road, Ajax, Ont. (S.1943)

Brooks, E. E. Y.M.C.A., 1441 Drummond St., Montreal. (S.1943)

Brooks, John A. Chief Supvr., Resin Divn., Canadian Resins & Chemicals Ltd., Shawinigan Falls. For mail: 2 Tamarac Ave., Shawinigan Falls, Que. (Jr.1945)

Brooks, John Kenneth, Director, Harbour & General Works Ltd., England. For mail: Rosegarth, Hatlex Hill, Hest Bank, Lancaster, England. (A.M.1932. M.1940)

Brooks, Joseph Warren Strl. Engr., Spruce Falls Power & Paper Co., Kapuskasing. For mail: Box 695, Kapuskasing, Ont. (S.1939. Jr.1941. M.1945)

Brooks, R. F. Surveys Engr., Dept. of Mines & Resources, Ottawa. (S.1944).

Brossard, Léo, Partner, Koulomzine, Geoffrey Brossard & Co., Cons. Min. Engrs. & Geol., P.O. Box 870, Val D'Or, Que. (S.1936. M.1941)

Brosseau, Augustin Quebec Dept. of Roads, L'Islet Village, Co. L'Islet, Que. (M.1945)

Brosseau, Georges, Prod. Engr., Regent Knitting Mills Ltd., St. Jerome. For mail: 2 De Martigny St., St. Jerome, Que. (M.1946)

Brosseau, Gérard, Mgr., Montreal Industries, Montreal. For mail: 8980 Routhier St., Montreal 12. (S.1940)

Brosseau, Joseph Supt. Engr., Division of Streets, City of Montreal. For mail: 2513 Cote St. Catherine Road, Montreal 26. (M.1945)

Brosseau, Lucien 20 Ave. Deschenes, E., Limoilou, Quebec. (S.1940)

Brosseau, Louis Philippe 1895 Bourbonnière Ave., Montreal 4. (S.1944)

Brosseau, Roland B. Asst. Chief Engr., Rural Electrification Bureau, 89 Notre Dame St. E., Montreal. (S.1936. M.1940)

Brouillet, Ignace Dean, Ecole Polytechnique, Montreal; also member of Brouillet & Carmel, Cons. Engrs., Montreal. For mail: 3778 Vendome Ave., Montreal. (M.1944)

Brown, Alan Gen. Mgr. of Distribution, Gatineau Power Co., 801 Victoria Bldg., Ottawa. (Jr.1925. A.M.1932. M.1940)

Brown, C. B. 152 Easton Ave., Montreal West, Que. (S.1902. A.M.1909. M.1914)

Brown, Donald B. 548 Prince Arthur St. W., Montreal. (S.1946)

Brown, Donald N. Asst. Mun. Engr., Municipality of St. James, Man. For mail: 78 Taché Ave., Norwood, Man. (S.1946)

Brown, D. R. Design Office, Canadair Ltd., Cartierville, Que. For mail: 3430 Beaconsfield Ave., Montreal 28. (S.1943. Jr.1946)

Brown, D. W. Barness Road, Warrington, Pa., U.S.A. (S.1937. Jr.1940)

Brown, Ernest, Emeritus Prof. of Civil Engrg., McGill University, Montreal. For mail: 1469 Drummond St., Montreal 25. (A.M.1906. M.1917)

Brown, E. D. Plant Supt., Canadian Industrial Minerals Ltd., Shelburne, N.S. (M.1944)

Brown, Ernest F. Supvr., Royal Canadian Mint, Sussex St., Ottawa. (S.1935. Jr.1941)

Brown, F. T. Constrn. Engr., Imperial Oil Ltd., Montreal. For mail: 11596 Notre Dame East, Pointe-Aux-Trembles, Que. (M.1942)

Brown, Frederick W. Geo-Technical Development Co. Ltd., Hotel Coulson, Bourlamaque, Que. (S.1946)

Brown, G. C. Engr., Bell Telephone Co. of Canada, 114 St. John St., Quebec. (S.1940. M.1946)

Brown, E. Canadian National Carbon Co. Ltd. For mail: 41 Iroquois Ave., Centre Island, Toronto. (S.1940. Jr.1946)

Brown, G. J. 260 Dundas St. East, Belleville, Ont. (S.1936)

Brown, G. M. Dist. Engr., Dept. of Public Works of Canada, P.O. Box 1417, Saint John, N.B. (M.1942)

Brown, George Sandels Asst. Mgr., St. Mary & Milk Rivers Development (Prov. Govt.) 207—7th St. S., Lethbridge, Alta. (Jr.1921. A.M.1921. M.1940)

Brown, Hugh C. Sales Engr., Canadian Westinghouse Co. Ltd., Montreal. For mail: 642 Lansdowne Ave., Westmount, Que. (M.1946)

Brown, H. McCrae 71 Queens Parks, Toronto. (S.1946)

Brown, Hilton Orland Asst. Engr., Chief Engr's. Dept. Abitibi Power & Paper Co., 408 University Ave., Toronto. (A.M.1929. M.1940)

Brown, James A. Design Engr., Spruce Falls Power & Paper Co., Kapuskasing. For mail: Kapuskasing Inn, Kapuskasing, Ont. (S.1944. Jr.1945)

Brown, J. A. 463 Hunter St. Peterborough, Ont. (S.1945)

Brown, J. A. W. Cons. Engr., 1316 Pigott Bldg., Hamilton. For mail: 70 Spadina Ave., Hamilton, Ont. (S.1908. A.M.1913. M.1940)

Brown, J. Edwin Associate, Survey & Design, Haddin & Miles Ltd., Calgary. For mail: 1427—7th St. N.W., Calgary, Alta. (Jr.1925. A.M.1929. M.1940)

Brown, Kenneth A. Jr. Design Engr., E. A. Cross, Toronto. For mail: 37 Bernard Ave., Toronto. (S.1946)

Brown, L. R. Pres. & Mgr., L. R. Brown & Co. Ltd., Sault Ste. Marie. For mail: 52 The Drive, Sault Ste. Marie, Ont. (S.1914. A.M.1917. M.1940)

Brown, M. C. Sutherland Lt. Col., Dist. Engr. Officer, M.D.11, Vaucouver. For mail: 6108 N.W. Marine Drive, Vancouver, B.C. (S.1937. Jr.1946)

Brown, Ray A. Jr. Engr., Dept. Mines & Resources of Canada. For mail: 11013—81st Ave., Edmonton, Alta. (S.1945)

Brown, Robt. Arthur 232 Lougheed Bldg., Calgary, Alta. (M.1941)

Brown, R. C. C. 200 St. Lawrence St., Longueuil, Montreal 23. (S.1933. Jr.1938. M.1945)

Brown, Roger S. Dftsmn., Boiler Design, Dominion Bridge Co. Ltd., Lachine. For mail: 72 York Ave., Westmount, Que. (S.1944. Jr.1946)

Brown, R. W. Asst. Mech. Supt., Winnipeg Free Press Co. Ltd., 300 Carlton St., Winnipeg, Man. (M.1942)

Brown, William B. Asst. Switchgear Engr., Canadian General Electric Co. Ltd., Peterborough For mail: 496 Monaghan Road. Peterborough, Ont. (S.1931. Jr.1936)

Brown, William C. Elec. Engr., Radio Branch. National Research Council, Sussex St., Ottawa. Ont. (S.1940. Jr.1946)

Brown, W. E. Wire Rope Engr., B. Greening Wire Co. Ltd., Hamilton. For mail: 91 Barnesdale Blvd., Hamilton, Ont. (Jr.1934 M.1943)

Brown, W. R. J. 284 Lytton Blvd., Toronto. (S.1946)

Browne, Ernest F. Surveys Engr., Dept. of Mines & Resources, Victoria Museum Ottawa. (S.1911. Jr.1918. A.M.1920. M.1940)

Browne, J. W. Engr., Continental Can Co. of Canada, Montreal. For mail: 497[illegible] Queen Mary Road, Montreal 29. (S.1939. Jr.1944)

Brownell, Harold R. Mgr., Vancouver Office, Bailey Meter Co. Ltd. For mail: 1292 W. 39th Ave., Vancouver, B.C. (S.1927. Jr.1932. A.M.1939. M.1940)
Brownie, F. A. Exec. Asst. to Pres., Canadian Western Natural Gas, Light, Heat & Power Co. Ltd., 215—16th Ave. W., Calgary, Alta. (S.1932. Jr.1935. A.M.1938. M.1940)
Browning, Douglas R. S. Dftsmn., Howard Smith Paper Mills, Cornwall. For mail: 18 Elm St., Cornwall, Ont. (S.1944)
Browning, Philip R. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 1540 Crescent St., Montreal. (S.1946)
Brownlee, W. D. Engrg. Dept., Electric Metallurgical Co. of Can. Ltd., Welland. For mail: No. 7 Leslie Apt. Griffith St., Welland, Ont. M.1943)
Brownlee, W. R. Dftsmn., Dominion Bridge Co. Ltd., Winnipeg. For mail: 91 Kanata St., Transcona, Man. (S.1946)
Bruce, Chas. Chief Engr., Dept. of Fisheries, West Block, Ottawa. (S.1907. A.M.1919. M.1940)
Bruce, G. W. Overseas (S.1941. Jr.1946)
Bruce, Rodney Engr., Steam Power Plant Divn., Canadian Industries Ltd., Montreal. For mail: 4633 Hampton Ave., Montreal. (S.1936. A.M.1939. M.1940)
Bruce, W. J. Asst. Engr., Dept. of Public Works of Canada, Toronto. For mail: 153 Elmwood Blvd., Lansing, Ont. (A.M.1926. M.1940)
Brûlé, Marcel 18 Belmont Ave., Quebec. (S.1944. Jr.1946)
Brumby, W. W. English Electric Co. of Canada Ltd., St. Catharines, Ont. (Jr.1930. A.M.1932. M.1940)
Brumell, Orby R. Chief Engr., Dominion Oilcloth & Linoleum Co. Ltd., Montreal. For mail: 1455 Drummond St., Montreal. (S.1930. A.M. 1939. M.1940)
Brunette, Chas. E. Chem Engr., Dept. of Mines, Quebec. Rm. 712-E, Parliament Bldgs., Quèbec. (S.1941. Jr.1946)
Brunner, Godfrey H. Hazeldene, Poulton-le-Fylde, Lancashire, England. (S.1904. A.M.1911. M.1940)
Brunskill, Harry T. Mech. Engr., Ford Motor Co. of Canada, Windsor, Ont. (Jr.1942)
Brusset, Jean A. Vice-pres., West Canadian Collieries Ltd., Blairmore, Alta. For mail: 342 Kitchener Ave., Montreal. (M.1945)
Bryant, James S. Provincial Electricity Board of Quebec, Montreal. For mail: 4637 Royal Ave., Montreal. (S.1926. Jr.1930. A.M.1936. M.1940)
Bryce, J. B. Hydro-Electric Power Comm. of Ontario, 620 University Ave., Toronto. (Jr.1937)
Bryce, Ronald Campbell Jr. Engr., Mech. Design, Dominion Engineering Works Ltd., Lachine. For mail: 158 Wolseley Ave., Montreal West, Que. (S.1942. Jr.1943)
Bryce, W. F. M. Sewer & Mech. Engr., City of Ottawa. For mail: 344 Lisgar Road, Rockcliffe Park, Ottawa. (S.1909. A.M.1913. M.1940)
Bryden, Donald C. Operating Engr., Winnipeg Hydro Electric System, 55 Princess St., Winnipeg, Man. (A.M.1938. M.1940)
Brydges, Robt. James Sales Engr., Northern Electric Co. Ltd., Montreal. For mail: 1960 Dorchester St. W., Montreal 25. (S.1938. Jr.1942)
Brydon, N. M. Royal Engineers, Overseas. (A.M.1932. M.1940)
Brydone-Jack, E. E. 2296 W. 40th Ave., Vancouver, B.C. (M.1906)
Bubbis, M. I. Chief Engr., Central Engineering Co., Montreal. For mail: 1176 Bishop St., Montreal 25. (S.1937. Jr.1943)
Bubbis, N. S. Engr. of Water Works & Sewerage, Engrg. Dept., City of Winnipeg, Ross & Tecumseh Sts., Winnipeg, Man. (S.1934. M.1945)
Buchan, P. H. Asst. Engr., City Lines, B.C. Electric Railway Co. Ltd., Carrall St., Vancouver, B.C. (A.M.1919. M.1935)
Buchanan, Arnold A. W/C. Sr. Aero. Engr. Officer, No. 2 Air Command H.Q., R.C.A.F., Stevenson Field, Winnipeg, Man. (S.1938. Jr.1941. M.1945)
Buchanan, A. M. Plant Engr., Gartshore-Thomson Pipe & Foundry Co. Ltd., Hamilton, Ont. (A.M.1939. M.1940)
Buchanan, Edward T. Asst. Chief Engr., Consolidated Paper Corp. Ltd., Grand'Mère, Que. (S.1926. Jr.1938. A.M.1940. M.1940)
Buchanan, Edward Victor Gen. Mgr., Public Utilities Commission & London Railway Commission, London, Ont. (M.1922)
Buchanan, James Charles Mech. Engr., Air Brake Dept., Canadian Westinghouse Co., Hamilton. For mail: 76 East Ave. N., Hamilton, Ont. (S.1941. Jr.1944)
Buchanan, N. R. 20 Somerset Ave., Toronto 4. (S.1946)
Buchanan, Walter S. Chief Electrician, Canadian Arsenals Ltd., Valcartier, Que. For mail: 21 Murray Ave., Quebec. (A.M.1930. M.1940)
Buchbach, C. K. Plant Supt., National Light & Power Co., Moose Jaw, Sask, (A.M.1938. M.1940)
Buchmann, Karl Emil Engr. & Dftsmn., McIntyre Porcupine Mines, Schumacher. For mail: P.O. Box 133, Schumacher, Ont. (S.1922. Jr.1926. A.M.1930. M.1940)
Buck, H. W. Riverside, Conn., U.S.A. (M.1919)
Buck, L. G. Divn. Plant Supt., Bell Telephone Co. of Canada, Beaver Hall Hill, Montreal. (A.M.1935. M.1940)
Buck, Richard S. 2123 R. St., N.W., Washington, D.C., U.S.A. (M.1903)
Bucke, Harold L. Constrn. Engr., Dist. Staff, Hydro-Electric Power Comm. of Ont., Niagara Falls. For mail: Seaham Lodge, Niagara-on-the-Lake, Ont. (S.1900. A.M.1904. M.1912)
Buckley, F. W. Asst. Engr., Nova Scotia Power Commission, Halifax, N.S. (M.1942)
Buckley, I. Walter Oper. Contr., Dominion Coal Co., Glace Bay. For mail: 190 Brookland St., Sydney, N.S. (A.M.1921. M.1940)
Budden, Arthur Napier Special Engr., Dept. of Reconstruction & Supply, Ottawa. For mail: 39 Central St., Aylmer East, Que. (S.1921. Jr.1926. A.M.1930. M.1940)
Budden, John H. Tel. Equipt. Engr., Northern Electric Co., Montreal. For mail: 4828 Dornal Ave., Montreal. (S.1936. Jr.1946)
Buerk, J. E. 6659 Sperling St., Vancouver, B.C. (A.M.1920. M.1940)
Buhr, Donald Alan Instrmn. on Surveying, P.F.R.A., Dominion Dept. of Agriculture, Outlook, Sask. For mail: Langham, Sask. (S.1946)
Buhr, Richard K. Student Engr., Plastics Dept., Canadian General Electric Co., Peterborough. For mail: 626 Charlotte St., Peterborough, Ont. (S.1942. Jr.1946)
Buller, Francis H. Cable Engr., General Electric Co., 1 River Road, Schenectady 5, N.Y., U.S.A. (S.1920. A.M.1931. M.1940)
Bullick, C. J. International Petroleum Co., Talara, Peru, South America. (M.1941)
Bunnell, Arthur E. K. Consultant, Ontario Dept. of Planning & Development, E. Block, Parliament Bldgs., Queen's Park, Toronto. (S.1907. A.M.1911. M.1925)
Bunnell, Frank R. Instrmn., Greater Vancouver Water District. For mail: 1623 East 12th Ave., Vancouver, B.C. (S.1943)
Bunting, Wm. Lloyd Sask. Mgr., Ducks Unlimited (Canada), 42 Government Insurance Bldg., Regina, Sask. (S.1927. Jr.1934 A.M.1939. M.1940)
Bunting, Wm. Russell Power Apparatus Specialist, Northern Electric Co. Ltd., Montreal. For mail: 4550 King Edward Ave., Montreal. (S.1920. Jr.1925. A.M.1928. M.1937)
Burbank, Jerome D. Elec. Engr., War Dept., Army Air Force, Buffalo, N.Y. For mail: 737 Delaware Ave., Buffalo 9, N.Y. (S.1921. Jr.1926. A.M.1931. M.1940)
Burbidge, Geo. H. Dist. Engr., Dept. of Public Works of Can., Fort William. For mail: 28 Hill St. N., Port Arthur, Ont. (S.1908. A.M.1912. M.1919)
Burbidge, H. G. 343 Frontenac St., Kingston, Ont. (S.1943. Jr.1946)
Burchill, G. H. Assoc. Prof. of Elec. Engrg., Nova Scotia Technical College, Spring Garden Road, Halifax, N.S. (S.1923. Jr.1926. A.M.1931. M.1940)
Burdett, Geo. H. Engr., Industrial Development Bank, Montreal. For mail: 3801 Botrel Ave., Montreal. (M.1942)
Burditt, Albert W. Jr. Indust. Engr., Robert A. Rankin & Co., Montreal. For mail: 3851 University St., Montreal. (S.1944)
Burfield, F. R. Chief Engr., Water Resources Dept., Alberta Govt., Terrace Bldg., Edmonton, Alta. (A.M.1916. M.1940)
Burgess, Basil Arthur Engr., Machine Design & Supv., Bowers Machine Co. Ltd., 5860 St. Lawrence Blvd., Montreal. (S.1943. Jr.1946)
Burgess, Bert I. Engr., Switchgear Engrg. Divn., Canadian General Electric Co. Ltd., Peterborough. For mail: 631 Weller St., Peterborough, Ont. (Jr.1924. A.M.1936. M.1940)
Burgess, Bernard W. Sr. Chemist, Ottawa Mill, E. B. Eddy Co., Hull, Que. (S.1943)
Burgess, F. V. Chief Dftsmn., Mech. Dept., Dominion Coal Co. Ltd., Bridgeport, N.S. (A.M.1938. M.1940)
Burgess, George H., Partner, Coverdale & Colpitts, 120 Wall St., New York 5, N.Y., U.S.A. (M.1912)
Burgess, J. R. Mech. Supt., Stauntons Ltd., Leaside, Toronto 12, Ont. (A.M.1921. M.1940)
Burgoon, Willard O. 160 Humbervale Blvd., Toronto 9, Ont. (S.1946)
Burke. J. A. Field Engr., Shawinigan Engineering Co. Ltd., P.O. Box 6072, Montreal. (S.1934. Jr.1939)
Burke, Jules B. Plant Supt., Alberta Govt. Telephones, Edmonton. For mail: 11145-86th Ave., Edmonton, Alta. (M.1941)
Burke-Gaffney, M. W. Rev., Dean of Engrg., St. Mary's College, Windsor St., Halifax, N.S. (M.1941)
Burket, Leslie H. Strl. Engr., Dominion Bridge Co. Ltd., Montreal. For mail: 165 Bedbrook Ave., Montreal West, Que. (A.M.1926. M.1940)
Burks, W. G. Testing & Repair, International Nickel Co. of Canada Ltd. For mail: Algoma Club, Copper Cliff, Ont. (S.1946)
Burnham, G. Alan, 1545 East 5th Ave., Vancouver, B.C. (S.1946)
Burns, Donald R. 114 Ardagh St., Toronto 9, Ont. (S.1944)
Burns, Stuart L. Mgr., Montreal Dist., Donald Inspection Ltd For mail: 3453 Peel St., Montreal. (M.1946)
Burns, Wm. 732 McMillan Ave., Winnipeg, Man. (A.M. 1890. M.1902)
Burpee, George W. Partner, Coverdale & Colpitts, Cons. Engrs., 120 Wall St., New York 5, N.Y., U.S.A. (A M.1912. M.1917)
Burpce, Lawrence H. Northern Construction Co. & J. W. Stewart Ltd., 724 Vancouver Block, Vancouver, B.C. (S.1924. A.M.1932. M.1940)
Burrell, C. E. 263 Queensdale Ave., Toronto 6. (S.1946)
Burri, Henry W. Abrasive Engr. & Repr. for Que., Maritimes & Nfld., Carborundum Co. Ltd. For mail: 837 Notre Dame St., Three Rivers, Que. (S.1934. Jr.1937. A.M.1938. M 1940)
Burris, Donald Archibald Field Engr., Canadian Ingersoll Rand Co. Ltd., 22 Portland Ave., Sherbrooke, Que. (S.1944)
Burroughs, John C. 78 Wintemberg St., Ottawa. (S.1946)
Burrows, Acton Pres., Acton Burrows Ltd., "Canadian Transportation", Toronto. For mail: 120 Bedford Road, Toronto 5. (Affil.1906)
Burrows, J. L. (S.1941. Jr.1946)
Burton, John A. 3855 W. 9th Ave., Vancouver, B.C. (S.1943. Jr.1946)
Burwell, Brock N. Instructor, Agric. Engrg., University of Saskatchewan, Saskatoon, Sask. (S.1945)
Bury, B. E. P.O. Box 1792, Vermilion, Alta. (A.M.1922. M 1940)
Busby, A. H. Wilson Supt., Physical Research, Consolidated Mining & Smelting Co. Ltd., Trail. For mail: 14 Murray Drive, Trail, B.C. (M.1946)
Busfield, James L. Mng. Dir., Gardner Engines (Eastern Canada) Ltd., 1440 St. Catherine St. W., Montreal 25. (S.1908. A.M.1913. M.1922)
Bush, Clayton E. Private Practice, 73 Fairlawn Ave., Toronto. (A.M.1921. M.1940)
Bush, H. F. Staff Engr., Bell Telephone Co. of Canada, 1050 Beaver Hall Hill, Montreal. (M.1945)
Bush, Orval F. International Petroleum Co., Talara, Peru, South America (M.1943)
Bushfield, Roy 3269 West 10th Ave., Vancouver, B.C. (S.1946)
Bushlen, Harvey E. Designing Engr., Proctor, Redfern & Laughlin, Cons. Engrs., Toronto. For mail: Box 295, Adelaide St. Station, Toronto. (M.1944)
Buss, Paul E. Pres., Spun Rock Wools Ltd., Thorold. For mail: 20 Vine St., P.O. Box 40, Thorold, Ont. (A.M.1927. M.1940)
Bussière, Marcel 167 De l'Epée Ave., Montreal 8. (S.1945)
Busso, E. J. M. Ste. Adèle-en-Haut, Que. (M.1945)
Buteau, Lucien, Outside Plant Engrg., Bell Telephone Co. of Canada, 114 St. Jean St., Quebec. (S.1936. M.1942)
Butler, Ernest Designing Engr., Consolidated Paper Corp., Three Rivers. For mail: 530 St. Francois Xavier St., Three Rivers, Que. A.M.1937. M.1940)
Butler, Ernest W. R. Mgr. Western Canada, Bailey Meter Co. Ltd , 906 McArthur Bldg., Winnipeg, Man. (S.1924. Jr.1930. A.M.1938. M.1940)
Butler, J. A. T. Chief Stress Analyst, Fairchild Aircraft Ltd., Longueuil, Que. For mail: 2090 Sherbrooke St. W., Montreal. (S.1931. M.1941)
Butler, Percy M., Jr. Dftsmn., H. H. Angus, Cons. Engr., Toronto. For mail: 35 Murray St., Toronto. (S.1945)
Butt, Alexander M. Strl. Design, J. W. Beretta Engineers Inc., 6 Blatch Ave., St. John's, Newfoundland. (S.1946)
Butt, Robt. E. Mech. Engr., Steel Co. of Canada, Hamilton. For mail: 585 Beach Blvd., Hamilton Beach, Ont. (A.M.1922. M.1940)
Buzzell, Henry W. Designing Engr., Dominion Bridge Co. Ltd., Lachine Que. (S.1923. A.M.1930. M.1940)
Byers, J. W. Agric. Engr., Experimental Farm, Nappan, N.S. (M.1943)
Byers, W. C. Elec. Engr., C. D. Howe Co. Ltd., Port Arthur. For mail: 131 Rupert St., Port Arthur, Ont. (Jr.1937. M.1944)
Byers, W. F. Asst. Engr., Northwestern Utilities Ltd., 10124-104th St., Edmonton, Alta. (M.1943)
Byrn, J. C. Supt. of Dredging, Marine Industries Ltd., 1405 Peel St., Montreal. (M.1946)
Byrne, John H. Sr. Engr., National Parks Bureau, Dept. of Mines & Resources, Ottawa. For mail: 8 Renfrew Ave., Ottawa. (S.1909. A.M.1915. M.1940)

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Cadario, Harry Paul Asst. Engr., Hydro Electric Power Commission, 620 University Ave., Toronto. (M.1945)
Cade, John E. Asst. Chief Engr., Fraser Companies Ltd., Box 762, Edmundston, N.B. (A.M.1933. M.1940)
Cadenhead, A. F. Grant Director, Dept. of Chem. Devlpt., Shawinigan Chemicals Ltd., Shawinigan Falls, Que. (M.1943)
Cahn, Arno, Grad. Asst., Dept. of Chemistry, Purdue University, Lafayette, Ind., U.S.A. (S.1946)
Cadieux, Jean Indust. Engr., Dominion Rubber Co., Montreal. For mail: 2559 Park Row East, Montreal 28. (S.1940. M.1946)
Cadieux, Jean Paul, 4632 Christophe Colomb St., Montreal 34. (S.1944)
Cadrin, Paul Mgr., Metalite Co. Ltd., Cap-de-la-Madeleine, Que. (S.1935. Jr.1939. M.1945)
Cageorge, N. Chief Dftsmn., Strl. Divn., Dominion Bridge Co., Lachine. For mail: 80-44th Ave., Lachine, Que. (A.M.1921. M.1940)
Cahill, Lionel 4 St-Leon St., Bienville, Levis Co., Que. (S.1946)
Cain, Bernard N. Acting Dean of Applied Science, Acadia University, Wolfville. For mail: Westwood Ave., Wolfville, N.S. (M.1943)
Cairncross, A. T., Aluminum Co. of Canada, Room 1700, Sun Life Bldg., Montreal. (S.1923. A.M.1937. M.1940)
Cairns, H. L. Locating Engr., Dept. of Public Works of B.C., Kamloops. For mail: 723 Nicola St., Kamloops, B.C. (A.M.1921. M.1940)
Calder, Frank Engr., Property Dept., AluminumCo. of Canada Ltd., Arvida. For mail: 117 Castner St., Arvida, Que. (M.1945)
Calder, John (S.1938)
Calderhead, Gordon A. Jr. Engr., Canadian Industries Ltd., Montreal. For mail: 3462 St. Famille St., Montreal. (S.1943)
Caldwell, G. A. Exchange Plant Engr., Bell Telephone Co. of Canada, 76 Adelaide St. W., Toronto. (M.1945)
Cale, Norman H. Asst. Metallurgist, American Brass Co., Waterbury, Conn., U.S.A. (M.1945)
Calkins, Harold A. Chief Engr., California Packing Corp., San Francisco. For mail: 5840 St. Paul Court, Oakland 11, Calif., U.S.A. (Jr.1913. A.M.1924. M.1940)
Callaghan, John Macdonald Hotel, Edmonton, Alta. (M.1908)
Callaghan, J. C. Works Mgr. of Canada Works, Steel Co. of Canada Ltd., Hamilton, Ont. (M.1945)
Callaghan, James F. 543 Brunswick St., Fredericton, N.B. (S.1941)
Callander, D. W. Divn. Engr. Transformers, Canadian Westinghouse Co. Ltd., Hamilton, Ont. (A.M.1927. M.1940)
Callum, J. P., Indust. Fuel Engr., Shell Oil Co. of Canada Ltd., Montreal. For mail: 1340 Regent Rd. Town of Mount Royal, Que. (S.1938. Jr.1943. M.1945)
Calvin, J. D. Agent, Canada Steamship Lines, Queen St., Kingston, Ont. (A.M.1920. M.1940)
Cam, Wm. G. H. 6 Merton Cres., Hampstead, Montreal 29. (A.M.1912. M.1929)
Cameron, Alastair D. Dftsmn, Mech. Dept., Dominion Bridge Co. Ltd., Lachine. For mail: 600-44th Ave., Lachine, Montreal 32. (S.1942. Jr.1943)
Cameron, Alan E. Deputy Minister, Dept. of Mines of Nova Scotia, Halifax, N.S. (M.1937)
Cameron, Alwyn J. 64 Portledge Ave., Moncton, N.B. (S.1945)
Cameron, Angus Johnstone, City Engineer, City Hall, Weyburn, Sask. (M.1943)
Cameron, Adam K. Indust Engr., Canadian Industries Ltd., Montreal. For mail: 5554 Decelles Ave., Montreal. (S.1938. Jr.1944)
Cameron, Alan M. Mech Mtce. Engr., International Nickel Co. of Canada, Copper Cliff, Ont. For mail: 10 McNaughton St., Creighton Mine, Ont. (Jr.1944)
Cameron, Curtis B. (S.1938. Jr.1946)
Cameron, Clyde F. Asst. Gen. Mgr., Maritime Steel & Foundries Ltd., New Glasgow, N.S. For mail: 300 Fraser St., New Glasgow, N.S. (M.1942).
Cameron, Dugald, Chief Engr., Hall Machinery of Canada Ltd., Sherbrooke. For mail: 17 Magog St., Sherbrooke, Que. (A.M.1933. M.1940)
Cameron, D. Roy, Acting Coordinator of Resources Development, Dept. of Reconstruction & Supply, Ottawa. (A.M.1921. M.1925)
Cameron, Donald R. Estimator, Vulcan Iron Works Ltd., Winnipeg. For mail: 1140 McMillan Ave., Winnipeg, Man. (M.1946)
Cameron, E. G. Chief Engr., National Harbours Board, Ottawa. For mail: 39 Monkland Ave., Ottawa. (S.1906. A.M.1911. M.1936)
Cameron, Hugh D. Mgr. for Canada Locomotive Firebox Co., 803 McGill Bldg., Montreal. (S.1899. A.M.1913. M.1940)
Cameron, John M. Royal Military College, Kingston, Ont. (S.1944)
Cameron, J. S. Asst. Gen. Mgr. (mfrg), Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (S.1906. A.M.1912. M.1940)
Cameron, Kenneth G. Town Manager, Hampstead, Que. For mail: 38 Dufferin Road, Hampstead, Montreal 29. (Jr.1914. A.M.1920. M.1940)
Cameron, Kenneth M. 312 First Ave., Ottawa. (S.1901. A.M.1907. M.1920)
Cameron, Norman Chas. Imperial Tobacco Co. of Canada, 3810 St. Antoine St., Montreal. (A.M.1907. M.1940)
Cameron, N. K. Partner, Cameron & Phin, Water St., Welland, Ont. (A.M.1922. M.1940)
Cameron, W. J. D. Supt. & Engr., Anthes Foundry Ltd., Winnipeg. For mail: 5 Carpathia St., Winnipeg, Man. (M.1943)
Campbell, Alexander Contracting Engr., Dominion Bridge Co., 702 Canada Bldg., Winnipeg, Man. (S.1922. A.M.1927. M.1940)
Campbell, Angus D., Mining Engr., McIntyre-Porcupine Mines Ltd. & Castle-Tretheway Mines Ltd., Schumacher. For mail: Box 140 Schumacher, Ont. (M.1918)
Campbell, David A. Proctor & Gamble Co., Hamilton. For mail: 998 Beach Blvd., Hamilton Beach, Ont. (S.1945)
Campbell, D. C. Mgr., Tractors & Equipment Ltd., Fredericton. For mail: 818 Charlotte St., Fredericton, N.B. (S.1935. Jr.1941. M.1944)
Campbell, D. K. Dftsmn, City Engineer's Office, Edmonton. For mail: 11138-87th Ave. Edmonton, Alta. (S.1943. Jr.1946)
Campbell, D. Keith 332 South St., Halifax, N.S. (S.1946)
Campbell, Donald R. Lecturer, Dept. of Drawing, Queen's University, Kingston, Ont. (S.1944)
Campbell, Don W. Sales Engr., T. C. Chown Ltd., Montreal. For mail: 137 Wolseley Ave., Montreal 28. (M.1946)
Campbell, Elliot S., Civil Engr., Registrar of Motor Vehicles, Dept. of Highways & Public Works, Halifax, N.S. (M.1940)
Campbell, G. A. Supt. of Constrn., E. G. M. Cape & Co., 960 New Birks Bldg., Montreal. (S.1937. Jr.1942. M.1944)
Campbell, George I. Trans. Design Engr., Canadian General Electric Co. Ltd., Toronto. For mail: 132 MacDonnell Ave., Toronto 3. (S.1942. Jr.1946)
Campbell, Geo. W. Asst. Dist. Engr., Highways Branch of Manitoba, 301 Legislative Bldgs., Winnipeg, Man. (Jr.1920. A.M.1930. M.1940)
Campbell, J. D. Mgr., Chemical Lime Ltd., Beachville, Ont. (M.1946)
Campbell, James G. 1841 Chilver Road, Walkerville, Ont. (A.M.1919. M.1940)
Campbell, John G. 14 Ball St. Kenogami, Que. (S.1946)
Campbell, John Graham Engr., Aluminum Reduction Plant, Aluminum Co. of Canada, Arvida. For mail: 844-6th St. Arvida, Que. S.1939. Jr.1945)
Campbell, J. M. Div. Engr., Canadian Pacific Railway, Lethbridge, Alta. (A.M. 1920. M.1940)
Campbell, John Murdoch Electric Light Company, Gananoque, Ont. (M.1907)
Campbell, J. P. James Robertson Co. Ltd., Saint John, N.B. For mail: Fairville, N.B. (M.1942)
Campbell, James S. Chief Engr., Canadian Top & Body Corp. Ltd., Tilbury. For mail: P.O. Box 121, Tilbury, Ont. (S.1928. A.M.1938 M.1940)
Campbell, Lorne Argyle Pres. & Mng. Director, West Kootenay Power & Light Co. Ltd., Trail, B.C. (M.1935)
Campbell, Noel Ford Motor Co., Windsor, Ont. For mail: 49 Jefferson Blvd., Riverside, Ont. (Jr.1940)
Campbell, Norman Macleod Pres., Engineering Equipment Co. Ltd., 620 Cathcart St., Montreal. (S.1899. A.M.1911. M.1940)
Campbell, Robt. Arthur 365 Holland Ave., Ottawa. (A.M.1938. M.1940)
Campbell, Robt. Anderson Great Lakes Power Co., Sault Ste. Marie, Ont. (A.M.1923. M.1940)
Campbell, Ronald E. P.O. Box 162, Sackville, N.B. (S.1944)
Campbell, V. H. Dist Engr., Highways Branch, Dept. of Public Works of Manitoba, Winnipeg, Man. (A.M.1920. M.1940)
Campbell, Wm. A. 521 Strathmore Blvd., Toronto. (S.1946)
Campbell, W. F. Mtce. Engr., Roberval Saguenay Railway, Arvida, Que. (A.M.1938. M.1940)
Campbell, Wm. Lyman Prof. & Head of Dept. of Food Tech., Massachusetts Institute of Technology, Cambridge, Mass., U.S.A. (M.1943)
Campbell, W. M. 56 James St. E., Brockville, Ont. (S.1946)
Campbell, W. R. 1035 University Drive, Saskatoon, Sask. (S.1945).
Campeau, C. E. Engr., City Planning Dept., Montreal. For mail: 6715 St. Lawrence Blvd., Montreal 14. (S.1940. Jr.1944. M.1945)
Campion, William Engr., Lightning Fastener Co., St. Catharines. For mail: 102 Queen St., St. Catharines, Ont. (A.M.1922. M.1940)
Campion, Wm. K. Jr. Mtce. Engr., Canada Packers Ltd., Toronto. For mail: 102 Queen St., St. Catharines, Ont. (S.1944. Jr.1946)
Campkin, W. L. Tel. Engr., Saskatchewan Government Telephones, Regina. For mail: 2253 Elphinstone St., Regina, Sask. (A.M.1938 M.1940)
Campling, Chas. H. R. Instr. in Maths., Queen's University, Kingston. For mail 23 Kensington Ave., Kingston, Ont. (S.1943. Jr.1946)
Camsell, Charles 240 Mariposa Road, Rockcliffe Park, Ottawa. (M.1923)
Candlish, John Boyd Chief Engr., Palmer-Bee Co., Detroit, Mich. For mail: 32415 West Seven Mile Road, Farmington, Mich., U.S.A. (A.M.1921. M.1940)
Cann, John A. R. (S.1942)
Cann, John L. c/o Bridge Engineer, Canadian National Railways, Union Station, Winnipeg, Man. (S.1942. Jr.1946)
Cann, Wm. N. Aluminium Co. of Canada Ltd. For mail: 1487 Chomedy St., Montreal 25. A.M.1910. M.1940)
Canning, D. V. Indust. Control Engr., Canadian General Electric Co. Ltd., Peterborough. For mail:: 631 Gilmour St., Peterborough, Ont. (M.1939)
Cantin, L. Arthur Arvida Works, Aluminum Co. of Canada. For mail: 302 Berthier St., Arvida, Que. (M.1940)
Cantwell, Herbert H. Brown Corporation, La Tuque, Que. (A.M.1921. M.1940)
Cantwell, Marcel Consolidated Mining & Smelting Co., Kimberley, B.C. (S.1939. Jr.1946)
Cape, E. G. M. Pres. E. G. M. Cape & Co., 960 New Birks Bldg., Montreal. (S.1899. A.M.1902. M.1909)
Cape, Gordon Chief Inspr., Dominion Bridge Ltd., Lachine. For mail: 626 Notre Dame St., Lachine, Que. (A.M.1940. M.1940)
Cape, John M. Director, E. G. M. Cape & Co., 960 New Birks Bldg., Montreal. (Jr.1934. M.1945)
Capelle, W. A. Asst. Engr., Dept. Public Works of Canada, 10138-100A St., Edmonton, Alta. (S.1929. Jr.1937. M.1940)
Carbert, John M. Refrig. Engr., National Research Council, Ottawa. For mail: 345 Laurier Ave. W., Ottawa. (S.1945)
Carey, C. J. Civil Engr., Tramway Bldg., Halifax, N.S. (Jr.1931. A.M.1933. M.1940)
Carey, Edward G. Asst. Engr., Abitibi Power & Paper Co. Ltd., Smooth Rock Falls, Ont. For mail: 38 Latimer Ave., Toronto 12. (A.M.1926. M.1940)
Carey, Leslie C. Engr., Canadian & General Finance Co. Ltd., Toronto. For mail: 23 The Aberdeens, Bain Ave., Toronto. (S.1939. Jr.1942)
Carey, Malcolm L. Gen. Prod. Supt. Aluminum Co. of Canada, Arvida. For mail: 13 Radin Road, Arvida, Que. (M.1945)
Carey, R. P. Instrmn., Dept. of Highways of N.B., Sackville, N.B. (Jr.1938. M.1942)
Carignan, Louis-Georges, 1950 St. Joseph St., Lachine, Que. (S.1942)
Cariss, G. C. Chief Engr., Waterous Ltd. Brantford, Ont. (M.1940)
Carley, Forest Cecil Dist. Mgr., Affiliated Engineering Corporations Ltd., 415 Harbour Commission Bldg., Toronto. (A.M.1938. M.1940)
Carlson, A. J. 259 Simcoe St., Winnipeg, Man. S.1940)
Carlstrom, E. B. 525 Dominion St., Winnipeg, Man. (S.1943)
Carlyle, E. J. Sec.-Treas., Canadian Institute of Mining & Metallurgy, 906 Drummond Bldg., Montreal 2. (M.1939)
Carmel, E. Guy Brouillet & Carmel, Cons. Engrs., 3605 St. Denis St., Montreal 18. (M.1944)
Carmel, Jos. Edward 4870 Côte-des-Neiges Road, Montreal. (M.1917)
Carmichael, Douglas Alfred Sales Engr., Empire Brass Mfg. Co., 74 Princess St., Winnipeg, Man. (S.1942)
Carmichael, James I. Chief Engr., Fort William Plant, Canadian Car & Foundry Co. Ltd., Fort William, Ont. (S.1935. M.1943)
Carmichael, John William Chemist, Dept. of Public Works, Ottawa. For mail: 37 Gloucester St., Ottawa. (Jr.1944)
Carmichael, Ross M. Design. Engr., Shawinigan Engineering Co. Ltd., Montreal. For mail: 4605 Marcil Ave., Montreal 28. (A.M.1920. M.1940)
Carniel, Carlo Contractor, 832 St. James St. W., Montreal. (A.M.1920. M.1940)
Carnwath, James Mgr., Concrete Pipe Ltd., 198 Riddell St., Woodstock, Ont. (A.M.1927. M.1940)
Caron, Jos. Geo. Engr., i/c Tech. Service, City of Montreal. For mail: 559 Letourneux St., Montreal. (Jr.1912. A.M.1919. M.1940)
Caron, Jean-Guy 383 Wiseman Ave., Outremont, Que. (S.1944)
Caron, Joseph Henry Guy 682 Jarry St., Montreal 10. (S.1945)
Caron, Lucien Antonio Arthur Surveyer & Co., Cons. Engrs., Montreal. For mail: 414 Sherbrooke St., E., Montreal. (S.1941. M.1945)
Caron, M. C. Laurentide Inn, Grand'Mère, Que. (Jr.1945)
Caron, Wm. R. Engr., National Harbours Board, Quebec. For mail: 297 St. Foye Road, Quebec. (A.M.1932. M.1940)

Carothers, Dave R. Constrn. Engr., Carter Construction Co. Ltd., Toronto. For mail: Box 68, Barrie, Ont. (S.1945)
Carpenter, E. R. Instructor, Univ. of Sask. For mail: Box 71, Meadow Lake, Sask. (S.1946)
Carptener, Edward Stanley Cameron Surveys Engr., P.F.R.A., Dominion Dept. of Agriculture, 910 McCallum-Hill Bldg., Regina, Sask. (A.M.1931. M.1940)
Carpenter, H. S. 198 Leopold Crescent, Regina, Sask. (A.M.1904. M.1922)
Carr, L. E. Neil 3851 University St., Montreal 2. (S.1944)
Carr, N. O. Director, Spec. Sales Divn., War Assets Corp., Ottawa. For mail: 425 Daly Ave., Ottawa. (M.1937)
Carr, Wm. Hamilton Box 502, New Liskeard, Ont. (S.1946)
Carr-Harris, Gordon Grant Macdonnell Mech. Engr., Research & Devlpt., Dept. of Reconstruction, Ottawa. For mail: 315 Somerset St. W., Ottawa. (A.M.1930. M.1939)
Carrick, M. Stanley Cons. Engr., Winnipeg. For mail: 365 Selkirk Ave., Winnipeg, Man. (Jr.1944. M.1945)
Carrie, G. Milroy The Ordnance Board, 34 De Vere Gardens, London, W.8, England. (M.1934)
Carrier, Marcel 18 DuPlessis St., Bienville, Levis Co., Que. (S.1946)
Carrière, Jean P. City Mgr. & Engr., City Hall, Hull, Que. (A.M.1929. M.1940)
Carrière, Paul H. Elec. Engr., Rural Electrification Bureau, 89 Notre Dame St. East, Montreal. (S.1939. M.1945)
Carrol, John Murray 118 Earl St., Kingston, Ont. (S.1946)
Carroll, A. F. G. R.C.N.V.R., Overseas. (S.1939. Jr.1940)
Carroll, Cyril J. G. Tech. Officer, National Research Council, Ottawa. For mail: 171 Minto Place, Rockcliffe Park, Ottawa. (M.1941)
Carroll, R. Hugh Devlpt. Engr., Dominion Electrohome Industries Ltd., Kitchener. For mail: R.R. No. 2, Tamworth, Ont. (S 1946)
Carrothers, Del 112 St. George St., Toronto. (S.1946)
Carrothers, P. J. G. Chem. Engr. i/c Research, Edward Lipsett Ltd., Vancouver. For mail: 1549 Western Crescent, Vancouver, B.C. (S.1941. Jr.1946)
Carruthers, A. L. Chief Engr. & Chairman of Highways Board, Dept. of Public Works of B.C., Victoria. For mail: 1258 St. Patrick St., Victoria, B.C. (A.M.1915. M.1921)
Carruthers, C. D. Strl. Engr., Gordon L. Wallace, Toronto. For mail: 72 Cheritan Ave., Toronto. (S.1927. Jr.1929. A.M.1935. M.1940)
Carry, Charles Wm. Owner & Mgr., C. W. Carry, 10530—103rd St., Edmonton, Alta. (A.M.1939. M.1940)
Carscallen, H. R. Hydraulic Engr., Dominion Dept. of Agriculture, Regina. For mail: 272 Leopold Crescent, Regina, Sask. (S.1909. A.M 1912. M.1940)
Carson, C. E. Gen. Mgr. of Refineries Imperial Oil Ltd., 56 Church St., Toronto 1. (M.1938)
Carson, E. F. Branch Mgr., Northern Electric Co. Ltd., 292 King St. W., London, Ont. (Affil.1944)
Carson, G. F. Corner Brook, Newfoundland. (S.1944)
Carson, James H. Engrg. Asst., Bell Telephone Co. of Canada, Toronto For mail: 70 Gloucester St., Toronto. (S.1946. Jr.1946)
Carson, J. R. Asst. Engr., National Harbours Board, Pier 20, Halifax, N.S. (S.1932. M.1941)
Carson, M. S. Prod. Engr., Link-Belt Ltd., Toronto. For mail: 27 Bingham Ave., Toronto. (S.1931. Jr.1937)
Carson, Nelson T. Lieut., R.C.N.(R), Elec. Base Mtce. Officer, c/o Mgr. of Elec. Engrg, H.M.C. Dockyard, Esquimalt, B.C. (A.M.1939. M.1940)
Carson, R. J. R.C.E. Overseas (S.1937. Jr.1946)
Carss, G. E. 336—6th Ave. N., Saskatoon, Sask. (S.1946)
Carss, Harold W., City Engr., City Hall, Swift Current, Sask. (M.1946)
Carswell, David B. Marine Consultant, David B. Carswell, 710 Roslyn Ave., Westmount, Que. (M.1946)
Carswell, Harry A. Asst. Engr., C. W. Carry, Edmonton. For mail: 10936—87th Ave., Edmonton, Alta. (S.1945)
Carswell, John Ballantyne Cons. Engr., John B Carswell, 6150 Wilson Blvd., Arlington, Virginia, U.S.A. (Jr.1912. A.M.1915. M.1928)
Carswell, J. Morrison, Asst. Chief, Central Inventory Records Divn., Dept. of Reconstruction & Supply, Ottawa. For mail: c/o Canadian Arsenals Ltd., Box 6112, Montreal, Que. (M.1944)
Carter, C. Douglas Valuator, Municipality of St. John. For mail: 25 Wentworth St., St. John, N.B. (S.1946)
Carter, Chas. J. (S.1940)
Carter, Edward F. Cons. Engr., 837 W. Hastings St., Vancouver, B.C. (M.1916)
Carter, H. A. Flight Test Proj. Engr., Boeing Aircraft Co., Seattle. For mail: 10053—62nd Ave. S., Seattle 88, Wash., U.S.A. (Jr.1942)
Carter, J. R. Constrn. Dept., Canadian Industries Ltd., Kingston, Ont. (S.1931. A.M 1937. M.1940)
Carter, Ronald Arnold Estimator, Spruce Falls Power & Paper Co., P.O. Box 278, Kapuskasing, Ont. (S.1946)
Carter, T. A. Supt., Project 45B, Aluminum Co. of Canada, Arvida. For mail: 836—2nd St., Arvida, Que. (A.M.1938. M.1940)
Carter, Tullis N. Vice-Pres. & Chief Engr., Carter Constrn. Co. Ltd., 419 Cherry St., Toronto. (M.1940)
Carter, Wm. F. S. Mech. Supt., Continental Can Co. of Canada Ltd., St. Laurent, Que. For mail: 4870 Cote des Neiges Road, Montreal. (Jr.1937)
Carthew, C. W. Engrg. Dept., City of Sault Ste. Marie, Ont. (S.1945)
Cartier, Jacques 5500 Ave. des Plaines, Cité-Jardin, Montreal. (S.1944)
Cartier, Léonard Asst. Prof. of Hydraulics, Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1936. Jr.1940. M.1945)
Cartier, René Asst. Engr., Roads & Incineration Dept., City of Montreal. For mail: 5650 rue des Cèdres, Cité-Jardin, Montreal. (M.1945)
Cartwright, G. H. Engr., Constrn. & Mtce., Quebec Power Co., Quebec, Que. (S.1920. A.M.1926. M.1940)
Carty, Desmond G. 2 Helendale Ave., Toronto 12. (S.1941)
Carty, E. G. Gen. Exec. Asst., Dept. of Transport, Ottawa. For mail: 160 Waverley St., Ottawa. (S.1910. A.M.1912. M.1940)
Carver, Stanley C. Asst. Engr., Dept. of Public Works, Maseru, Basutoland, South Africa. (S.1927. A.M.1935. M.1940)
Casault, J. M. Supt. of Constrn., Town of Grande Prairie. For mail: 10934—125th St., Edmonton, Alta. (S.1943)
Casey, William Pres. & Gen. Mgr., Canadian Locomotive Co., Kingston, Ont. (M.1922)
Cass, Lorne O. Asst. Engr., National Harbours Board, P.O. Box 1393, Saint John, N.B. (S.1939. M.1944)
Cassels, W. L. L. 366 Daly Ave., Ottawa. (A.M.1924. M.1940)
Cassidy, S. B. Radio Engineering Improved, 64 York St., Fredericton, N.B. (Jr.1936. M.1943)
Casson, H. Vincent Cost & Gen. Accounting & Consulting, R. J Casson & Co., 744 West Hastings St., Vancouver, B.C. (Jr.1945)
Cataford, P. R. Sub-Stations Designer, Quebec Hydro-Electric Commission, 107 Craig St. W., Montreal. (S.1943)
Catchpole, Gordon M. 1706 Drummond Rd., Niagara Falls, Ont. (S.1946)
Cate, C. L. Private Practice, North Hatley, Que. (A M.1911. M.1940)
Caton, A. Richard 687 Walker Ave., Winnipeg, Man. (S.1945)
Caton, E. V. Chief Engr. & Mgr., Winnipeg Electric Co., Winnipeg, Man. (M.1917)
Cavanagh, A. L. 331 Baltimore Rd., Winnipeg, Man. (S.1911. A M.1919. M.1940)
Cavanagh, John L. Gen. Mgr., Malagash Salt Co. Ltd., New Glasgow, N.S. (M.1940)
Cavanagh, J. Richard Associate to Patent Attorneys, Fetherstonhaugh & Co., Toronto. For mail: 56 Ridley Blvd., Toronto. (S.1945. Jr 1946)
Cavanagh, R. T. Research & Devlpt. Engr., Cyclograph Services Co. Ltd., Toronto. For mail: 282 Melrose Ave., Toronto 12. (S.1945)
Caverly, David S. Asst. Sanitary Engr., Ontario Dept. of Health, Toronto. For mail: R.R. No. 5, Aylmer (West), Ont. (S.1942. Jr.1946)
Caverly, J. A. Howe Sound Exploration Co. Ltd., Snow Lake Divn., Snow Lake, Man. (via The Pass). (Jr.1942)
Cawley, H. R. (Jr.1938)
Cawthra-Elliot, Harry Macintosh Cawthra Lotten, Lakeview, Ont. (M.1920)
Cepella, Otto 7959 De l'Epée Ave., Montreal 15. (S.1945)
Chabot, Arthur J. Elec. Engr., Gatineau Power Co., 140 Wellington St., Ottawa. (M.1945)
Chabot, J. M. 2429 Grand Trunk, Montreal. (S.1945)
Chabot, J. Yvon Training Course, Shawinigan Water & Power Co. For mail: St.-Isidore, Co. Dorchester, Que. (S.1945)
Chadillon, Francois 2176 St. Luke St., Montreal 25. (S.1937. M.1945)
Chadwick, Austin R. Pres. & Gen. Mgr., Construction Equipment Co. Ltd. & Gunite Waterproofing Ltd., 180 Vallée St., Montreal. (S.1921. A.M.1930. M 1940)
Chadwick, Douglas Moore Dist. Contracting Engr., Canadian Bridge Co. Ltd., 552 New Birks Bldg., Montreal. (A.M.1912. M.1940)
Chadwick, R. E. Pres. Foundation Co. of Canada Ltd., 1538 Sherbrooke St. W., Montreal. (A.M.1913. M.1921)
Chadwick, Walter Wyburn Pres. & Gen. Mgr., Chadwick-Carroll Brass & Fixtures Ltd., 365 Wilson St., Hamilton, Ont. (M.1944)
Chagnon, Jacques 8783 Routhier St., Montreal 12. (S.1944)
Chagnon, J. C. Chief Engr., Quebec Streams Commission, 100 Notre Dame St. East, Montreal. (M.1943)
Challies, J. B. Vice-Pres. & Exec. Engr., Shawinigan Water & Power Co., 613 Power Bldg., Montreal. (A.M.1907. M.1914)
Chalmer, Thomas E. Dftsmn., Canada Cement Co. Ltd., Montreal. For mail: 5457 Jeanne Mance, Montreal. (S.1945)
Chalmers, Geo. H. Canada Ingot Iron Co. Ltd., 41 George St. N., Guelph, Ont. (S.1916. Jr.1919. A.M.1924. M.1940)
Chalmers, G. J. Mount Allison University, Sackville, N.B. (S 1944)
Chalmers, Hugh McL. Jr. Engr., Dominion Engineering Co., 770—6th Ave., Lachine, Que. (S.1946)
Chalmers, John 2677 West 36th Ave., Vancouver, B.C. (A.M.1899. M.1910)
Chambers, Hugh D. Pres, G. D. Peters & Co. of Can. Ltd., 620 Cathcart St., Montreal. (S.1914. A.M.1922. M.1940)
Chambers, Harold J. A. Pres. & Gen. Mgr., Standard Machine & Tool Co. Ltd., 870 Ottawa St., Windsor, Ont. (S.1920. A.M.1930. M.1939)
Chambers, Joseph B. Power Trans. Engr., Canadian General Electric Co., Toronto. For mail: 53 Glenholme Ave., Toronto. (S.1943. Jr.1946)
Chambers, Robert Field Engr., Shawinigan Water & Power Co. For mail: 74 des Casernes, Three Rivers, Que. (S.1937. Jr.1941)
Chambers, R. J. Asst. Chief Engr., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. (Jr.1936. A.M.1939. M.1940)
Champion, Cecil H. Asst. Chief Engr., Canadian International Paper Co., 1417 Sun Life Bldg., Montreal. (S.1923. A.M.1930. M.1940)
Chan, Lloyd George Jr. Engr., i/c soil mech. lab. testing, P.F.R.A., Dept. of Agriculture, Saskatoon. For mail: Y.M.C.A., Saskatoon, Sask. (S.1943. Jr.1946)
Chandler, Ralph B. Mgr., Public Utilities Commission, Public Utilities Bldg., Port Arthur, Ont. (A.M.1917. M.1923)
Chandler, Ralph W. Jr. Hydraulic Engr., Hydro-Electric Power Comm. of Ont., Toronto. For mail: 50 Millwood Road, Toronto 12. (S.1940. Jr.1943)
Chant, R. E. Flin Flon, Man. (S.1946)
Chapleau, Henri Chief Chemist, Quebec Liquor Commission, Delorimier & Craig Sts., Montreal. (M.1945)
Chapleau, J. P. Vice-Pres. & Chief Engr., Quemont Construction Inc., Montreal. For mail: 5711 Waverly St., Montreal (Jr.1921. A.M.1923. M.1940)
Chapleau, Samuel J. (A.M.1896. M.1909)
Chaplin, C. J. P.O. Box 30, Almonte, Ont. (S.1904. A.M.1912. M.1917)
Chaplin, Herbert E. Factory Engr., Imperial Tobacco Co. of Canada Ltd., 3710 St. Antoine St., Montreal. (Jr.1938. M.1945)
Chapman, Alfred S. 2164 Bartlett St., Oak Bay, B.C. (A.M.1916. M.1940)
Chapman, Edward Willard Gordon, Engr., Mtce. of Way, Canadian National Railways, Moncton. For mail: Spencer Manor, 119 Weldon St., Moncton, N.B. (Jr.1919. A.M.1925. M.1940)
Chapman, Harris J. 8 Fenwick Ave., Montreal West. (S. 1942. Jr.1943. M.1944)
Chapman, Stuart M. Research Associate, Pulp & Paper Research Institute of Canada, 3420 University St., Montreal 2. (S.1936. M.1942)
Chappell, B. Engr. of Track, Canadian National Railways, Union Station, Winnipeg, Man. (M.1943)
Chappell, Douglas S. Can. Kodak Co., Toronto. For mail: 504 Palmerston Blvd., (S.1943. Jr.1946)
Chappell, Frank 45 Connaught St., Oshawa, Ont. (S.1908. A.M.1913. M.1936)
Chappell, M. R. Gen. Constrn., M. R. Chappell Ltd., 62-80 Brookland St., Sydney, N.S. (Affil.1928)
Chappelle, J. W. S. Civil Engr., Engineering Construction, Corona Hotel, Edmonton, Alta. (A.M.1921. M.1940)
Chard, A. E. Mech. Engr., Powell River Co. For mail: P.O. Box 824, Powell River, B.C. (Jr.1940)
Charest, P. A. Residence 732, Ajax Divn., University of Toronto, Ajax, Ont. (Jr.1937)
Charest, René Divn. Engr., Drainage Service, Dept. of Agriculture of Quebec, Montreal. For mail: 5401 Bourret, Montreal. (S.1943)
Charland, Roger 4098 St. Hubert St., Montreal 34. (S.1938. Jr.1946)
Charlebois, J. E. 7544 Henri-Julien St., Montreal 10. (S.1945)
Charles, F. Roland Patents, National Research Council, Ottawa. For mail: 15 Torrington Place, Ottawa. (M.1944)
Charles, John Leslie 879 Grosvenor Ave., Winnipeg, Man. (A.M.1919. M.1940)
Charles, Robert S., Jr. Chief Engr., International Water Supply Ltd., London, Ont. For mail: 107 Windsor Ave., London, Ont. (A.M.1938. M.1940)
Charlesworth, Edward F. Chem. Engr., Canadian Armament Research & Development Establishment, Quebec. For mail: 90 Brighton Ave., Ottawa. (S.1943)

Charlesworth, L. C. 3602 Cadboro Bay Road, Victoria, B.C. (M.1918)
Charlton, Richard M. 6th Range, St. Gabriel de Brandon, Que. (A.M.1905. M.1940)
Charnley, Jas. Elec. Engr. i/c design & installn., Shawinigan Engineering Co. Ltd., Montreal. For mail: 134 Victoria Ave., Longueuil, Que. (A.M.1939. M.1940)
Charnock, E. T. Asst. Sulphite Supt., Great Lakes Paper Co. Ltd., Fort William. For mail: 1435 Cuthbertson Place, Fort William, Ont. (Jr.1944)
Charron, Roland S. Asst. to Mgr., Union Quarries & Paving Ltd., 48 Second Ave., Quebec. (M.1944)
Charters, Stewart A. Sales Engr., Westeel Products Ltd., Montreal. For mail: 4577 Coolbrook Ave., Montreal 28. (S.1936. M.1945)
Chartier, Albert Dir. Industl. Training & Relations, Forano Ltd., Plessisville. For mail: P.O. Box 197, Plessisville, Que. (A.M.1920. M.1940)
Charton, Herman 46 Austin Terrace, Toronto 10, Ont. (S.1942. Jr.1946)
Charyk, J. V. California Institute of Technology, Pasadena, Calif., U.S.A. (S.1942. Jr.1946)
Chaussée, P. M. Elec. Techn. i/c Motive Power, City of Montreal. For mail: 1612 Pie IX Blvd., Montreal, Que. (S.1919. Jr.1922. Affil.1934)
Cheeseman, Edgar W. Asst. Geol., Upper Canada Mines Ltd., Dobie, Ont. (S.1935. Jr.1946)
Chéné, J. D. Cons. Engr., 163 Notre Dame St., Hull, Que. (M.1945)
Chênevert, J. Georges Cons. Engr. & Partner, Arthur Surveyer & Co., 1010 St. Catherine St. W., Montreal. (M.1935)
Cheney, Wayne P. Supt., Asphalt Sales, Western Region, British American Oil Co., Toronto General Trusts Bldg., Calgary, Alta. (S.1926. A.M.1932. M.1940)
Chenivesse, Emile (S.1942)
Cheriton, W. R. 1996 West 14th Ave., Vancouver, B.C. (S.1945. Jr.1946)
Chernick, Alexander, Strl. Engr., Toronto Transportation Commission, 14 Front St., Toronto. (M.1944)
Cherry, Harold J. Columbia Basin Investigation, Dom. Water & Power Bureau, Dept. of Mines & Resources, Vancouver. For mail: 283 Main St. W., North Bay, Ont. (S.1944. Jr.1946)
Cheshire, W. V. Telephone Sales Dept., Northern Electric Co. Ltd., Montreal. For mail: 4 Waverly Road, Pointe Claire, Que. (S.1919. A.M.1930. M.1940)
Chestnut, Kenneth R. Airways Engr., Dept. of Transport, Ottawa. For mail: 342 Metcalfe St., Ottawa. (M.1938)
Chestnut, V. S. Sr. Engr., Saint John Harbour, National Harbours Board, 115 Prince William St., Saint John, N.B. (A.M.1919. M.1940)
Chevalier, J. Emile Asst. to Assoc. Chief Engr., Bridge Branch, Dept. of Public Works of Quebec, Quebec, Que. For mail: 125 Cartier Ave., Quebec. (A.M.1936. M.1940)
Chevalier, Jean-Paul Engr., Dept. of Public Works of Canada, Montreal. For mail: 3740 Cote Ste. Catherine Road, Montreal 26. (S.1944. Jr.1946)
Chevalier, Philippe Asst. Engr., Technical Service, City of Montreal. For mail: 4695 Roslyn Ave., Montreal. (S.1907. A.M.1913. M.1940)
Chevrette, Bruno Drainage Service, C.P. 370, Drummondville, Que. (S.1943)
Chillcott, G. T. Dist. Airway Engr., Dept. of Transport, 312 Pacific Bldg., Vancouver, B.C. (A.M.1939. M.1940)
Chilman, Wm. R. Constrn. Engr., Tope Construction Co., Hamilton. For mail: 352 Hunter St. East, Hamilton, Ont. (S.1941. Jr.1946)
Chinn, Norman W. Design Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 4639 Melrose Ave., Montreal 28. (S.1941)
Chipman, H. C. 9 Catherinie St., Glace Bay, N.S. (M.1940)
Chipman S. Gerald Mng. Dir., Canada Vulcanizer & Equipment Co. Ltd., London. For mail: 972 Waterloo St., London, Ont. (M.1946)
Chisholm, Arthur F., Operational Staff, Regents of Mount Allison, Sackville, N.B. For mail: Great Village, N.S. (S.1944)
Chisholm, A. H. Asst. to Mgr. of Mfg., Canadian International Paper Co., Sun Life Bldg., Montreal. (S.1920. A.M.1926. M.1940)
Chisholm, D. A. Res. Engr., Dept. of Highways & Public Works, Provincial Bldg., Halifax, N.S. (S.1930. Jr.1934. A.M.1938. M.1940)
Chisholm, Edward Owen Asst. to Dist. Geologist, Kenora, Dept. of Mines of Ontario, Toronto. For mail: Blacks Harbour, N.B. (Affil.1946)
Chisholm, F. A. Local Mgr., Southern Canada Power Co., 228 Heriot St., Drummondville, Que. (A.M.1909. M.1940)
Chisholm, Joseph D. Works Mgr., Canadian Arsenals Ltd., St. Paul L'Ermite, Que. For mail: P.O. Box 6112, Montreal. (S.1920. Jr.1925. A.M.1930. M.1940)
Chisholm, K. G. Sales Engr., R.C.A. Victor Co. Ltd., 1140 Yonge St., Toronto (M.1944)
Chisholm, W. H. Sales Mgr., Maritime Dist., Northern Electric Co. Ltd., Halifax. For mail: 55 Pine St., Dartmouth, N.S. (M.1942)
Chisholm, Wm. Ronald, Antigonish, N.S. (A.M.1907. M.1940)
Chivers, C. W. U. Northwood & Chivers, Architects, Nanton Bldg., Winnipeg, Man. (A.M.1907. M.1940)
Chizen, Martin 367 Park St. S., Peterborough, Ont. (S.1946)
Choinière, Maurice, 3414 Parc Lafontaine, Montreal 24. (S.1944)
Cholette, Albert Head, Dept. of Chem. Engrg., Faculty of Science, Laval University, Quebec. (S.1940. Jr.1943. M.1945)
Chomyn, Michael Wm. Malcolm Mech. Engr., Dept. Reconstruction (Navy). 225 Kent St., Ottawa. (S.1943. Jr.1946)
Choquet, Guy Asst. Engr., River St. Lawrence Ship Channel, Dept. of Transport, Montreal. For mail: 4364 St. Hubert St., Montreal. (S.1939. Jr.1946)
Choquet, Jean, 10540 St. Charles St., Ahuntsic, Montreal 12. (S.1944)
Choquet, J. André 10540 St. Charles St., Ahuntsic, Montreal 12. (S.1944)
Chorolsky, Eugene Designing Engr., Ford Motor Co. of Canada, Windsor. For mail: 2478 Buckingham Drive, Sandwich East, Ont. (S.1926. A.M.1937. M.1940)
Christie, A. G. Prof., Dept. of Mech. Engrg., Johns Hopkins University, Baltimore 18, Maryland, U.S.A. (M.1943)
Christie, C. V. Cons. Engr. & Head of Dept. of Elec. Engrg., McGill University, Montreal. (S.1908. A.M.1911. M.1925)
Christie, F. C. Private Practice, Gen. Survey. For mail: 2033 Retallack St., Regina, Sask. (A.M.1938. M.1940)
Christie, G. W. Metal Inspr., Imperial Oil Ltd., Sarnia. For mail: 322 N. College Ave., Sarnia, Ont. (A.M.1933. M.1940)
Christie, R. Louis Plant Engr., Canadian Kodak Co. Ltd., Toronto. For mail: 40 Old Mill Drive, Toronto 9, Ont. (S.1932. Jr.1940)
Christie, Wm. Prince Albert, Sask. (M.1922)
Christmas, Lynwood M. 2nd Vice-Pres. & Chief Engr., Dibblee Construction Co. Ltd., 248 Albert St., Ottawa. (M.1943)
Chubb, Thomas Alford Dominion Bridge Co., Lachine. For mail: 215-35th Ave., Lachine, Que. (A.M.1920. M.1940)
Church, Charles E. Gen. Mgr., Crane Packing Co. Ltd., Hamilton. For mail: 112 York St., Hamilton, Ont. (A.M.1936. M.1940)
Church, James W. 556 Johnson St., Kingston, Ont. (S.1945)
Chutter, P. W. 1987-55th Ave. W., Vancouver, B.C. (S.1946)
Chwedchuk, Leonard Radio Devlpt., Canadian Signals Research & Development Establishment, 332 Somerset East, Ottawa, Ont. (S.1946)
Ciment, Mortimer, Gen. Engrg., Scientific Enterprises Regd., 4186 Colonial Ave., Montreal. (S.1944)
Cimon, Hector Sec., Price Bros & Co. Ltd., 65 Ste. Anne St., Quebec. (S.1912. A.M.1919. M.1930)
Circé, Armand 3515 Durocher St., Montreal. (M.1939)
Clairmont Adolphe Works Engr. Singer Manufacturing Co., Thurso, Que. (S.1937. M.1945)
Claprood, H. E. 5306 Marquette St., Montreal. (S.1944)
Clark, Alvin I. Prod. Engr., Riverside Iron Works Ltd., Calgary. For mail: Y.M.C.A., 9th Ave., Calgary, Alta. (S.1940. Jr.1942)
Clark, Arthur L. 200 Albert St., Kingston, Ont. (Affil.1920. Hon.M.1922)
Clark, Andrew T. Constrn. Plant Engr., Hydro Electric Power Comm. of Ont., Toronto. For mail: 19 Glencairn Ave., Toronto. (M.1942)
Clark, A. W. G. Pres. & Mng. Dir. B.C. Concrete Co. Ltd., Vancouver. For mail: 5326 Angus Drive, Vancouver, B.C. (S.1908. Jr.1913. A.M.1921. M.1940)
Clark, C. Gordon Chief Engr., Atlantic Sugar Refineries Ltd., Saint John. For mail: 201 Duke St., Saint John, N.B. (M.1942)
Clark, Chester Graham (S.1946)
Clark, Frederick Hubert Sales Engr., Construction Equipment Co. Ltd., Toronto. For mail: c/o Sun Life Assurance Co., St. John's, Newfoundland. (S.1943)
Clark, Francis W. Asst. Engr., Hydro-Electric Power Comm. of Ontario, 620 University Ave., Toronto. (M.1940)
Clark, George Engr. of Water Service, Canadian National Railways, Winnipeg. For mail: 137 Eugenie St., Norwood Grove P.O., Man. (A.M.1934. M.1940)
Clark, Harold S. Constrn. & Mtce. Engr., Ford Motor Co. of Canada, Windsor. For mail: 1168 Chilver Road, Windsor, Ont. (A.M.1921. M.1940)
Clark, James E. Dist. Plant Engr., Laurentian Dist. E. Divn., Bell Telephone Co., Montreal. For mail: 5811 Cote St Luc Road, Hampstead, Montreal. (S.1928. Jr.1932. A.M.1937. M.1940)
Clarke, Bruce P. Engr. i/c Hoist Divn., Canadian Ingersoll-Rand Co. Ltd., Sherbrooke. For mail: Lennoxville, Que. (S.1934. Jr.1941)
Clarke, E. R. General Contractor, 143 Bloor St. W., Toronto. (A.M.1906. M.1940)
Clarke, George C. 2nd Vice-Pres. & Treas., Fraser Brace Engrg. Co. Inc., 10 East 40th St., New York, N.Y., U.S.A. (M.1914)
Clarke, George G. Strl. Steel Designer, Dominion Bridge Co. Ltd., Lachine, Que. (A.M.1925. M.1940)
Clarke, G. T. Asst. Engr., Dept. of Public Works of Canada, Federal Bldg., Halifax, N.S. (Jr.1930. M.1940)
Clarke, G. W. Demonstrator, Engrg. Drawing, University of Saskatchewan. For mail: 620-9th Ave. N., Saskatoon, Sask. (S.1943. Jr.1946)
Clarke, John E. County Engr., Dept. of Highways & Public Works, P.O. Box 549, Bridgewater, N.S. (M.1940)
Clarke, J. L. Trans & Foreign Wire Relations Engr., Bell Telephone Co. of Canada, Montreal. For mail: 530—44th Ave., Lachine, Que. (A.M.1922. M.1932)
Clarke, J. W. Civil Engr., Haddin & Miles Ltd., Cons. Engrs., Calgary. For mail: 801—13th Ave. W., Calgary, Alta. (M.1946)
Clarke, Kenneth H. J. Asst. Mgr., Candn. Sales, International Nickel Co. of Can., Toronto. For mail: "Post Manor", Pickering, Ont. (M.1943)
Clarke, Owen M. Asst. Mgr., Worthy Park Ltd., Worthy Park, Ewarton, Jamaica, B.W.I. (S.1929. A.M.1937. M.1940)
Clarke, Ross E. Asst. Engr., Dept. of Highways of Ont., Kingston. For mail: 117 Dundas St., Kingston, Ont. (M.1945)
Clarke, Stephen H. Asst. Engr., Bepco Canada Ltd., Montreal. For mail: 2039 McGill College Ave., Montreal. (S.1933. A.M.1938. M.1940)
Clarke, Wilfred Ernest Vice-Pres. & Gen. Mgr., Sydney Foundry & Machine Works Ltd., Sydney, N.S. (M.1923)
Clarkson, A. G. Aeron. Engr., Canadian Pacific Air Lines Ltd., P.O. Box 67, St. James, Man. (Jr.1938. M. 1944)
Clawson, Ernest A. 227 Pownal St., Charlottetown, P.E.I. (S.1945)
Clawson, Robt. H. Brunswick House, Mount Allison University, Sackville, N.B. (S.1944)
Clawson, W. Kennerley Contracting Engr., Horton Steel Works Ltd., Toronto. For mail: 96 Oakwood Ave., Toronto. (Jr.1944)
Clay, C. H. Asst. Engr., International Pacific Salmon Fisheries Comm., Dominion Bldg., New Westminster, B.C. (S.1943. Jr.1946)
Cleaton, R. Ewart 20 Eyre Court, St. Johns Wood, London, N.W.8, England. (M.1923)
Clemens, James N. 303 Furby St., Suite 19, Winnipeg, Man. (M.1943)
Clement, Albert Time Study & Standards Dept. Engr., British Rubber Co. Ltd., Lachine. For mail: 2501 Orleans Ave., Montreal 4. (S.1942. Jr.1946)
Clement, Sheldon B. 715 Durrill St., North Bay, Ont. (S.1899. A.M.1906. M.1911)
Clément, Yvon 2209 Desmarteau St., Montreal 5. (S.1944)
Clendening, Chester S. Mgr., Irrigation Dist., Lethbridge Northern Irrigation District, Box 630, Lethbridge, Alta. (A.M.1922. M.1940)
Clerk, David D. Cons. Engr., Montreal. For mail: 322 Laurier Ave., Quebec. (M.1945)
Clermont, L. P. Mgr., Pointe-Claire Lumber Co. Regd., Pointe Claire. For mail: 178 Cartier St., Pointe Claire, Que. (S.1946)
Cleveland, E. A. Chief Commissioner, Greater Vancouver Water District and Chairman, Vancouver & Districts Joint Sewerage & Drainage Board, Vancouver. For mail: 1251 West Keith Road, North Vancouver, B.C. (M.1914)
Cleveland, Courtney Ernest Field Engr. & Geologist, Bralorne Mines Ltd., Vancouver. For mail: 980 Gilford St., Vancouver, B.C. (S.1937. M.1943)
Cleverdon, R. K. 31 Wayland Ave., Toronto. (S.1946)
Clibbon, A. R. Chief Dftsmn., Longue Pointe Plant, Canadian Car & Foundry Co. Ltd., Montreal. For mail: 5180 Musset Ave., Montreal 29. (Affil.1939)
Clifford, H. L. Vice-Pres. & Gen. Supt., Dufresne Construction Co. Ltd., 1832 Pie IX Blvd., Montreal. (M.1944)
Climo, Cecil Constrn. Engr., The Carborundum Co., Niagara Falls. For mail: 2711 Lundy's Lane, Niagara Falls, Ont. (M.1943)
Climo, Percy L. Mech. Engr., Frost & Wood Co. Ltd., Smiths Falls. For mail: Box 1209, Smiths Falls, Ont. (S.1928. Jr.1934. M.1940)
Cline, C. Gordon Sr. Asst. Engr., Water & Power Bureau, Dept. of Mines & Resources, c/o Ontario Power Plant, Niagara Falls, Ont. (S.1911. Jr.1912. A.M.1914. M.1940)
Cline, Richard C. Mech. & Mtce. Engr., American Can Company, Niagara Falls. For mail: Box 142, Chippawa, Ont. (S.1944. Jr.1946)
Clossey, E. G. Checking of Plans & Inspection of Bldgs., City of Montreal. For mail: 2098 Maplewood Ave., Montreal. (M.1946)
Cloutier, Jean-Maurice Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Cloutier, Jean-Paul 864 Sherbrooke St. East, Montreal 24. (S.1944)

Clow, James Allen Apptce. Engr., Calgary Power Co. Ltd., Calgary. For mail: 229 8th Ave. N.W., Calgary, Alta. (S.1946)
Coates, D. F. 4501 Decarie Blvd., Montreal 28. (S.1945)
Coates, James P. City Engineer City Hall, Trail, B.C. (A.M.1926. M.1940)
Coburn, Frederic G. Pres., Brown Company, Berlin, N.H. & Brown Corp. of Canada, 600 Fifth Ave., New York 18, N.Y., U.S.A. (M.1943)
Cochrane, Hew Grant Dept. of Reconstruction & Supply, Ottawa. For mail: 8 Maple Ave., St. Anne de Bellevue, Que. (A.M.1913. M.1940)
Cochrane, M. Farrer Water & Power Engr., Dept. of Mines & Resources, Ottawa. For mail: 218 Coltrin Road, Rockcliffe, Ottawa. (A.M.1905. M.1926)
Cochrane, Peter William Design Engr., Polymer Corp., Sarnia. For mail: 337 Cameron St., Sarnia, Ont. (M.1945)
Cock, C. J. 4022 Quesnelle Drive, Vancouver, B.C. (M.1944)
Cockburn, J. Roy Prof. of Descriptive Geometry, Dept. of Engrg. Drawing, University of Toronto, Toronto. (A.M.1911. M.1919)
Cockburn, K. O. Plant Engr., Smelting Plant, Algoma Ore Properties, Helen Mines, via Sault Ste. Marie, Ont. (Jr.1944)
Cockshutt, C. F. Overseas (S.1921. A.M.1928. M.1940)
Codd, Percy Tech. Supvr., Canadian Carborundum Co., Shawinigan Falls. For mail: Cascade Inn, Shawinigan Falls, Que. (S.1940. Jr.1944)
Cogdell, H. Bldg. & Engrg. Supt., Montreal General Hospital, Montreal. For mail: 783 Oak Ave., St. Lambert, Que. (A.M.1933. M.1940)
Cogsley, Roscoe Cochrane Instrmn. & Res. Asst., Dept. of Public Works of N.B., Moncton. For mail: St. Martins, N.B. (S.1943)
Cohen, Abbey Plant Clearance Officer, Radio & Elec. Equipt., War Assets Corp., Montreal. For mail: 4654 Hutchison St., Montreal. (S.1944. Jr.1946)
Cohen, Louis Elec. Engr. on Radio Interference, Radio Divn., Dept. of Transport, Hunter Bldg., Ottawa. (S.1944)
Cohen, Julius M. Cons. Mining Engr., 215 St. James St. W., Montreal. (M.1945)
Cohen, Louis Brunswick House, Mount Allison University, Sackville, N.B. (S.1944)
Cohen, Peter Z. Machine & Tool Design, Electric Tamper & Equipment Co., Montreal. For mail: 5215 Jeanne Mance St., Montreal 8. (S.1941. Jr.1946)
Coish, Harry Oswald Instructor, Ajax Divn., University of Toronto, Ajax. For mail: Arbor Lodge, Ajax, Ont. (S.1944. Jr.1946)
Coke, R. Norman, Vice-Chief Engr. & Gen. Supt., Quebec Hydro-Electric Comm. 107 Craig St. W., Montreal. (Jr.1917. A.M.1923. M.1939)
Colas, Emile Asst. Divn. Engr., Roads Dept. of Quebec, Napierville. For mail: 3927 St. Hubert St., Montreal 24. (S.1945)
Colby, Alan Rutherford, Asst. Dist. Engr., Dept. Public Works of B.C., Main St., Penticton, B.C. (S.1939. Jr.1944)
Colby, Wm. D. 318 University Ave., Kingston, Ont. (S.1940. Jr.1946)
Colditz, H. W. Overseas. (S.1940)
Cole, A. Herman Asst. Fire Prevention & Safety Engr., Canadian Car & Foundry Co. Ltd., Montreal. For mail: 3875 Broadway, Lachine, Que. (S.1931. Jr.1940)
Cole, A. L. Supt., Saskatoon Power Plant, Saskatchewan Power Commission. For mail: 832 University Drive, Saskatoon, Sask. (A.M.1938. M.1940)
Cole, Donald L. Asst. Engr., Elec. Apparatus, Canadian General Electric Co. Ltd., Peterborough, Ont. For mail: 185 Crescent St., Peterborough, Ont. (Jr.1942)
Cole, Geo. E. Amulet Apts., Winnipeg, Man. (S.1905. A.M.1910. M.1940)
Cole, G. Percy, Tech. Engr., Dominion Glass Co. Ltd., 1111 Beaver Hall Hill, Montreal. (M.1919)
Cole, Robt. A. 162 Monarch Park Ave., Toronto 6. (S.1941. Jr.1946)
Coleman, Frank R. Partner, Pragnell & Coleman, Dartmouth. For mail: Clarence Park, Eastern Passage, N.S. (M.1943)
Coleman, Sheldon W. G/C, Director of Air Staff Plans, R.C.A.F., Air Force Headquarters, Lisgar Bldg., Ottawa. (S.1925. A.M.1936. M.1940)
Coles, Eric M. Vice-Pres. & Director of Engrg., Canadian Westinghouse Co. Ltd., 286 Sanford Ave. N., Hamilton, Ont. (S.1922. A.M.1926. M.1940)
Colgan, Patrick (S.1930. Jr.1937)
Collard, R. R. Commonwealth Construction Co. Ltd., 300 Royal Bank Bldg., Winnipeg, Man. (M.1942)
Colle, Samuel S. Owner, Air Conditioning Engineering Co., 79 Vitre St. W., Montreal. (S.1919. A.M.1929. M.1940)
Collet, Marc A. Dominion Rubber Co., Montreal. For mail: 223 Clarke Ave., Westmount. Que. (S.1944. Jr.1946)
Collier, David B. Civil Engr., Northwestern Utilities Ltd., 10124—104th St., Edmonton, Alta. (S.1940. Jr.1943. M.1945)
Collier, Ernest Victor Mng. Dir., Victor Collier & Co. Ltd., 158 Bishopsgate, London. E.C.2, England. (S.1907. A.M.1909. M.1923)
Collings, D. B. 76 Willingdon Blvd., Toronto 9. (S.1945)
Collingwood, John C. (S.1937. Jr.1946)
Collins, Kenneth F. R.C.E.M.E. Overseas. For mail: 144 Copeland St., North Bay, Ont. (S.1941. Jr.1946)
Collins, Richard Engrg. Dept. of Longue Point Plant, Canadian Car & Foundry Co. Ltd., Montreal. (A.M.1921. M.1940)
Collins, W. H. Deputy City Engr., Hamilton. For mail: 16 Senator Ave. Hamilton, Ont. (Jr.1920. A.M.1923. M.1940)
Collis, W. O. Field Engr., Temiskaming & Northern Ontario Railway. For mail: Box 145, North Bay, Ont. (A.M.1921. M.1940)
Collison Lloyd S. Sewer Engr., City of Hamilton. For mail: P.O. Box 74, Hamilton, Ont. (S.1921. A.M.1938. M.1940)
Collitt, Bernard Met. Engr. & Dir., Jenkins Bros. Ltd., 617 St. Remi St. Montreal 30. (M.1934)
Colls E. A. G. Mgr., Chemicals & Fertizer Divn., Consolidated Mining & Smelting Co. Ltd., Trail, B.C. (M.1945)
Colman, A. R. Outside Plant Standards & Mtce. Engr., Bell Telephone Co. of Canada, 1050 Beaver Hall Hill, Montreal. (M.1945)
Colotelo, John 728 Queens Road, University of Toronto, Ajax, Ont. (S.1946)
Colpitts, C. A. Divn. Engr., Canadian Pacific Railway, Vancouver. For mail: 1926 Aspen Ave., Vancouver, B.C. (Jr.1937. M.1942)
Colpitts, Gordon L. Refinery Supt., Tropical Oil Co., Barranca Bermeja, Colombia, South America. (Jr.1934. M.1941)
Colpitts, Rolfe R. Jr. Engr., International Paper Co., Royal Hotel, Dalhousie, N.B. (S.1944. Jr.1946)
Colpitts, Walter William Cons. Engr., Coverdale & Colpitts, 120 Wall St., New York, N.Y. (S.1897. A.M.1899. M.1905)
Colter, Ashley A. Pres., Diamond Construction Co. Ltd., Box 847, Fredericton, N.B. (S.1909. A.M.1913. M.1940)
Coltcr, W. Royden 55 Alexander St., Fredericton, N.B. (S.1945)
Colwell, Charles H. Office Engr., Highway Divn., Dept. of Public Works of N.B., St. John St., Fredericton, N.B. (M.1942)
Combe, F. A. Cons. Engr., Canada Cement Bldg., Montreal. (A.M.1911. M.1920)
Comeau, J. Jules Engr. i/c Lines & Levels, City of Montreal. For mail: 3563 Vendome Ave., Montreal. (S.1918. Jr.1921. A.M.1931. M.1940)
Comtois, Paul E. Civil Engr., Dept. of Mines of Quebec. For mail: 34 Lamontagne Ave., Quebec (Jr.1946)
Confortin, J. C. Squamish, B.C. (S.1943)
Conklin, Maurice W. M. Tool Engr., Frost & Wood Co. Ltd., Smiths Falls. For mail: 21 Glen Ave., Smiths Falls, Ont. (S.1938. Jr.1942)
Conlin, G. H. 16 Rosedale Heights Drive, Toronto. (S.1940. Jr.1946)
Conn, Hugh Gordon Prof. & Head, Dept. Mech. Engrg., Queen's University, Kingston, Ont. (S.1931. A.M.1936. M.1940)
Connaught, His Royal Highness the Duke of Connaught and Strathearn, London, England. (HonM.1912)
Connell, Chas. H. N. Callander, Ont. (A.M.1915. M.1931)
Connell, Edwin A. Lieut., M.P.O., Elkins Barracks, A-23, T.C., Halifax, N.S. (S.1938. Jr.1946)
Connell, Gordon A. Chief Petroleum Engr., Royalite Oil Co. Ltd., Turner Valley, Alta. (S.1937)
Connell, John Robert 1196 Avenue Road, Toronto. (S.1946)
Connell, Thos. C. Constrn. Accountant, Power Corp. of Canada, 355 St. James St. W., Montreal. (A.M.1917. M.1940)
Connelly, A. B. Brig., Overseas. For mail: P.O. Box 6, Wolfville, N.S. (S.1932)
Connolly, J. L. Aluminum Co. of Canada, Arvida. For mail: 820 Second St., Arvida, Que. (S.1930. M.1943)
Connor, Arthur W. Cons. Engr., 106 Highlands Ave., Toronto. (A.M.1899. M.1922)
Connor, Eric J. International Ecuadorian Petroleum Co., Guayaquil, Ecuador, South America (S.1943. Jr.1946)
Connor, G. R. Engr., Industrial Dept., Aluminate Chemicals Ltd., 555 Eastern Ave., Toronto. (A.M.1937. M.1940)
Connors, F. B. Dist. Engr., Roads Branch, Dept. of Public Works, Old Court House Bldg., Calgary, Alta. (M.1941)
Conrod, G. R. Wire & Cable Mgr., General Sales Divn., Dept. 55, Northern Electric Co. Ltd., 1620 Notre Dame St. W., Montreal 3. (A.M.1938. M.1940)
Conway, G. R. G. Pres., Mexican Light & Power Co. Ltd., Apartado Postal 124 Bis, Mexico, D.F. (M.1909)
Conway, G. S. Cons. Engr., 1339 Marine Drive, West Vancouver, B.C. (A.M.1920. M.1936)
Conway, J. M. Industrial Engrg. Dept., Dominion Rubber Co. Ltd., Kitchener. For mail: 292 Wellington St. N., Kitchener, Ont. (S.1944)
Cooch, H. A. Vice-Pres., Canadian Westinghouse Co. Ltd., Hamilton, Ont. (M.1939)
Cook, C. A. G/C, Aeron. Engr., R.C.A.F. Headquarters, Ottawa. For mail: 415 Hillson Ave., Ottawa. (A.M.1938. M.1940)
Cook, C. H. Cons. Engr., 1440 St. Catherine St. W., Montreal. (S.1940. Jr.1945)
Cook, George H. Test Course, Canadian General Electric Co., Peterborough. For mail: 182 McDonnel St., Peterborough, Ont. (S.1944)
Cook, James E. 781 Markham St., Toronto. (S.1940)
Cook, James L. 1035 University Drive, Saskatoon, Sask. (S.1945)
Cook, K. Gilbert Engrg. Dept., Cresswell Rollforming Co. Ltd., Montreal. For mail: 48 Stratford Road, Hampstead, Que. (S.1936. Jr.1946)
Cook, Lloyd Arnold Apptce. Engr., Canadian Westinghouse Co., Hamilton For mail: 215 Herkimer St., Hamilton, Ont. (S.1946)
Cook, Richard M. Smithers, B.C. (S.1946)
Cook, W. A. McMichael Designing Engr., Canadian & General Finance Co. Ltd., Toronto. 232 Rose Park Drive, Toronto (A.M.1914. M 1940)
Cook, W. H. 10611 Chambord St., Montreal. (A.M.1924. M.1940)
Cooke, Chas. Hemlock, Mich., U.S.A. (S.1902. A.M.1911. M.1940)
Cooke, Don. N. Mgr., Soft Water Supply Ltd., 573½ Grey St., London, Ont. (M.1946)
Cooke, Norman L. 13 Sherwood St., Halifax, N.S. (A.M.1930. M.1940)
Cooke, N. Melville Sales Supvr., Paving Materials, Barrett Company Ltd., Keating St., Toronto 8. (Jr.1921. A.M.1930. M.1940)
Cookson, L. H. Plant Engr., Bathurst Pulp & Paper Co., P.O. Box 311, Bathurst, N.B. (M.1942)
Coons, R. M. Demonstrator & Asst. Geologist, University of Saskatchewan. For mail: 810 Saskatchewan Crescent East, Saskatoon, Sask. (Jr.1946)
Cooper, Ashton Burton Pres. & Gen. Mgr., Ferranti Electric Ltd., Mount Dennis, Toronto 9. (M.1921)
Coopcr, Alex Charles Jr. Engr., International Pacific Salmon Fisheries Comm., New Westminster. For mail: 3719 Inman Ave., New Westminster, B.C. (S.1943, Jr.1946)
Cooper, C. E. Municipal Engr., Municipality of Delta, B.C. For mail: Westham St., Ladner, B.C. (S.1903. A M.1907. M.1940)
Cooper, Douglas L. Director, Nova Scotia Division of Fisheries, Hollis St., Halifax, N.S. (M.1946)
Cooper, Frank W. Engineering Materials Ltd., 500 Dominion Square Bldg., Montreal. (A.M.1907. M.1940)
Cooper, Glenn A. 118 Harvard Ave., Winnipeg, Man. (S.1943)
Cooper, John S. Asst. Engr., Ontario Northland Railway, North Bay. For mail: 555 McIntyre St. West, North Bay, Ont. (Jr.1936. A.M.1940. M.1940)
Cooper, L. O. Canadian Johns Manville Co., Asbestos, Que. For mail: P.O. Box 539, Asbestos, Que. (S.1928. A.M.1938. M.1940)
Cooper, Paul E. Pres., Pacific Mills Ltd., Vancouver. For mail: 3690 Osler Ave., Vancouver, B.C. (S.1920. Jr.1925. A.M.1928. M.1940)
Cooper, S. C. Contractor's Engr., C. A. Pitts General Contractor Ltd., R.R.1, St. Catharines, Ont. (S.1945)
Cooper, W. E. Bathurst Power & Paper Co. Ltd., Bathurst, N.B. (S.1935. M.1941)
Coote, Alexander H. Traffic Divn., Bell Telephone Co., Montreal. For mail: 7 Cedar Ave., Pointe Claire, Que. (Jr.1946)
Coote, George F. Seismograph Computer, Tropical Oil Co., Nacional 335, Bogota, Colombia. (S.1939. Jr.1941)
Coote, J. A. Asst. Prof., Dept. of Mech. Engrg., McGill University, Montreal, Que. (A.M.1926. M.1940)
Coppick, Sydney (S.1936. Jr.1946)
Copping, Edward E., Supvr., Elec. Mtce., Shawinigan Water & Power Co., Shawinigan Falls. For mail: 125 Defond St., Shawinigan Falls, Que. (S.1941. Jr 1946)
Corbet, V. S. J. D. Woods & Gordon, 15 Wellington St. W., Toronto. (S.1943. Jr.1946)
Corbin, Terrance L. Lieut., R.C.E., Works Officer, Dept. of National Defence, Halifax. For mail: 31 Brenton St., Halifax, N.S. (S.1945. Jr.1946)
Cordon, Frank R. Jr. Engr., Trans-Canada Air Lines, Winnipeg. For mail: 251 Scotia St., Winnipeg, Man. (S.1943)
Corelli, C. Rae Gunningsville, Albert Co., N.B. (S.1945)
Corey, B. H. Asst. Mining Engr., Dept. Natural Resources, Canadian Pacific Railway, Calgary, Alta. (S.1940. Jr.1941. M.1945)
Corio, Paul 651 Victoria Ave., St. Lambert, Montreal 23. (S.1944)
Corless, Charles V. Tillsonburg, Ont. (S.1903. M.1910)

Cormack, J. W. Engr., Dept of Public Works of Canada, Winnipeg. For mail: 84 Canora St., Winnipeg, Man. (Jr.1946)

Corman, W. E. Pres. & Gen. Mgr., Corman Engineering Co. Ltd., 525 Richmond St. W., Toronto. (M.1945)

Cormick, Harold L. Engrg. Apptce., Canadian Westinghouse Co. Ltd., Hamilton. For mail: 76 East Ave. N., Hamilton, Ont. (Jr.1946)

Cormier, Ernest Arch. & Engr., 2039 Mansfield St., Montreal. (S.1904. A.M.1909. M.1935)

Corneil, Fred. M. Vice-Pres. Iddon & Corneil Inc., Montreal. For mail: 4043 Melrose Ave., Montreal 28. (S.1922. Jr.1925. A.M.1929. (M.1940)

Corneille, Jean 284 5th Ave., Verdun, Que. (S.1945)

Cornish, C. R. Asst Engr., Engrg. & Constrn. Service. Dept. of Mines & Resources of Canada. For mail: P.O. Box 368, Banff, Alta. (S.1928. Jr.1932. A.M.1939. M.1940)

Corriveau, Gérard 1940 Calvert St. N.W., Washington, D.C., U.S.A. (M.1945)

Corriveau, R. deB. Cons. Engr., 21 Broadway Ave., Ottawa. (S.1893. A.M.1904 M.1918)

Cosgrove, E. T. 13 Vienne St., Halifax, N.S. (S.1944. Jr.1946)

Cosgrove, John R. 54 Priory Road, High Wycombe, Bucks, England. (A.M.1910. M.1917)

Cosman, Ernest Design Engr., Meadows, Critoph & Co., Toronto. For mail: 23 Maple Villa Apts., 105 Kenwood Ave., Toronto. (S.1943. Jr.1946)

Cosser, W. G. Mech. Supt., Sigma Mines (Quebec) Ltd., Bourlamaque, Que. (S.1930. Jr.1936. M.1944)

Cossitt, Lawrence S. Plant Engr., Dominion & Turcot Works, Canadian Car & Foundry Co. Ltd., Montreal. For mail: 39 Lakeshore Road, Valois, Que. (S.1921. Jr.1926. A.M.1932. M.1940)

Cossitt, Murray F. City Engineer, City Hall, Sydney, N.S. (Jr.1920. A.M.1927. M.1940)

Costantini, D. H. Res. Bridge Engr., Highways Branch, Manitoba Dept. of Public Works, 302 Legislative Bldg., Winnipeg. Man. (M.1945)

Costigan, James P. McD. Asst. Vice-Pres. & Engr., Manufacturers Mutual Fire Insurance Co., 607 Sterling Tower, Toronto 2. (S.1925. A.M 1935. M.1940)

Costigan, James Shearer Pres., T. Pringle & Son Ltd., Cons. Engrs., Montreal. For mail: 494 Grosvenor Ave., Westmount, Que. (S.1889. A.M.1899. M.1908)

Côté, Bernard 6646 Delanaudière St., Montreal 35. (S.1945)

Côté, Eugene Designing Engr., Shawinigan Water & Power Co., Montreal. For mail: 6004 Des Ecores St., Montreal. (A.M.1939. M.1940)

Côté Gaëtan Jules Cons. Engr. & Land Surveyer, Crépeau, Côté & Lemieux, 45 Wellington North, Sherbrooke, Que. (M.1946)

Côté, Jos. Léon 220 Grande Allée, Quebec. (S.1940. Jr.1946)

Côté, Jean-Marie (S.1945)

Cothran, F. H. Pres., Piedmont & Northern Railway, and the Durham & Southern Railway, Charlotte, N.C., U.S.A. (M.1926)

Cottee, John F. Chemist, Canadian International Paper Co., Gatineau, Que. For mail: 678 Gilmour St., Ottawa. (S.1946)

Cottingham, D. P. Engrg. Service Dept., Apparatus Divn., Canadian General Electric Co., Toronto. For mail: 145 Fairview Ave., Toronto 9. (S.1945. Jr.1946)

Couillard, J. O. Bell Telephone Co. of Canada, 114 St. John St., Quebec. (Affil.1940)

Coulby, Wm. G. 263 John St., Belleville, Ont. (S.1946)

Coulter, Stanley L. Elec. Constrn. Supt., Albert Kahn Associated Architects & Engineers Inc., Detroit. For mail: P.O. Box 26, Doraville, Georgia, U.S.A.. (S.1921. Jr.1926)

Coulthart, E. N. Mech. Engr., Aluminum Co. of Canada, Arvida. For mail: 2A Brittany Row, Arvida, Que. (S.1941. Jr.1946)

Coultis, S. G. Pres. & Gen. Mgr., Valley Pipe Line Co. Ltd., 617-7th Ave. W., Calgary, Alta. (M.1926)

Coupe, Herbert F. Jamaica Bauxites Ltd., Mandeville P.O., Jamaica, B.W.I. (S.1941. Jr.1946)

Coupienne, Gilbert Dept. of Roads of Quebec, Montreal. For mail: 2091 Union Ave., Montreal. (S.1937. Jr.1946)

Courchesne, Armand Consolidated Paper Co., Grand'Mère. For mail: P.O. Box 277, Grand 'Mère, Que (S.1942. Jr. 1946)

Courchesne, C. E. Asst. Dist. Engr., Dept. of Highways of Quebec. For mail: 324 Laurier Ave., Quebec. (M.1941)

Courtice, E. Dean W. Tech. Dir., Westdale Secondary School, Hamilton Board of Education. For mail: 81 Rosslyn Ave. S., Hamilton, Ont. (A.M.1919. M.1940)

Courtwright, James M. Mgr., Lubricants Dept., Toronto Divn., Shell Oil Co. of Canada Ltd., 25 Adelaide St. E., Toronto. (S.1941. Jr.1945)

Cousineau, Aimé Dir. City Planning Dept., City Hall, Montreal. (S.1908. A.M.1915. M.1939)

Cousineau, J. Emile Quebec Streams Commission, New Court House, Montreal. (S.1939. Jr.1942. M.1945)

Cousineau, Louis-Philippe Town Mgr., City Hall, Val d'Or, Que. (S.1934. A.M.1938. M.1940)

Cousineau, Yvon Engr., Aluminum Co. of Canada, Arvida. For mail: 846-7th St., Arvida, Que. (M.1944)

Cousins, Edward L. Cons. Engr., Harbour Commissioners Bldg., Toronto (S.1907. A.M.1909. M.1923)

Coutts, Erskine Engr., James Thom & Co. Ltd., Genl. Contrs., Montreal. For mail: 3469 Montclair Ave., Montreal 28. (S.1936 Jr.1944)

Couture, Félix 1658 Panet St., Montreal 24. (S.1944)

Coverdale, Harold M. Liaison Engr., Trans-Canada Airlines, on leave of absence. For mail: 522 The Graduate House, Massachusetts Institute of Technology, Cambridge, Mass., U.S.A. (Jr.1944)

Covo, Peter Victor 3653 University St., Montreal. (S.1941. Jr.1946)

Cowan, E. Cons. Engr., 204 Notre Dame St. W., Montreal. (S.1921. A.M.1934. M.1940)

Cowan, Edgar C. Constrn. Engr., Powell Equipment Co. Ltd., 1060 Arlington St., Winnipeg, Man. (S.1919. A.M.1922. M.1940)

Cowan, G. A. Sales & Service Engr., Railway & Power Engineering Corp. Ltd., P.O. Box 325, Winnipeg, Man. (Jr.1944. M.1945)

Cowan, Wm. Kennedy Sales Engr., Aluminum Co. of Canada Ltd., 1700 Sun Life Bldg., Montreal. (M.1945)

Coward, Geo. W. Divn. Engr.,, Entre Rios Railways Co. Ltd. For mail: Ferro Carriles de Entre Rios, Basavilbaso, Entre Rios, Argentina. (A.M.1910. M.1940).

Cowie, A. H. Mgr. Eastern Divn., Dominion Bridge Co. Ltd., Box 280, Montreal (M.1932)

Cowie, Frederick William Cons. Engr., Harbours Board of Montreal. For mail: 3745 Westmount Blvd., Westmount, Que. (A.M.1887. M.1898)

Cowie, N. Claude Engr., Great Lakes Power Co., Sault Ste. Marie. For mail; 26 Coulson Ave., Sault Ste. Marie, Ont. (Jr.1931. M.1942)

Cowley, P. V. Asst. Engr., Municipal Dept., City of Vancouver. For mail: 942 West 22nd Ave., Vancouver, B.C. (S.1907. Jr.1913. A.M.1918. M.1936).

Cowley, W. H. Mgr. & Tech. Advisor, Cowley Bros., Edmonton. For mail: 11208-65th St., Edmonton, Alta. (S.1946).

Cox, Archibald Constrn. & Mech. Engr., Oliver, B.C. (A.M.1926. M.1940)

Cox, Burnell B. 2/Lieut., New Wellington Barracks, Officers' Mess, Halifax, N.S. (S.1944. Jr.1946)

Cox, Kenneth V. Transmission Engr. New Brunswick Telephone Co. Ltd., 22 Prince William St., Saint John, N.B. (S.1942. Jr.1942. M.1945)

Cox, Otis Stanley Dist. Engr., Dept. of Public Works of Canada, Federal Bldg., Hâlifax, N.S. (Jr.1916. A.M.1918. M.1940)

Cox, R. Edward Cable Engr., Northern Electric Co. Ltd., Montreal. For mail: 7228 Chambord St., Montreal 35. (S.1938).

Cox, W. J. Asst. Research Engr., National Research Council, Ottawa. For mail: 384 Sunnyside Ave., Ottawa. (S.1939. Jr.1946).

Coy, Vincent M. Distribution Engr., Nova Scotia Light & Power Co. Ltd., Halifax. For mail: 71 Elm St., Halifax, N.S. (M.1942).

Craibbe, Harold Kenneth Highway Engr., Dept. of Highways of Ontario, Toronto. For mail: 43 Eastwood Road, Toronto 8. (S.1945).

Craig, A. F. 65 Cordova St., Winnipeg, Man. (S.1946)

Craig, Carleton, Assoc. Prof. of Civil Engrg. & Asst. Vice-Principal, Dawson College, Que. (S.1931. Jr.1937. M.1943)

Craig, C. E. Supt., Tubing & Extension Dept., Aluminum Co. of Canada, Kingston. For mail: 191 Park St., Kingston, Ont. (S.1938 Jr.1944)

Craig, D. S. National Research Council, Chalk River Laboratory, Chalk River, Ont. (S.1944)

Craig, Gordon Harbison Sales Engr., Mumford, Medland Ltd., 576 Wall St., Winnipeg, Man. (M.1946)

Craig, H. B. R. Town Engr., P.O. Box 290, Wallaceburg, Ont. (S.1902. A.M.1905. M.1910)

Craig, Henry Clifford Office of Comptroller of the Treasury, Federal Govt., Ottawa. For mail: 340 Second Ave., Ottawa. (Jr.1916. A.M.1917. M.1940)

Craig, James W. Mgr., Devlpt. & Research, Canadian Refractories Ltd., Montreal. For mail: 4534 Wilson Ave., Montreal 29, Que. S.1928. Jr.1930. M.1942).

Craig, Shirley A. Progress Engr., Wartime Shipbuilding Ltd., 420 Lagauchetière St., West, Montreal 1. (M.1945)

Craig, W. Hardy Constrn. Supvr., Dow Chemical of Canada Ltd., Sarnia, Ont. (Jr.1945)

Craig, W. R. Asst. Engr., B.C. Sugar Refining Co., Ft. Rogers St., Vancouver, B.C. (S.1933. Jr.1938. M.1943)

Craik, O. S. Elec. Supt., Canadian International Paper Co., Gatineau Mills. For mail: 25 Park Ave., Gatineau Mills, Que. (M.1940)

Crain, Harold F. Vice-pres. i/c Mfg., R. L. Crain Ltd., Ottawa, Ont. (S.1932. Jr.1935. M.1943)

Cram, Haldane R. Sec. Federal District Commission, 291 Carling Ave., Ottawa. (A.M.1919. M.1940)

Cram, J. D. Res. Engr., H. J. Heinz Co. of Canada Ltd., Wallaceburg. For mail: General Delivery, Wallaceburg, Ont. (Jr.1944).

Cramer, David Jr. Hydraulic Engr., P.F.R.A., Dominion Dept. of Agriculture, 418 Public Bldg., Calgary, Alta. (S.1943. Jr.1945)

Crandall, S. Arnold Overseas (Jr.1941).

Crane, George Joseph Works Engr., Electric Reduction Co. of Canada Ltd., Buckingham Que. For mail: P.O. Box 315, Buckingham, Que. (Jr.1943. M.1945)

Cranston, Michael Civilian Personnel Mgr., Dept. of National Defence for Air, Calgary. For mail: 2223-27th St. S.W., Calgary, Alta. M.1941).

Cranton, C. S. 36 Clarence St., Amherst N.S. (S.1945).

Cranswick, Jack E. Branch Mgr., Canadian Westinghouse Co. Ltd., 10127-104th St. Edmonton, Alta. (M.1942)

Crase, George H. General Sales Mgr., Horton Steel Works Ltd. 330 Bay St., Toronto. (A.M.1930. M.1938)

Craster, James E. Chief Inspr., St. Laurent Plant, Robert Mitchell Co. Ltd., Montreal. For mail: 708 Ball Ave., Montreal. (S.1930. Jr.1939)

Cratchley, Reginald H. Strl. Engr., Penitentiaries Branch, Dept. of Justice, Ottawa. For mail: 54 Strathcona Ave., Ottawa. (Jr.1925. A.M.1937. M.1940)

Crawford, A. W. Supt. of Vocational Training, Dept. of Veterans Affairs, Ottawa. For mail: 132 Broadway Ave., Ottawa. (Jr.1919. A.M.1927. M.1940)

Crawford, George B. Jr. Engr., Gore & Storrie, Toronto. For mail: 152 Bloor St. W., Toronto 5. (S.1943. Jr.1946)

Crawford, Jackson Engr., i/c pulp mills, Orient Paper Mills Ltd., Brajranagar, B.N. Rly., District Sambalpur, India. (S.1921 A.M.1927. M.1940)

Crawford, James M. Asst. Supt., Engrg. Divn., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (S.1928. A.M.1935. M.1940)

Crawford, Robert T. Anvers Apts., Ste. 3, Winnipeg, Man. (S.1946).

Crawley, E. A., Divn. Engr., Dept. of Highways & Public Works of N.S., Middleton, N.S. (Jr.1911. A.M.1916. M.1940)

Crawley, Frederick A. Divn. Engr., Dept. of Highways & Public Works of Nova Scotia, P.O. Box 160, Sydney, N.S. (M.1940)

Creaghan, T. C. Pres., Creaghan and Archibald, Engrs. & Contrs., 1440 St. Catherine St. W., Montreal 25. (M.1945)

Creasor, John A. Constrn. Engr., Canada Cement Co. Ltd., Montreal. For mail: 4724 Victoria Ave., Montreal 6. (S.1914. Jr.1919. A.M.1923. M.1940)

Creed, Frank C. National Research Council, Ottawa. For mail: 14 Mt, Pleasant, Ottawa. (S.1944)

Creelman, E. A. 422 Donegal St., Peterborough, Ont. (S.1946)

Creer, A. D. Registrar, Association of Professional Engineers of British Columbia, 930 Birks Bldg., Vancouver, B. C. (A.M.1911. M.1914)

Creighton, C. Sydney Res. Engr., Dept. of Highways & Public Works of N.S. For mail: P.O. Box 666 Armdale, Halifax Co., N.S. (Jr.1919. A.M.1924. M.1940)

Crépeau, Armand C. Cons. Engr., Sherbrooke, Que. For mail: P.O. Box 64, Sherbrooke, Que. (M.1945)

Crépeau, Jean-Guy Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1945)

Crépeau, Louis Director of Tech. Serv., City of St. Hyacnthe. For mail: 1058—21st Ave., St. Hyacinthe. (M.1945)

Crépeau, Marcel Engr. on Mte. of Bridges, Dept. of Public Works of Que. For mail: 7569 St. Denis St., Montreal. (S.1936. M.1942)

Critchley, John C. Asst. Elec. Supt. & Elec. Engr., Page-Hersey Tubes Ltd., Welland. For mail: 42 Elizabeth St. E., Welland, Ont. (M.1946)

Croasdale, C. B. R.R. No. 6, Fredericton, N.B. (M.1942)

Croft, Philip J. Elec. Engr., Canada Wire & Cable Co. Ltd., Box 340, Toronto. (M.1945)

Croker, M. D. 16 Delaware Ave., Toronto. (S.1946)

Crombie, Hugh Asst. to Vice-Pres., Dominion Engineering Works Ltd., P.O. Box 220. Montreal. (Jr.1921. A.M.1926. M.1940)

Crombie. Wm. Bradshaw Res. Engr., Constrn. Work. Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (A.M.1919. M.1940)

Cromwell, A. Ross Pres., Laval Enterprises Co. Ltd., Montreal. For mail: 3649 Durocher St., Montreal. (M.1944)

Cronyn, John B. R.R. No. 3, London, Ont. (S.1941)

Crook, Donald Gordon Asst. Engr., Home Oil Distributors Ltd., Vancouver. For mail: 1267 Burnaby St. Vancouver, B.C. (S.1940. Jr.1943)

Crook, Wes. Dist Engr., Eastern Irrigation District, Brooks, Alta. (Jr.1923. M.1941)
Crooks, C. M. Staff Engr., Maritime Telegraph & Telephone Co. Ltd., 88-92 Hollis St., Halifax, N.S. (M.1945)
Crookshank, Allan R. Sr. Asst. Engr., Chief Engr's Branch, Dept. of Public Works of Canada, Saint John, N.B. (S.1905. A.M.1910. M.1915)
Croome, N. C. Flin Flon, Man. (S.1944)
Cropper, W. C. M. Apparatus Engr., Northern Electric Co. Ltd., Montreal. For mail: 1251 Gouin Blvd. W., Montreal. (M.1927)
Crosby, N. Leroi Sales Engr., Hamilton Bridge Co. Ltd., Hamilton. For mail: 76 Barclay St., Hamilton, Ont. (S.1902. A.M.1909. M.1940)
Cross, Edgar A. Cons. Engr., 156 Alexandra Blvd., Toronto. (A.M.1925. M.1935)
Cross, H. Morrey Lieut., R.C.E., 2007 Wyoming St., Washington, D.C., U.S.A. (S.1943. Jr.1946)
Cross, Ivor F. Ground Station Radio Engr., Trans Canada Air Lines, Winnipeg. For mail: 797 Garwood Ave., Winnipeg, Man. (S.1941. Jr.1946)
Crossland, Charles W. W/C, Director Aircraft Research & Devlpt., R.C.A.F., Ottawa. For mail. 242 Harmer Ave., Ottawa. (S.1928. Jr.1934. A.M.1938. M.1940)
Crossley, R. J. Rm. 366, Hunter Bldg., Ottawa. (Jr.1940)
Crossley, T. Linsey Inspector in Science, Training & Re-Establishment Institute, 50 Gould St., Toronto 2. (A.M.1916. M.1940)
Crossley, W. E. Airway Engr., Waterworks & Sewerage, Dominion Dept. of Transport, 423 Post Office Bldg., Regina, Sask. (A.M.1939. M.1940)
Crothers, Donald C. Mgr., Compressor Divn., Canadian Ingersoll Rand Co. Ltd., 620 Cathcart St., Montreal. (M.1945)
Crouch, William W. Private Practice, Constrn., 6830 Tomahawk Road, Kansas City 5, Missouri, U.S.A. (S.1916. Jr. 1920. A.M.1922. M.1940)
Crowdis, L. G. 86 Wellington St., Halifax, N.S. (S.1946)
Crowe, J. M. A. Tropical Oil Co., Barranca Bermeja, Colombia, S.A. For mail: 40 Kings Lynn Road, Toronto. (Jr.1940)
Crowell, Seth W. Field Engr., Dept. of Transport, Port Mulgrave, N.S. For mail: 138 Victoria St. E., Amherst, N.S. (Jr.1912. A.M.1918. M.1940)
Crowley, John Francis Pres. & Mng. Dir., J. F. Crowley Co. Ltd., Bond St., Dundas, Ont. (Affil.1929)
Crowley, Vernon F. Engr., Transmission Line Design Dept., Shawinigan Water & Power Co., Craig St. W., Montreal 1. (M.1945)
Crowther, E. J. (S.1943)
Crozier, Glendon L. Hamilton, P.E.I. (S.1944)
Crudge, Harry J. Bldg. Engr., Canadian National Railway, Moncton, N.B. (S.1904. A.M.1910. M.1940)
Crump, Norris R. Gen. Mgr., Eastern Lines, Canadian Pacific Railway, Toronto. For mail: 71 Cheritan Ave., Toronto, Ont. (S.1928. Jr.1931. A.M.1938. M.1940)
Cruthers, Wm. Maurice Asst. Engr., Switchgear Divn., Canadian General Electric Co., Peterborough. For mail: 561 King St., Peterborough, Ont. (A.M.1920. M.1940)
Cryer Edward 5841 Decarie Blvd., Montreal 29. (A.M.1932. M.1940)
Crysdale, C. E. Reg. Rep., Bureau of Rehabilitation & Reconstruction, Victoria. For mail: 5837 Blenheim St., Vancouver, B.C. (A.M. 1911. M.1919)
Crysler, Roy A. Strl. Engr., Canada Cement Co. Ltd., Toronto. For mail: 94 Snowdon Ave., Toronto. (Jr. 1921. A.M.1924. M.1940)
Cudworth, W. O. Engr. Mtce. of Way, Canadian Pacific Railway, Toronto. For mail: 305 Inglewood Drive, Toronto 5, (A.M.1920. M.1940)
Cuke, N. H. Engr., Devlpt. & Engrg. Dept. Canadian Liquid Air Co. Ltd., 1111 Beaver Hall Hill, Montreal 1. (Jr.1946)
Cullen, V. H. 110 College St., Sudbury, Ont. (S.1944)
Cullwick, Ernest Godfrey Captain (L) R.C.N. (R), Director of Elec. Engrg., Royal Canadian Navy, Naval Service Headquarters, Ottawa. (Jr.1926. A.M.1938. M.1940)
Culpeper, Bernard A. Chief Engr. & Mgr. of Hamilton Branch Office, C. D. Howe Co. Ltd., 301 Pigott Bldg., Hamilton, Ont. S.1920. Jr.1925. A.M.1929. M.1940)
Cummine, W. S. Overseas. (S.1943)
Cumming, E. K. Mech. Engr. University of Alberta, Edmonton. For mail: 11135—84th Ave., Edmonton, Alta. (S.1943. Jr.1945)
Cumming, J. William Civil Engr. Ward-McKee Engineering Ltd., 112 Merton St., Toronto. (S.1941. Jr.1945)
Cummings, Geo. W. 38 Lauder Ave., Toronto. (S.1944. Jr.1946)
Cunha, S. H. 2007 Union Ave., Montreal. (A.M. 1922. M.1940)
Cunningham, Adam Chief Engr. Paper Divn., Price Bros. & Co. Ltd., Kenogami, Que. (Jr.1925. A.M.1927. M.1940)
Cunningham, C. N. Jr. Eng. Training Plan, Hydro-Electric Power Commission of Ont., Toronto. For mail: 247 Margueretta St., Toronto 4. (S.1942. Jr.1946)
Cunningham, Donald David MacCoubrey S/L, Engrg. Officer, R.C.A.F., Moncton. For mail: 13 Copp St., Lakeburn, Westmorland Co., N.B. (S.1937. Jr.1938. M.1944)
Cunningham, George A. Industrial Sales Engr., Imperial Oil Ltd., Welland. For mail: 166 James St., St. Catharines, Ont. (S.1927. A.M.1935. M.1940)
Cunningham, H. E. Asst. Chief Engr. Paper Machinery Divn., Dominion Engineering Works Ltd., P.O. Box 220, Montreal. (S.1929. A.M.1939. M.1940)
Cunningham, John Supt. Northern Construction Co. & J. W. Stewart Ltd., Vancouver. For mail: 2575—15th Ave. W., Vancouver, B.C. (M.1945)
Cunningham, John F. Sr. Inspr. of Dredges Dept. of Public Works of Can., 10138—100A St., Edmonton, Alta. (Affil.1928. A.M.1932. M.1940)
Cunningham, M. W. 170 Temperance St., New Glasgow, N.S. (S.1944)
Cunningham, R. A. Field Engr., H. G. Acres & Co., Campbell River, B.C. (S.1941. Jr.1945)
Currie, G. J. Engr., Nova Scotia Light & Power Co. Ltd., P.O. Box 848, Halifax, N.S. (S.1931. A.M.1936. M.1940)
Currie, H. L. Office Engr., Canadian National Railways, Montreal. For mail: 55 Cornwall Ave., Town of Mount Royal, Que. (A.M.1921. M.1940)
Currie, Robt. Henderson Instr., Dept. of Civil Engrg., University of British Columbia. For mail: 7610 Cartier St., Vancouver, B.C. (S.1944)
Currie, V. R. Canal Engr., Dept. of Transport, Trent Canal Office, Peterborough, Ont. (S.1922. Jr.1925. A.M.1931. M.1940)
Curry, Angus D. M. Coulderwood, Jollimore P.O., Halifax Co., N.S. (M.1926)
Curtis, G. L. (S.1940)
Curtis, John K, Sanitary Engr., Ont. Dept. of Health, Toronto. For mail: 321 St. Clements Ave., Toronto. (S.1940. Jr.1946)
Curzon, D. M. 46 Elora St., Guelph, Ont. (S.1943. Jr.1946)
Cushing, A. G. Cushing, Ross Ltd., 3227 Cedar Ave., Westmount, Que. (A.M.1922. M.1940)
Cuthbertson, Chas. C. Prod. Supt., Alkali Divn., Canadian Industries Ltd., Shawinigan Falls, Que. (S.1939. M.1942)
Cuthbertson, R. S. Tool Engrg. Dept., Timken Roller Bearing Co., Canton, Ohio, U.S.A. (S.1941. Jr.1944)
Cuthbertson, W. B. Instrmn., Dept. of Transport, Moncton. For mail: East Saint John, N.B. (S.1936. Jr.1942. M.1943)
Cyr, René J. 26 Damour St., Edmundston, N.B. (S.1945)
Cyr, Séraphin A. Supt., Eastern Steel Products Ltd., Montreal. For mail: 4395 St. André St., Montreal. (Jr.1931. A.M.1932. M.1940)
Cyr, Wm. H. Grande Ligne, Que. (S.1943. Jr.1946)
Czerwinski, W. 3 Claxton Blvd., Toronto. (M.1944)

D

D'Aeth, J. B. Chief Engr., Dufresne Engineering Co. Ltd., Montreal. For mail: 4660 Roslyn Ave., Montreal 6. (A.M.1916. M.1924)
Dagenais, Camille 3876 Harvard Ave., Montreal. (S.1942)
Dagenais, Christian 1167 Berri St., Montreal. (S.1944)
Dagenais, Emilien Asphals Sales Engr., Imperial Oil Ltd., Montreal. For mail: 255 De L'Epée Ave., Outremont, Que. (M.1945)
Dagenais, Henri 3876 Harvard Ave., Montreal 24. (S.1944)
Dagenais, Jean-Paul 4030 Lafontaine Park, Montreal 24. (S.1944)
Dagg, Frank A. Indust. Engr., Aluminum Co. of Canada, Arvida. For mail: 4B Brittany Row, Arvida, Que. (M.1945)
Dahl, H. Lewis Statistical Engr., Manitoba Power Commission, Winnipeg. For mail: Ste. 36, Rosemount Apts., Winnipeg, Man. (S.1943. Jr.1946)
Daignault, Jean Marcel 4550 Christophe Colomb, Montreal 34. (S.1945)
Daignault, Laurence G. Chief Engr., Dufresne, McLagan & Associates Regd., 437 St. James St. W., Montreal. (S.1933. Jr.1940)
Daiter, Philip 149 Charles St., Winnipeg, Man. (S.1946)
Dakin, F. W. Cons. Engr., 1405 Peel St., Montreal. (M.1945)
Dale, John C. Engrg. Dept., Canadian Utilities Ltd., 215 6th Ave. W., Calgary, Alta. (S.1930. Jr.1937. M.1946)
Dale, J. G. Combust. Engr. & Statistician, Northwestern Utilities Ltd., and Registrar, Assoc. Prof. Engrs. of Alta., 10124-104th St., Edmonton, Alta. (Jr.1939. M.1941)
Dale, Wm. P. Plant Engr. & Purch. Agent, Dale Estate Ltd., Brampton, Ont. (A.M.1922. M.1940)
Dalkin, Robt. S. 9 Willow Ave., Westmount, Que. (S.1942)
Dalkin, Thomas William Supt., Tech. Divn., Dept. Lands & Mines of Alberta. For mail: 9907-108th St., Edmonton, Alta. (M.1941)
Dalrymple, A. Eric Demonstrator, Dept. of Mech. Engrg., University of Toronto. For mail: 42 King George's Road, Toronto 9. (S.1946)
Dalrymple, J. R. Indust. Engr., Canadian Johns-Manville Co., Asbestos, Que. For mail: 42 King George's Road, Toronto 9. (Jr.1946)
Dalton, J. T. Newcastle, N.B. (S.1946)
Dalton, P. D. Pres., Dalton Engineering & Construction Co. Ltd., 587 Fleet St. W., Toronto. (S.1926. A.M.1937. M.1940)
Dalton, Wm. R. Dftg. Instr., Sault Ste. Marie Technical School. For mail: 251 Pim St., Sault Ste. Marie, Ont. (M.1944)
Daly, Robt. E. 6960 Sherbrooke St. W., Montreal. (M.1945)
Daly, Thos. C. N. 445 Wiseman Ave., Outremont, Que. (S.1942)
Dalzell, Arthur G. 58 Sherwood Ave., Toronto 12. (A.M.1911. M.1921)
Dalziel, J. W. Scott 15-31st St., Long Branch, Ont. (S.1945)
Dalziel, N. P. Holetown, Sampford Spiney, Horrabridge, Devon, England. (A.M.1906. M.1918)
Dalziel, William Sales Engr., Lynn MacLeod Engineering Supplies Ltd., 218 College St., Toronto. (S.1911. Jr.1913. A.M.1919. M.1940)
D'Amours, Albert Asst. Gen. Supt., Marine Industries Ltd., Sorel. For mail: 35 Goupil St., Sorel, Que. (S.1939. Jr.1944. M.1945)
D'Amours, Maurice, 160 Maisonneuve Ave., Quebec. (S.1944)
Dancose, Leon Paul Emile Asst. Divn. Engr., Mtce. of Way, Laurentian Divn., Canadian National Railways, Quebec. For mail: 549-4th Ave., Quebec. (S.1942. Jr.1946)
Dand, H. Stewart, 39 Castle Knock Road, Toronto. (S.1946)
Daudois, Gatien, 4208 Chapleau St., Montreal 24. (S.1944)
D'Angelo, Joseph A. Demonstrator, Faculty of Engrg. University of Manitoba. For mail: 901 Riverwood Ave., Fort Garry, Man. (S.1943)
Daniels, Ray D. L. Jr. Hydraulic Engr., P.F.R.A., Dominion Dept. of Agriculture, 910 McCallum Hill Bldg. Regina, Sask. (S.1946)
Danks, Cyril N. Dist. Engr., Canadian Ingersoll-Rand Co. Ltd., 27 Wellingthon St. East, Toronto. (M.1941)
Dann, Norman Leslie Chief Cable Engr., Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (A.M.1927. M.1940)
Dansereau, Gérard, Civil Engr., Dansereau Ltd., Outremont. For mail: 3660 Hutchison St., Montreal. (S.1943)
Danscreau, J. Lucien Cons. Engr., 59 St. James St. W., Montreal. (S.1909. A.M.1913. M.1940)
Dansereau, René 4637 Westmore Ave., Montreal. (S.1940. Jr.1944)
Danylkiw, Dmytro Box 305, Rivers, Man. (S.1946)
Danyluk, Daniel Transitman, Canadian Pacific Railway, Kenora, Ont. For mail: Box 358, Souris, Man. (S.1946)
D'Aoust, J. Gilbert Res. Engr., Sorg Pulp Co. Ltd., Port Mellon, B.C. For mail: Box 122, Port Mellon, B.C. (Jr.1930. A.M.1939. M.1940)
Daoust, Jean-Marc 6350 Christophe-Colomb St., Montreal. (S.1946)
Daoust, Roland Quebec Dept. of Roads, Plessisville, Que. (M.1945)
D'Appolonia, Elio Research Asst., Strl. Engrg., University of Illinois, Talbot Laboratory, Urbana, Ill., U.S.A. (S.1941. Jr.1943. M.1945)
Dargie, A. H. Sternsons Laboratories Ltd., Eastern Passage, N.S. For mail: 26 Chester Ave., Halifax N.S. (M.1944)
Dargis, Gérard Robert 89 Levis St., Shawinigan Falls, Que. (S.1946)
Darling, A. B. Comptroller, Darling Bros. Ltd., 140 Prince St., Montreal. (M.1945)
Darling, Edward Pres. & Gen. Mgr., Darling Bros. Ltd., 140 Prince St., Montreal. (M.1925)
Darling, E. H. Cons. Engr. For mail: 21 Stanley Ave., Hamilton, Ont. (A.M.1904. M.1919)
Darling, Ralph G. 39 Tyndale Ave., Toronto 3. (S.1944)
Darveau, Georges 1 St-Charles, La Providence, St. Hyacinthe, Que. (S.1945)
Daubney, Jas. E. Engrg. Dept., Ford Motor Co. of Canada, Windsor. For mail: 825 Riverside Drive, Riverside, Ont. (A.M.1917. M.1940)
Dauphinais, E. Supt. Saguenay Telephone Co., 7 Lafontaine, Chicoutimi, Que. (S.1938. (M.1945)
Davey, R. E. Canada Oils Co. Ltd., 385 Bridge St., Montreal. (S.1935. Jr.1942)
Davidson, Arthur C. Lecturer, Mechanics of Materials, University of Toronto, Ajax. For mail: 80 St. Clair Ave. W., Toronto 5. S.1935. Jr.1937. M.1943)
Davidson, C. A. G/C, Director of Construction & Engineering, R.C.A.F., Lisgar Bldg., Ottawa. (M.1936)
Davidson, Fred W. Engrg. Asst., Transmissions, Bell Telephone Co. of Canada, Plant Dept., 5th Floor, 87 Ontario St. W., Montreal. (S.1943)
Davidson, G. D. Plant Engr., Canadian International Paper Co., Gatineau. For mail: P.O. Box 97, Gatineau, Que. (M.1945)

Davidson, Gordon P. Strl. Designer, G. G. Reid, Cons. Engr., Toronto. For mail: 329 Fairlawn Ave., Toronto. (S.1945)
Davidson, G. Ross 717 Stanley St., New Westminster, B.C. (S.1934. Jr.1942)
Davidson, J. Knox Chief Engr., Orange Crush Ltd., 100 Claremont St., Toronto. (Jr.1930. A.M.1935)
Davidson, J. M. Gen. Mgr., Lethbridge Collieries Ltd., 413 Eighth St. S., Lethbridge, Alta. (M.1941)
Davidson, M. Robt. Mech. Engr., Longlac Pulp & Paper Co. Ltd., Schreiber, Ont. (S.1946)
Davidson, Philip Vice-Pres. & Chief Engr., Robinson Engrg. & Devlpt. Co., Calgary. For mail: P.O. Box 100, Calgary, Alta. (M.1945)
Davidson, Ross Jr. Research Engr., National Research Council, Ottawa. For mail: 23 Clarey Ave., Ottawa. (S.1946)
Davies, Clarence E. Secretary, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y. (M.1937)
Davies, D. C. M. Supt. of Ferries, Dept. of Highways of Sask., Regina. For mail: 2250 Garnet St., Regina, Sask. (Jr. 1920. A.M.1922. M.1940)
Davies, E. J. Dftsmn., Marathon Paper Mills, Toronto, Ont. (S.1923. Jr.1927. A.M.1936. M.1940)
Davies, George V. Mech. & Erection Engr., Canadian Bridge Co. Ltd., Walkerville, Ont. (A.M.1918. M.1940)
Davies, P. T. Vice-Pres., Southern Canada Power Co. Ltd., 355 St. James St. W., Montreal. (M.1925)
Davies, R. L. 11647-95th St., Edmonton, Alta. (S.1941. Jr.1944)
Davies, S. J. Mgr., Valley Gas Co., and Cons. Engr. to City of Calgary on Natural Gas. For mail: 1128 Prospect Ave., Calgary, Alta. (A.M.1925. M.1940)
Davies, Vernon Russell Special Lecturer, University of Toronto. For mail: 60 Wellington St., Kingston, Ont. (Jr.1921. A.M.1923. M.1940)
Davies, W. Edward 3747 de l'Oratoire, Montreal. (S.1946)
Davis, Bruce L. Supt., Project Dept., Aluminum Co. of Canda Ltd., Arvida. For mail: 805 Second St., Arvida, Que. (S.1941. Jr.1944)
Davis, Clinton H. Plant Engr., Bell Telephone Co. of Canada, Montreal. For mail: 1425 Bernard Ave. W., Montreal 8. (Jr.1932)
Davis, D. F. Student Engr.,Northern Electric Co. Ltd., Dept. 65, 1620 Notre Dame St., Montreal. (S.1946)
Davis, Ernest Comptroller of Water Rights of B.C., Victoria. For mail: 1421 Stadacona Ave., Victoria, B.C. (M.1914)
Davis, Ernest G. Tech. Officer, Dom. Water & Power Bureau, Dept. of Mines & Resources, 744 W. Hastings St., Vancouver, B.C. (S.1945)
Davis, Edgar H. Cons. Engr., Davis Ripley & Associates, 218-7th Ave. W., Calgary, Alta. (S.1938. Jr.1939. M.1944)
Davis, F. Allan Process Engr., British American Oil Co. Ltd., Toronto. For mail: 9 Tennis Crescent, Toronto. (Jr.1941)
Davis, Frank L. Supervising Engr. of Aerodromes, Civil Aviation, Dept. of Transport, Ottawa. For mail: 34 Amherst St., Hull, Que. (A.M.1924. M.1940)
Davis, Geo. C. Vice-Pres., Winnipeg Heating Co. Ltd., 307 Power Bldg., Winnipeg, Man. (A.M.1936. M.1940)
Davis, G. R. Supt. of Substations & Engr., Ottawa Hydro Electric Commission. For mail: 243 Carling Ave., Ottawa. (S.1927. Jr.1930. A.M.1936. M.1940)
Davis, Gordon T. Switchgear Engr., Canadian General Electric Co., Peterborough. For mail: 566 Waterford St., Peterborough, Ont. (S.1943. Jr.1946)
Davis, Harold A. Plant Engr., divn. B, Ontario Steel Products Co. Ltd., Oshawa. For mail: 247 Simcoe St. N., Oshawa, Ont. (S.1939. M.1943)
Davis, Herbert R. Partner, Davis & Fisher, 302 Grain Bldg., Saskatoon, Sask. (M.1942)
Davis, Merritt M. Greenview, Ont. (S.1943)
Davis, Robt. A. i/c Indust. Engrg. Dept., Aluminum Goods Ltd., Toronto. For mail: 77 Canning Ave., Islington, Ont. (S.1940. Jr.1946)
Davis, Samuel, Consultant, 1 Charlotte St., Saint John, N.B. (S.1938. Jr.1943. M.1946)
Davis, Stuart G. Asst. Prof. of Chem., University of Alberta, Edmonton, Alta. (S.1942)
Davis, Sydney H. Mining Engr., Dentonia Mines Ltd., Greenwood, B.C. (S.1921. Jr.1924. A.M.1927. M.1940)
Davis, Wm. R. Elec. Engr., Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (Jr.1935. M.1942)
Davison, C. F. Works Manager, Sifto Salt Co. Ltd., Sarnia. For mail: 232 N. College St., Sarnia, Ont. (A.M.1932. M.1940)
Davison, H. D. Welland Electric Steel Foundry. For mail: 102 Parkway, Welland, Ont. (A.M.1920. M.1940)
Davison, John L. Chief Engr., Canadian Comstock Co. Ltd., 835 Dominion Square Bldg., Montreal. (M.1945)
Davison, W. E. Asst. Supt., Substation Divn., Shawinigan Water & Power Co., Montreal. For mail: 861 Victoria Ave., St. Lambert, Montreal 23. (M.1946)
Davy, A. C. M. Captain (E) R.C.N., H.M.C. Dockyard, Esquimalt, B.C. (A.M.1933. M.1940)
Davy, H. M. Engr., Test Boring Divn., Dept. of Public Works of Canada, Hunter Bldg., Ottawa. (S.1900. A.M.1906. M.1940)
Davy, R. F. 2024 Newton St., Victoria, B.C. (A.M.1907. M.1940)
Dawes, A. Sidney Pres., Atlas Construction Co. Ltd., 679 Belmont St., Montreal. (A.M.1914. M.1921)
Dawson, G. E. Design & Devlpt. Engr., Dowty Equipment Ltd., Montreal. For mail: 4961 Coronet Ave., Montreal. (S.1941. Jr.1946)
Dawson, Gerald P. Dawson College, St. John's, Que. ((S.1946)
Dawson, K. L. Supt., Gas Dept., Nova Scotia Light & Power Co. Ltd., Capitol Bldg., Halifax, N.S. (Jr.1919. A.M.1921. M.1929).
Dawson, S. G. Engr., Survey & Engrg. Branch, Water & Power Bureau, Dept. of Mines & Resources, Laurentian Bldg., Ottawa. (Jr.1913. A.M.1918. M.1940)
Dawson, W. A. Branch Mgr., F. F. Barber Machinery Co., Hamilton. For mail: 154 Dalewood Crescent, Hamilton, Ont. (S.1921. A.M.1925. M.1938)
Dawson, Wm. Frank Foreign Service with Shell Oil Co. For mail: Caribbean Petroleum Co., Apartodos 19, Maracaibo, Venezuela, S.A. (S.1943)
Dawson, W. J. S. Dept. of Public Works, Edmonton, Alta. (M.1941)
Day, C. M. 75 Brydges St., Moncton, N.B. (S.1940)
Day, H. Nelson Topeka Ave., East Saint John, N.B. (S.1946)
Day, J. Chas. Cons. Engr., 1502 St. Catherine St. W. Montreal. (S.1914. A.M.1920. M.1928)
Daye, J. Robt. Civil Engr., Dept. of Public Works of Canada, Saint John. For mail: Hampton Station, Kings Co., N.B. (S.1946)
Daynes, L. S. 2571 Dunlevy St., Oak Bay, Victoria, B.C. (A.M.1920. M.1940)
Dean, Clayton D. Vice-Pres. & Mgr., Imperial Pipe Line Co. Ltd., Toronto. For mail: 16 Dewbourne Ave., Forest Hill Village, Toronto 10. (A.M.1919. M.1940)
Dean, C. M. Shell Oil Co., Martinez, Calif. For mail: 1600 Altamira, Martinez, Calif., U.S.A. (M.1936)
Dean, L. Allyn Caledonia, Ont. (S.1946)
Dean, M. F. Cons. Engr., Maritime Engineering Consultants, 75 Upper Water St., Halifax, N.S. (S.1938. M.1946)
Deane, John Cdr. (L) R.C.N., Director of Elec. Personnel, Naval Service Headquarters, Ottawa. (M.1943)
Deans, Charles Warbrick Design Engr. & Estimator, Western Bridge & Steel Fabricators Ltd., Vancouver. For mail. 3049 W. 27th Ave., Vancouver, B.C. (S.1928. A.M.1937. M.1940)
DeBlois, H. C. Engr., Canadian Industries Ltd., Shawinigan Falls, Que. (M.1946)
DeBlois, Jules 161½ Second Ave., Quebec. (S.1943)
Debney, Philip L. Constrn. Engr., City of Edmonton. For mail: Clifton Place, Edmonton, Alta. (A.M.1936. M.1940)
deBondy, Joseph A. Metallurgist & Sales Mgr., Manitoba Steel Foundries Ltd., Winnipeg. For mail: Elgin Court, Winnipeg, Man. (M.1941)
Décarie, Alex Asst. Engr., Pressure Pipe Co. of Canada Ltd., Montreal. For mail: 5655 Terrebonne Ave., Montreal. (M.1945)
Décarie, Maurice 3533 Oxford Ave., Montreal. (S.1942)
Décarie, Yves Engr., Tech. Serv., City of Montreal. For mail: 3664 Northcliffe Ave., Montreal. (S.1937. Jr.1942)
Décary, Albert R. Supt. Engr. for Quebec, Dept. Public Works of Canada, Quebec. (A.M. 1900. M.1907)
DeCew, J. A. Chem. Engr., & Pres., Process Engineers Inc., 9 W. Prospect Ave., Mount Vernon, N.Y., U.S.A. (A.M. 1906. M.1919)
deChazal, Philippe Marc Chief Engr., Cia Brasileira De Cimento Portland, Perus, Caixa Postal 126B, Sao Paulo, Brazil, S.A. (M.1943)
Dechman, Walter F. Constrn. Engr., Bowater's Newfoundland Pulp & Paper Mills Ltd., Corner Brook, Nfld. (M.1944)
deGrandmont, Marcel Prod. Supvr., Merck & Co. Ltd., Valleyfield, Que. (S.1942)
de Guise, Paul, Cons. Engr., 4475 Beaconsfield Ave., Montreal 28. (M.1942)
De Guise, Yvon Asst. to Supt. of Generating Stations, Quebec Hyro-Electric Commission. 107 Craig St. W., Montreal. (S. 1936. M.1942)
deHart, J. B. Mining Engr., Dept. of Natural Resources, Canadian Pacific Railway, Calgary, Alta. (A.M.1925. M.1926)
deHart, Wm. G. Aero. Engr., Trans-Canada Air Lines, Winnipeg. For mail: 564 Simcoe St., Winnipeg, Man. (S.1942. Jr.1946)
DeHueck, Baron Boris Chief Engr., Canadian Cottons Ltd., Cornwall, Ont. (M.1944)
deJong, Sybren H. Assoc. Prof. of Civil Engr., University of British Columbia, Vancouver, B.C. (Jr.1936. A.M.1937. M.1940)
Delage, Jean B. Capt., R.C.E., Dept. Nat. Def., Sun Life Bldg., Montreal. (Jr.1945)
Delage, Jean E. Economic Technician, Tourist Developt. Bureau, City of Montreal. For mail: 6 St. Jean, Longueuil, Que (M.1946)
Delage, Marcel Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
de Lamirande, Paul Chief Engr., Lord & Co. Ltd., 4700 Iberville St., Montreal. (S.1936. M.1945)
de Launay, Leon H. W. Engr., Bell Telephone Co., 200 First Ave., Ottawa (S.1946)
Delaute, Frederic J. P.O. Box 1031, Sarasota, Florida, U.S.A. (A.M.1903. M.1940)
deLéry, Alex. C.\ 5 De Brébeuf, Quebec (S.1946)
DeLeuw, Chas. E. Pres , DeLeuw, Cather & Co., Cons. Engrs., 20 N. Wacker Drive Chicago 6, Ill., U.S.A. (M.1944)
Delgado, P. G. Supt. Public Works, City Hall, Westmount, Que. (A.M.1930 M.1940)
Delisle, E. A. City Engr., City Hall, Shawinigan Falls, Que. (M.1944)
Delisle, J. L. Lavoie & Delisle, Cons. Engrs., Racine St., Chicoutimi, Que. (A.M.1924. M 1940)
Delisle, Lucien Divnl. Engr., Dept. Roads of Quebec, Waterloo, Que. (S.1936. Jr.1941 M.1945)
Delisle, Maurice 20 Elmwood Ave., Outremont, Que. (S.1943)
Dell, C. A. Oris Asst. Engr., Elec. Dept , H. G. Acres & Co., Niagara Falls. For mail: 2237 Pine Grove Ave., Niagara Falls, Ont. (M.1942)
Delvin, Ray B. Elec. Engr., Fraser-Brace Ltd., Montreal. For mail: 2276 Grand Blvd., Montreal 28 (M.1945)
DeMaio, A. Constrn. Dept., Hydro Electric Power Commission of Ont., Glasgow Station, Ont. (S.1937. Jr.1946)
Dembicki, Steve Standards Engr., Dominion Electrohome Industries Ltd., 39 Edward St., Kitchener, Ont. (Jr.1941)
Dembie, Thos. Designing Engr., Dominion Bridge Co. Ltd., Toronto. For mail: 60 Thompson Ave., Toronto 9. (S.1934. M.1942)
Demcoe, John W. Engr., Mtce. of Way, Canadian National Railways, Union Station, Toronto 1. (S.1938. Jr.1940)
Demers, Charles-Eugène Engr. & Mgr. of Constrn., Komo Construction Ltd , Quebec. For mail: 60 Gomin Road, Quebec. (S.1941. Jr.1943)
Demers, Geo. Cons. Engr., 126 St. Peter St., Quebec. (Jr.1936. M.1946)
Demers, J. Robert 2103 Sherbrooke St. East, Montreal 24. (S.1945)
Dempsey, F. C. (A.M.1938. M.1940)
Dempsey, W. T. 571 Greenwood Ave., Toronto. (A.M.1934. M.1940)
Dempster, G. H. L. Res. Engr., Dept. of Mines & Resources, Prince Albert National Park, Prince Albert, Sask. (A.M.1938. M.1940)
Dempster, W. E. 3592 University St., Montreal 2. (S.1944)
Deneau, Gaston Sr. Engr., Aluminum Co. of Canada, P.O Box 376, Arvida, Que. (S.1919. A.M.1927. M.1940)
Denford, W. R. Jr. Mech. Engr., Hornet Industries Ltd., 151 Surrey St., Guelph, Ont. (S.1946)
Denhez, C. H. Ecole Polytechnique, 1430 St Denis St., Montreal, Que. (S.1944)
Deniger, Jean F. Patent Attorney, Marion & Marion, Montreal. For mail: 2500 Sheppard St., Montreal. (S.1942)
Denis, André 1561 St. Hubert St., Montreal 24 (S.1944)
Denis, Léo G. Dist. Hydraulic Engr., Dom. Water & Power Bureau, Dept. of Mines & Resources of Canada, Montreal. For mail: 4231 Wilson Ave., Montreal 28. (M.1919)
Denis, V. Engr., Dept. of Public Works of Canada, Hunter Bldg., Ottawa, Ont. (S.1899. A.M.1909. M.1940)
Denley, W. E. Dist. Engr., Dept. of Highways, Regina. For mail: 2300 McIntyre St., Regina, Sask. (A.M.1921. M.1940)
Dennis, W. M. Geodetic Survey of Canada, Ottawa. (A.M.1920. M.1923)
Dennison, James A. Instrmn., Dept. of Public Works of B.C., Hope, B.C. (S.1943)
Denovan, John J. Design Engr., Dominion Engineering Co. Ltd., P.O. Box 220, Montreal. (S.1938. Jr.1946)
Denton, A. L. Engr., Fredericton Dist., N.B. Electric Power Commission, Fredericton, N.B. (S.1932. Jr.1937. M.1942)
Denton, H. E. Cons. Engr. & Exec. Mgr., Denton-Spencer Co. Ltd. & General Petroleum Ltd., 509—8th Ave. W., Calgary, Alta. (M.1945)
Denyes, Blake B. Plant Mech. Engr., Monarch Battery Mfg. Co. Ltd., Kingston, Ont. (S.1943. Jr.1946)
De Pauw, George A. St. Alphonse, Man. (S.1946)
Deptford, J. A. 1462 East 10th Ave., Vancouver, B.C. (S.1945. Jr.1946)
Dernier, Herbert (Jr.1938)
Derome, Louis-P. Field Engr., Foundation Co. of Canada Ltd., Box 279, Valleyfield, Que. (S.1943)
Derome, Paul L. 4514 Marcil Ave., Montreal 28. (S.1944)

Déry, J. L. 4162 Van Horne Ave., Montreal 26. (Jr.1936. M.1946)
de Savigny, H. J. Dist. Engr., P.F.R.A., Dominion Dept. of Agriculture, Estevan, Sask. For mail: 17 Bartleman Apts., Regina, Sask. (A.M.1920. M.1940)
Desbaillets, C. J. Chief Engr., Montreal Water Board, City Hall, Montreal. (A.M.1917. M.1920)
Desbarats, George H. Cdr. (E), Director of Engrg. Personnel, Royal Canadian Navy, N.S.H.Q., Ottawa. For mail: 330 Wilbrod St., Ottawa. (S.1919. Jr.1926. A.M.1933. M.1940)
Deschamps, Albert Contracting Engr., 680 Sherbrooke St. W., Montreal. (M.1945)
Deschenes, Adrien M. Highway Engr., Quebec Roads Dept., Rivière-du-Loup. For mail: 27½ Iberville St., Rivière-du-Loup, Que. M.1945)
Deschenes, Fernand M. Private Practise, Engrg. Draughting Service. For mail: 3511 Shuter St., Montreal 18. (M.1946)
Descoteaux, Paul Pres., Dollard Construction Co. Ltd., Cap de la Medeleine. For mail: 490 Notre-Dame St., Cap de la Madeleine, Que. (S.1934. Jr.1940. M.1945)
Desjardins, J. Claude 8346 Henri Julien Ave., Montreal 10. (S.1944)
Desjardins, Olivier Chief Engr., Dept. of Public Works of Quebec, Parliament Bldgs., Quebec. (S.1919. A.M.1922. M.1940)
Desjardins, Roger Engr., Provincial Transportation & Communication Board, Court House, Quebec. (S.1937. Jr.1940. M.1945)
Deslauriers, Alfred Joseph City Engr. & Water Works Supt., City Hall, 15—18th Ave., Lachine, Que. (M.1944)
Deslauriers, Charles-Ed. Asst. Chief Engr., Dept. of Hydraulic Resources of Quebec, Parliament Bldgs., Quebec. (S.1940. Jr.1942)
Deslauriers, U. Edouard Arthur Surveyer & Co., Cons. Engrs., Montreal. For mail: 373 St. Joseph Blvd. E., Montreal. (S.1943. Jr.1946)
Deslauriers, Jos. H. Field Engr., Dominion Bridge Co., Lachine. For mail: 291—34th Ave., Lachine, Que. (M.1946)
Deslauriers, L. W. Asst. Engr., Canadian Pacific Railway, Windsor Station, Montreal. (Jr.1914. A.M.1922. M.1940)
Desloover, J. R. Engr. i/c Inventory & Valuation Dept., Provincial Electricity Board, 132 St. James St. W., Montreal. (A.M.1938. M.1940)
Desmarais, J. R. Asst. to Suptg. Engr., Electrical Commission of City of Montreal. For mail: 665 Wiseman Ave., Montreal 8. (S.1936. Jr.1938)
DesOrmeaux, Dollard Engrg. Divn., City of Montreal. For mail: 1405 Bélanger St., Montreal 35. (S.1936. Jr.1940)
des Rivières, Edouard M. 41 St. Ursule St., Quebec. (S.1939. Jr. 1946)
Desrochers, André B. 6666 St. Vallier St., Montreal 10. (S.1944)
Desrochers, Fernand 2196 Papineau Ave., Montreal 24. (S.1944)
Desrochers, Fernand 2078 Baldwin Ave., Montreal 5. (S.1945)
Desrochers, Léon Cons. Engr. & Land Surveyor, 116 Park Ave., Granby, Que. (M.1945)
Desrochers, Marcel 2064 St. Germain St., Montreal. (S.1945)
Desroches, Raymond 4623 City Hall Ave., Montreal 14. (S.1945)
Desrosiers, Louis 5627 Canterbury Ave., Montreal 26. (S.1944)
Desrosiers, Paul-Réal Design Office, Canadair Ltd., Cartierville. For mail: 5722 Hadley Ave., Montreal 20. (M.1945)
Dessaulles, Jean C. H. Industrial Power Sales Engr., Shawinigan Water & Power Co., Three Rivers, Que. (S.1939. M.1946)
Desserud, Anton Engr., Power Corp. of Canada, 355 St. James St., Montreal. (A.M.1932. M.1940)
De Stefano, Frank J. Field Engr., International Nickel Co. Ltd. For mail: 245 Wembley Drive, Sudbury, Ont. (Jr.1936)
de Stein, Joseph N. Cons. Civil Engr., 1704 Scarth St., Regina, Sask. (M.1938)
de Stein, J. L. Aluminum Co. of Canada, Montreal. For mail: 5771 Côte St. Luc Rd., Hampstead, Montreal 29. (Jr.1940)
Désy, Gaston 1327 St. Zotique St. E., Montreal 35. (S.1945)
Dethridge, S. G. Chief Engr., Light & Power Dept. City of Regina. For mail: 2507 Winnipeg St., Regina, Sask. (A.M.1938. M.1940)
deTonnancour, Charles G. Plant Engr., Canadian Resins & Chemicals Ltd., Shawinigan Falls. For mail: 9E St. Edouard St., Shawinigan Falls, Que. (S.1940. Jr.1942)
Devereaux, Wm. A. Branch Mgr., Bailey Meter Co. Ltd., 315 Bank of Nova Scotia Bldg., Halifax, N.S. (M.1946)
de Villers, Raoul-Albert Asst. Engr., Office of Dist. Engr., Canadian National Railways, Marché Champlain, Quebec. S.1940. Jr.1944. M.1945)
Dewar, C. Leonard Gen. Mgr., Eastern Area, Bell Telephone Co. of Canada, Montreal. For mail: 104 Dufferin Road, Hampstead, Montreal 29. (A.M.1937. M.1940)
Dewar, Geoffrey P. Engr. Imperial Oil Co. Ltd., Montreal. For mail: 9692 St. Victor St., Montreal 5. (Jr.1944)
Dewar, Peter Stewart Mech. Engr., Foundry, Ford Motor Co. of Canada Ltd., Windsor. For mail: 1909 Loraine St., Windsor, Ont. (Jr.1944)
Dewhirst, K. J. Designing Engr., B. F. Sturtevant Co. of Canada Ltd., 553 New Birks Bldg., Montreal. (M.1945)
Dewhurst, Jas. B. Lieut., Workshop Officer, R.C.E.M.E., Camp Borden, Ont. For mail: Rossmore Blvd., Port Nelson, Ont. (S.1944. Jr.1946)
Dewis, Clifford Sayre Chief Engr., Canmore Mines Co. Ltd., Box 337, Canmore, Alta. (A.M.1917. M.1940)
Dewis, Marshall W. Box 337, Canmore, Alta. (S.1940. Jr.1946)
deWitt, George H. Asst. to Supt., Elec. Repair Shop, Shawinigan Water & Power Co., Three Rivers, Que. (Jr.1946)
deWolf, Edward G. Chem. Engr. Standard Chemical Co., 9 Seldon St., Halifax, N.S. (Jr.1945)
DeWolfe, Wm Joseph 106 Henry St. Halifax, N.S. (A.M.1906. M.1940)
Dexter, Donald M. Brunswick House, Mount Allison University, Sackville, N.B. (S.1944)
Dexter, Val. F. Mount Allison University, Sackville, N.B. (S.1944)
Diamond, Geo. B. 48 Joyce Ave., Outremont, Que. (S.1941. Jr.1946)
Diamond, R. W. Vice-Pres. & Gen. Mgr., & Director, Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C. (M.1945)
Dibblee, F. A. Y.M.C.A., 1441 Drummond St., Montreal 25. (S.1937. Jr.1946)
Dibblee, H. M. 2170 Lincoln Ave., Montreal 25. (S.1895. A.M.1906. M.1940)
Dibblee, John Chief Engr. on Operations, Hydro-Electric Power Commission of Ont., 620 University Ave., Toronto 2. (M.1939)
Dick, A. 4560 Michel Bibaud St., Montreal. (S.1905. A.M.1909. M.1940)
Dick, Geo. M. Mgr. of Engrg. Canadian Ingersoll-Rand Co. Ltd., Sherbrooke. For mail: 24 Walton Ave., Sherbrooke, Que. (S.1922. A.M.1928. M.1940)
Dick, James Director, Civil Engrg. & Mtce., National Defence Naval Service, Ottawa. For mail: 142 Aylmer Ave., Ottawa. (S.1906, A.M.1909, M.1940)
Dick, Sidney A. Steam & Heat Engr., Spruce Falls Power & Paper Co. Ltd. For mail: Kapuskasing Inn, Kapuskasing, Ont. (Jr.1944)
Dick, Victor Wm. Engr., Winnipeg Electric Co. For mail: 83 Kingsway Ave., Winnipeg, Man. (S.1920. Jr.1922. A.M.1930. M.1940)
Dick, William 168 University Ave., Kingston, Ont. (S.1945)
Dick, W. A. 4560 Michel Bibaud St., Montreal 6. (S.1937. Jr.1943)
Dick, W. J. Pres. & Gen. Mgr., Cadomin Coal Co. Ltd., and Regional Oil Controller, Edmonton. For mail. 11326—99th Ave., Edmonton, Alta. (A.M.1911. M.1918)
Dickens, Harry B. Cons. Engr., Ottawa. For mail: 269 Slater St., Ottawa. (A.M. 1925. M.1938)
Dickenson, John G. Mining Engr., Toronto. For mail: 28 Yackes Ave., Toronto 5. (S.1905. A.M.1912. M.1919)
Dickie, Edwin J. Admin., Prod. & Mtce., Canadian Lumber Co. Ltd., Stewiacke, N.S. (S.1945)
Dickie, Frank E. Tech. Asst. to Gen. Mgr., Aluminum Co. of Canada Ltd., 1700 Sun Life Bldg., Montreal. (M.1939)
Dickie, Harold G. Kinghorn & Dickie, Sackville, N.B. For mail: 7 Regent St., Amherst, N.S. (S.1940)
Dickieson, A. L. Elec. Engr., Canadian General Electric Co., Peterborough. For mail: 385 Reid St., Peterborough, Ont. (A.M.1920. M.1940)
Dickinson, Ernest Newfoundland Light & Power Co., St. John's, Nfld. (A.M.1938. M.1940)
Dickinson, J. A. Chief Engr., Brompton Pulp & Paper Co. Ltd., P.O. Box 251, East Angus, Que. (Jr.1918. A.M.1920. M.1940)
Dickinson, J. G. Materials Handling, Northern Electric Co., Montreal. For mail: 2123 Tupper St., Montreal 25. (S.1944)
Dickson, Archibald Squad Leader, Drawing Office, Dominion Bridge Co. Ltd., Vancouver. For mail: 1465 West 15th Ave., Vancouver, B.C. (A.M.1934. M.1940)
Dickson, George Leslie 15 School St., Moncton, N.B. (A.M.1923. M.1940)
Dickson, Thomas H. Elec. Engr., Canadian National Railways, Moncton. For mail: 238 Cameron St., Moncton, N.B. (Jr.1920. A.M.1929. M.1940)
Dickson, Wallace Locating Engr., City of Montreal Engrg. Dept. For mail: 4817 Western Ave., Westmount 6. (A.M.1915. M.1920)
Dickson, William L. County Engr., County of Lanark, Ont. For mail: 15 Thom St., Perth, Ont. (S.1914. A.M.1924. M.1940)
Dickson, William L. Asst. Chief Engr., Deloro Smelting & Refining Co. For mail: P.O. Box 241, Deloro, Ont. (S.1930. Jr.1936. M.1942)
Diggle, W. M. S/L, Airworthiness & Maintenance Command H.Q., R.C.A.F., Uplands, Ont. (S.1940. Jr.1941. M.1945)
Dill, Edwin W. Steam & Power Plant Supt., Polymer Corp. Ltd., Sarnia, Ont. (S.1929. A.M.1938. M.1940)
Dillon, Eldridge A. Transformer Engr., English Electric Co. of Canada, St. Catharines. For mail: 11 York St. St. Catharines, Ont. (Jr.1942)
Dillon, M. Murray Sr. Partner, M. M. Dillon & Co., Cons. Engrs., 365 Richmond St., London, Ont. (A.M.1938. M.1940)
Dimock, A. C. Instrmn., Dept. of Public Works of B.C., Box 233, Princeton, B.C. (S.1944)
Dimock, R. L. New Richmond West, Bonaventure Co., Que. (S.1943)
Dineen, Jas. O. Asst., Dept. of Elec. Engrg., University of New Brunswick. For mail: 255 Brunswick St., Fredericton, N.B. (S.1940)
Dingwall, Robt. M. Mgr. & Dir., Standard Iron Works Ltd., 121st St. & 106th Ave., Edmonton, Alta. (A.M.1923. M.1937)
Dinsmore, C. S. Mgr. & Sec. Treas., Grenville Castings Ltd., Merrickville, Ont. (S.1940. Jr,1945)
Dion, J. Edgar Sr. Supervising Engr., Stevenson & Kellogg Ltd., Sun Life Bldg., Montreal. (S.1922. Jr.1927. A.M.1932. M.1940)
Dion, Louis A. Trainee for Prod. Management, Standard Brands Ltd., Ville LaSalle. For mail: 45 Logan St., St. Lambert 23, Que. (S.1942)
Dionne, J. P. 7781 Drolet St., Montreal 10. (S.1945)
Disney, Chas. P. Engr. of Bridges, Canadian National Railways, Union Station, Toronto. (A.M.1921. M.1922)
Dixon, Frederick Box 1149, Georgia Tech., Atlanta, Ga., U.S.A. (S.1941)
Dixon, Frank F. Apptce., Canadian Westinghouse Co., Hamilton. For mail: 30 Arthur Ave. N., Hamilton, Ont. (S.1944)
Dixon, G. Bruce Inspr. of Dykes & Commissioner, Court House, New Westminster, B.C. (Jr.1914. A.M.1923. M.1940)
Dixon, H. A. Fort Garry Hotel, Winnipeg, Man. (A.M.1908. M.1940)
Dixon, Howard H. Aerodynamacist, Douglas Aircraft Co., Santa Monica. For mail: 441—7th St., Santa Monica, Calif., U.S.A. (S.1939. Jr.1946)
Dixon, Keith Marine Agent, Dept of Transport, P.O. Box 999, Prince Rupert, B.C. (A.M.1935. M.1940)
Dixon, L. S. Bangor, Maine, U.S.A. (A.M.1921. M.1923)
Dixon, Noel Asst. Engr., Canadian National Railways, Montreal. For mail: 4435 Broadway, Lachine, Que. (M.1941)
Dixon, Wm. Asst. to Elec. Engr., National Harbours Board, Montreal. For mail: 2050 Claremont Ave., Montreal 6. (M.1942)
Dixson, Geo. W. Distribution Engr., Manitoba Power Commission, Winnipeg. For mail: 315 Berry St., St. James, Man. (S.1940. Jr.1946)
Doane, F. W. W. Cons. Engr., 25 Young Ave., Halifax, N.S. (S.1887. A.M.1889. M.1892)
Doane, Harvey W. L. Mgr., Public Service Commission of Halifax. For mail: 601 Barrington St., Halifax, N.S. (A.M.1919. M.1923)
Dobbin, Davin Crawford Intermediate Engr., Stevenson & Kellogg Ltd., Montreal. For mail: 13 Ste. Anne St., Ste. Anne de Bellevue, Que. (S.1931. Jr.1938)
Dobbin, Ross L. Gen. Mgr., Utilities Commission, Peterborough. For mail: 295 Reid St., Peterborough, Ont. (S.1910. A.M.1914. M.1919)
Dobbin, W. L. Vice-Pres. & Gen. Mgr., Grant Contracting Co. Ltd., Toronto. For mail: 145 Strathallan Blvd., Toronto. (S.1915. A.M.1921. M.1940)
Dobridge, R. W. Gen. Radio Engr., Comm. Dept., Canadian Pacific Railway, Montreal. For mail: 975 MacNaughton Road, Town of Mount Royal, Montreal 16. (S.1928. A.M.1935. M.1940)
Dobson, R. N. Engr., Massey Harris Co. Ltd., Toronto. For mail: 450 Portland Ave., Town of Mount Royal, Que. (S.1933. M.1942)
Dobson, William Percy Director of Research, Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (M.1920)
Dodd, G. J. Assoc. Prof. of Civil Engrg., McGill University. For mail: 2082 Sherbrooke St. W., Montreal. (S.1910. Jr.1913. A.M.1920. M.1940)
Dodd, G. J., Jr. Asst. to Chief Engr., Russell-Miller Milling Co., 900 Midland Bank Bldg., Minneapolis, Minn., U.S.A. (S.1939. Jr.1944)
Doddridge, P. W. Asst. Engr., Switchgear Sec., Apparatus Sales Dept., Canadian General Electric Co. Ltd., 212 King St. W., Toronto. (S.1928. Jr.1936. M.1942)
Dodds, Donald J. 58 Belvedere Road, Montreal 6. (S.1946)
Dodson, W. L. 941 Victoria Road, Sydney, N.S. (S.1944).
Doehler, R. J. Asst. Engr., Montreal Welding Co., 115 Young St., Montreal. (S.1939. Jr.1946)
Dohan, John T. 327 Redfern Ave., Westmount, Montreal 6. (S.1944)
Doherty, C. A. (S.1914. A.M.1922. M.1940)
Doherty, Robt. E. Pres., Carnegie Institute of Technology, Schenley Park, Pittsburgh 13, Pa., U.S.A. (Hon.M.1944)
Doherty, Thos. B. Engr., Process & Devlpt. Dept., Imperial Oil Ltd., Sarnia. For mail: 150 Cecil St., Sarnia, Ont. (M.1946)

Doherty, T. H. Engr., Coca-Cola Export Corp., 515 Madison Ave., New York 22, N.Y., U.S.A. (S.1928. A.M.1936. M.1940)
Dokken, E. K. Laurentide Inn, Grand'Mère, Que. (S.1943. Jr.1946)
Dokken, Lorne Albert Plant Engr. (Mtce.), Imperial Oil Ltd., Regina Refinery. For mail: 3229-15th Ave., Regina, Sask. (Jr.1946)
Dolan, M. A. (S.1937)
Dolmage, Victor Cons. Geologist, 355 Burrard St., Vancouver, B.C. (M.1936)
Donahue, John Joseph Asst. Distribution Engr., New Brunswick Power Commission. For mail: 126 Prince William St., Saint John, N.B. (S.1943)
Donald, A. S. Chief Highway Engr., Dept. of Public Works of N.B., Fredericton. For mail: 86 Alexandra St., Fredericton, N.B. (M.1942)
Donald, James Richardson Chem. Engr., J. T. Donald & Co. Ltd. & Donald Inspection Ltd., 1181 Guy St., Montreal. (A.M.1921. M.1927)
Donald, Robt. J. Chief Chemist, Montreal Refinery, Imperial Oil Ltd., 10510 Notre Dame St. E., Montreal. (M.1945)
Donaldson, A. G. Mine Engr., Lethbridge Collieries Ltd., Lethbridge. For mail: Shaughnessy, Alta. (A.M.1940. M.1940)
Donaldson, C. S. 924-7th Ave. S., Lethbridge, Alta. (A.M.1925. M.1940)
Donaldson, David R. Aircraft Stress Analyst, Boeing Aircraft Co., Seattle. For mail: 7471 S. 116th Place, Seattle, 88, Wash., U.S.A. (Jr. 1940)
Donaldson, W. A. Airway Engr., Dept. of Transport, Edmonton. For mail: 11133-71st St., Edmonton, Alta. (M.1946)
Donato, Paul 9333 Bellerive St., Montreal. (S.1944)
Doncaster, P. E. Dept. Public Works of Canada, 10th Floor, Union Trust Bldg., Winnipeg, Man. (A.M.1911. M.1918)
Donnelly, John Elec. Supt. Algoma Steel Corp., Sault Ste. Marie, Ont. (M.1944)
Donnelly, J. P. Exec. Engr. Noorduyn Aviation Ltd., P.O. Box 6083, 715 Windsor St., Montreal 3. (M.1944)
Donnelly, W. D. Mech. Dftsmn, Ford Motor Co. of Canada, Windsor. For mail: Sharon Apts, 558 Partington Ave., Windsor, Ont. (S.1924. Jr.1936. A.M.1938. M.1940)
Donohoe, G. M. Dept. Mines & Resources, Ottawa. For mail: 422 Gladstone Ave., Ottawa. (S.1931. Jr.1938)
Donohue, E. W. Engr., Defence Industries Ltd., Montreal. For mail: 1607 Selkirk Ave., Montreal 25. (M.1945)
Doob, Otto Chief Engr., H. J. O'Connell Ltd., P.O. Box 483, Montreal. (M.1945)
Doody, Cyril W. Traffic Supt., Saskatchewan Government Telephones, Regina. For mail: 2200 Angus St., Regina, Sask. (A.M.1938. M.1940)
Doody, W. Kevin Power Plant Layouts, Shawinigan Engineering Co. Ltd., 107 Craig St. W., Montreal. (S.1945)
Dooley, W. K. Jr. Engr., Southern Canada Power Co., 355 St. James St. W., Montreal. (S.1946)
Dorais, Gabriel Gohier & Dorais, Cons. Engrs., Montreal. For mail: 5685 Gatineau Ave., Montreal 26. (Jr.1937)
Doan, H. T. Office Mgr., Dominion Flow Meter Co. Ltd. & Whiting Corp. (Canada) Ltd., Montreal. For mail: 24 Springfield Ave., Westmount, Montreal 6. (A.M.1925. M.1940)
Dore, Richard Francis Engr. & Ont. Land Surveyer, Federal District Commission, Ottawa. For mail: 119 Belmont Ave., Ottawa. (S.1932. A.M.1937. M.1940)
Dorey, George B. Mainguys Ltd., 1245 University St., Montreal 2. (A.M.1921. M.1940)
Dorey, John David 540 Cote St. Antoine Road, Westmount, Que. (S.1945)
Dorion, Robt. City Mgr., City Hall, Shawinigan Falls, Que. (S.1920. A.M.1926. M.1940)
Dormer, Wm. John Smylie Plant Constrn. & Mtce. Supvr., Bell Telephone Co., Montreal. For mail: 4209 Hampton Ave., Montreal 28. (S.1920. Jr.1927. A.M.1933. M.1935)
Dorrance, F. Y. Divn. Engr., Dept. Public Works of Montreal. For mail: 341 Brock Ave. North, Montreal West, Que. (A.M.1915. M.1940)
Doty, John W. Pres., The Foundation Co., 120 Liberty St., New York, N.Y. (A.M.1913. M.1913)
Doucet, Jean Engr., Doucet & Doucet Ltd., 1019 Laurier Ave., Montreal. (S.1935. Jr.1940)
Dougall, A. T. Engr., Standard Chemical Co. Ltd., Toronto. For mail: 115 Springmount Ave., Toronto. (S.1940. Jr.1946)
Douglas, A. Howard Inspecting Engr., Dept. of Highways & Transportation of Sask., Regina. For mail: 296 Angus Cres., Regina, Sask. (S.1931. Jr.1937. M.1940)
Douglas, C. M. 4159 West 11th Ave., Vancouver, B.C. (S.1946)
Douglas, D. Hugh C. Jr. Aero. Engr., Fairchild Aircraft Ltd., Longueuil. For mail: 507 Victoria Ave., Montreal 6. (S.1946)
Douglas, George Vibert Prof. of Geology, Dalhousie University, Halifax. For mail: 20 Kent St., Halifax, N.S. (Jr.1920. A.M.1921 M.1940)
Douglas, J. B. Douglas Engineering Co., 5840 McLynn Ave., Montreal 29. (M.1945)
Douglas, Jack H. Mech. Engr., Shawinigan Chemicals Co. Ltd. For mail: 87-A 1st St., Shawinigan Falls, Que. (S.1946)
Douglas, L. Robt. Commercial Engr., Canadian General Electric Co., Toronto. For mail: 22 DeSavery Cresc., Toronto. (S.1938. Jr.1945)
Douglas, R. B. Works Mgr., Propeller Divn., Canadian Car & Foundry Co. Ltd., 621 Craig St. W., Montreal. (M.1944)
Douglas, Ralph L. (Jr.1940)
Doull, G. Roy Bridge Engr., Canadian National Railways, Moncton, N.B. (M.1944)
Doull, R. M. Gen. Mgr. & Director, Canada Gunite Co. Ltd & Preload Co. of Canada Ltd., Montreal. For mail: 497 Grosvenor Ave., Westmount, Que. (S.1927. Jr.1934. A.M.1934. M.1940)
Douville, Gérard, 1603 St. Hubert St., Montreal. (S.1944)
Douville, Paul E. Chem. Engr., Acton Rubber Ltd. For mail: P.O. Box 92, Acton Vale, Que. (S.1938. Jr.1946)
Dove, Allan Burgess Works Supt., Dominion Works, Steel Co. of Canada Ltd., Lachine, Que. (S.1932. Jr.1934. A.M.1936. M.1940)
Dow, G. E. 2019 Marlowe Ave., Montreal. (S.1946)
Dow, G. Y. Service Mgr., Refrigeration Service Co., Saint John. For mail: 162 Orange St., Saint John, N.B. (S.1934. M.1941)
Dow, Wm. A. 235 Oak St., Winnipeg, Man. (S.1943)
Dow, Walter K. Elec. Engr., Canadian Comstock Co., Montreal. For mail: 350 Willowdale Ave., Outremont. (Jr.1938)
Dowd, Frank V, Supt. Engr., Water & Sewerage Divn., Dept. of Public Works of Montreal. For mail: 5348 Duquette Ave., Montreal. (Jr.1915. A.M.1920. M.1940)
Dowell, E. H. 88 Blackthorn Ave., Toronto. (Jr.1943)
Dowler, John B. Chief, Machine Engrg. Dept., Ford Motor Co. of Canada, Windsor. For mail: 754 Chilver Road, Windsor, Ont. (A.M.1939. M.1940)
Dowling, Harry L. Strl. Engr., Canadian & General Finance Co. Ltd., 25 King St. W., Toronto. (S.1919. A.M.1922. M.1940)
Downes, Michael Augustine Engrg. Dept., City of Montreal. For mail: 3985 Laval Ave., Montreal. (S.1911. Jr.1917. A.M.1930. M.1940)
Downie, Guy W. Dftsmn., Consolidated Mining & Smelting Co., Trail. For mail: 1290 Green Ave., Trail, B.C. (S.1946).
Downie, Wm. W. Bldgs. Engr., Board of School Commissioners, 1 Brunswick St., Halifax, N.S. (M.1940).
Downing, C. G. E. Head, Agric. Engrg. Dept., Ontario Agricultural College, Guelph, Ont. (M.1946)
Downman, Bernard H. C. Engr., Foxboro Co. Ltd., 266 St. Patrick St., Montreal. (S.1941. Jr.1946)
Doye, Marius Marine Industries Ltd., 1405 Peel St., Montreal. (A.M.1925. M.1940)
Drabinsky, Ralph 639 Ave. I So., Saskatoon, Sask. (S.1946)
Drake, Edward A. 3506 University St., Montreal. (S.1946)
Draper, Chas. F. 4055 Highland Ave., Montreal, (M.1943)
Drohan, John Francis International Harvester Co. of Canada, Chatham. For mail: 208 Wellington St. W., Chatham, Ont. (S.1946)
Drolet, Jean-Paul Field Engr., Dept. of Mines of Quebec. For mail: 13 Canardière Road, Quebec. (Jr.1945)
Drouin, Jacques Service Engr., Mathews Conveyer Co. Ltd., 1440 St. Catherine St. W., Montreal. (S.1940. Jr.1944. M.1945)
Drouin, Paul-Emile 826 Gouin Blvd. E., Montreal 12. (S.1944)
Drury, Chipman H. 1523 Summerhill Ave., Montreal. (S.1937. Jr.1946)
Drynan, D. Alan Asst. Switchgear Engr., Canadian General Electric Co., Peterborough. For mail: 10 Anne St., Peterborough, Ont. (S.1936. Jr.1944)
Drysdale, Wm. F. Cons. Mech. Engr., 5767 Northmount Ave., Montreal 26. (S.1904. A.M.1911. M.1919)
Dubesky, W. J. Supt. of Refinery, North Star Oil Ltd., Winnipeg. For mail: 162 Yale Ave., Transcona, Man. (Jr. 1937. M.1940)
Du Bois, N. W. Supt., Northland Utilities Ltd., 10042-109th St., Edmonton, Alta. (A.M.1938. M.1940)
DuBose, McNeely Vice-Pres., Aluminum Co. of Canada Ltd., Saguenay Power Co. Ltd., Arvida, Que. (M.1938)
Dubreuil, L. Adrien Civil Engr., Provincial Electricity Board, Montreal. For mail. 1212 St Matthew St., Montreal 25. (S.1913. A.M.1921. M.1940)
Dubuc, Jacques 426 Sherbrooke St. W., Montreal 2. (S.1944)
Dubuc, Julien 3156 Maplewood Ave., Montreal 26. (S.1944)
Dubuc, Roch 260 Galt Ave., Verdun, Que. (S.1945)
Ducharme, Gaëtan 484 Bloomfield Ave., Outremont, Que. (S.1944)
Duchastel, Léon Alexandre Employ. Supvr., Shawinigan Water & Power Co., Montreal. For mail: 40 Kelvin Ave., Outremont, Que. (S.1925. Jr.1933. A.M.1939. M.1940)
Duchastel, Pierre A. Elec. Engr., Quebec Power Co., Quebec. For mail: 23 Pine Ave, Sillery, Que. (S.1937. Jr.1943)
Duchesneau, Jean 10806 St. Denis St., Montreal. (S.1944)
Duckett, W. Anderson Engr., Bell Telephone Co. of Canada, Montreal. For mail: 468 Dollard Ave., Montreal South, Que. (S.1935. Jr 1942)
Duclos, Murray B. Box 93, Woodstock, N.B. (S.1946)
Dudych, Daniel Designer, Foundation Co. of Ont., 1220 Bay St., Toronto. (S.1942)
Duey, George A. Instr., University of Saskatchewan, Saskatoon. For mail: Val Marie, Sask. (S.1945)
Duff, D. C. V. Sr. Asst Engr., Dept. of National Defence, Halifax. For mail: 37 Bellevue St., Halifax, N.S. (S.1933. Jr.1937. M.1942)
Duff, P. B. Res. Engr., Dept of Highways of N.S, Bridgewater, N.S. (M.1940)
Duff, W. A. 1455 Drummond St., Montreal. (S.1900. A.M.1905. M.1919)
Duffy, D. A. Engr., City Hall, Saint John, N.B. (A.M.1920 M.1940)
Duffy, Frank H. System Protection Engr., Aluminum Co. of Canada, Shipshaw. For mail: 840—5th St., Arvida, Que. (S.1939. Jr.1944)
Dufort, C. L. 1571 St. Joseph Blvd. E., Montreal 34 (M.1941)
Dufour, Gaston Employ. Mgr., Aluminum Co. of Canada, Arvida. For mail: 8A Brittany Row, Arvida, Que. (S.1936. Jr.1941)
Dufresne, Alphonse-Olivier Deputy Minister, Dept. of Mines of Quebec. For mail: 181 Bougainville Ave., Quebec. (M.1935)
Dufresne, Lionel 7282 Christophe Colomb St., Montreal 10. (S.1944)
Dufresne, Paul Edmond City Engr., City Hall, Three Rivers, Que. (M.1945)
Dugal, Fernand Asst. Supt., American Locomotive Co., Schenectady, N.Y., U.S.A. (Jr.1940. M.1945)
Dugas, Jean Mining Engr., 454 Outremont Ave., Montreal 8. (S.1942)
Dugas, J. E. Armand Power Sales Engr., Quebec Hyro-Electric Commission, Montreal. For mail: 3705 St. André St., Montreal. (A.M. 1937. M.1940)
Dugas, Louis J. 436 Cherrier St., Montreal 24. (S.1944)
Duguid, A. Fortescue Director, Historical Section, Dept. of National Defence, Ottawa. (S.1912. A.M.1923. M.1940)
Duhamel, Julien 914 Dorchester St. E., Montreal 24. (S.1944)
Dumaresq. J. Philip Dftsmn., Canadian Gypsum Co., Windsor, N.S. For mail: 96 Oxford St., Halifax, N.S. (S.1939. Jr.1946)
Dumas, Albert-V. Prof. & Head, Elec. Dept., Quebec Technical School, Quebec. For mail: 68 Brown Ave., Quebec. (A.M.1929. M.1940)
Dumka, J. 593 Notre Dame Ave., St. Lambert, Que. (S.1946)
Dumont, Eudore 3433 Laval Ave., Montreal 18. (S.1944)
Dumont, Gilbert Elec. Engr., Rural Electrification Bureau of Quebec. For mail: 38 Ste-Famille, Chicoutimi, Que. (S.1944. Jr.1946)
Dumont, Joseph Field Engr., Paradis Mining Corp., Amos, Que. (A.M.1920. M.1940)
Dumont, Lomer Mining Engr., Paul D'Aragon & L. K. Smith, Val d'Or, Que. (S.1941. M.1945)
Dumont, Paul 805 Sherbrooke St. E., Montreal 24. (S.1945)
Dumont, T. F. Robert Chief Acct. & Asst. Supt., Meagher Bros. & Co. Ltd., Montreal. For mail: P.O. Box 84, Dorion-Vaudreuil. Que. (M.1946)
Dumontier, J. E. Dist. Engr., Board of Transport Commissioners, Union Station, Ottawa. (M.1944)
Dumouchel, Léo-Georges 8636 Henri-Julien Ave., Montreal 10. (S.1945)
Dumoulin, J. R. Box 339, Kapuskasing, Ont. (S.1946)
Dunbar, Donald G. Chief Engr., Pictou County Power Board, New Glasgow, N.S. (M.1940)
Dunbar, George G. Supvr. of Fuel Oils, Imperial Oil Ltd., Dartmouth. For mail: 3 Maple St., Dartmouth, N.S. (S.1941. Jr.1944)
Dunbar, J. B. 199 Atlantic St., Halifax, N.S. (A.M.1925. M.1940)
Dunbar, John R. Elec. Engr., Canadian Westinghouse Co. Ltd., Hamilton, Ont. (S.1917. Jr.1922. A.M.1927. M.1940)
Dunbar, T. W. 4267 Old Orchard Ave., Montreal. (S.1945)
Dunbar, Wm. B. Assoc. Prof., University of Toronto, Toronto. (A.M.1921. M.1940)
Duncan, Allan S. E. Plant Mgr., Oxygen Co. of Canada Ltd., Montreal. For mail: 3404 Kingston Ave., Montreal. (Jr.1943)
Duncan, F. R. 110 St. Clair Ave. W., Toronto 5. (S.1939. Jr.1945)
Duncan, G. Paterson Res. Engr., City of Edmonton. For mail: 10034-106th St., Edmonton, Alta. (S.1938. M.1945)

Duncan, G. R. Mgr. for Ontario, Electric Tamper & Equipment Co. Canada Ltd., 1 Denison Ave., Toronto 2B. (S.1935. M.1946)
Duncan, J. D. Overseas. (S.1928. A.M.1940. M.1940)
Duncan, J. E. 970 MacMillan Ave., Winnipeg, Man. (S.1922. Jr.1925. A.M.1931. M.1940)
Duncan, John M. Dist. Engr. i/c Prodn., L'Air Liquide Society, 400 West 5th Ave., Vancouver, B.C. (M.1941)
Duncan, Norman M. Elec. Engr., Bell Telephone Co. Toronto. For mail: 53 Maxwell Ave., Toronto. (S.1946)
Duncan, W. A. Sales Mgr. Dominion Oxygen Co. Ltd., 159 Bay St., Toronto. (M.1941)
Duncan, W. E. P. Chief Engr., Toronto Transportation Commission, 35 Yonge St. Toronto. (S.1911. A.M.1919. M.1936)
Dunham, D. F. 13 Connolly St., Halifax, N.S. (S.1944. Jr.1946)
Dunlap, Clarence R. Overseas. (S.1928. A.M.1936. M.1940)
Dunlop, D. M. Canadian Pacific Railway. For mail: 202 Carleton Apts., Prince Albert, Sask. (S.1934. M.1941)
Dunlop, James Russell, Lt. Col., Asst. Dir. Mech. Engrg., Dept National Defence (Army), New Army Bldg., Ottawa. (S.1935. Jr.1937)
Dunlop, Robt. J. F. Times Study Supvr., Belding-Corticelli Ltd. Montreal. For mail: 4182 Beaconsfield Ave., Montreal 28. (S.1930. M.1943)
Dunlop, R. W. Gen. Engrg., Imperial Oil Ltd., Sarnia. For mail: 214 Talfourd St., Sarnia, Ont. (Jr.1928. A.M.1936. M.1940)
Dunlop, W. H. Squad Foreman i/c Strl. contracts, Canadian Bridge Co., Windsor. For mail: 2327 Windermere Rd., Windsor, Ont. (M.1946)
Dunn, Alex C. Mng. Dir., Great West Coal Co. Ltd., 10117—100A St., Edmonton, Alta. (M.1941)
Dunn, Guy C. 7 Drummond St. W., Perth, Ont. (A.M.1887. M.1897)
Dunn, H. S. 6 Commodore Apts., Halifax, N.S. (A.M.1931. M.1940)
Dunn, John R. Lt. Cdr. (L) Air Radio Officer, Royal Canadian Navy, D.E.E., N.S.H.Q., Ottawa, Ont. (S.1939. Jr.1941)
Dunn, J. T. Chem. Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 4034 Northcliffe Ave., Montreal. (S.1937. Jr.1946)
Dunn, Russell A. Asst. to Pres. L'Air Liquide Society, Montreal. For mail: 2070 Peel St., Montreal. (S.1939. Jr.1944)
Dunn, Sydney M. S. Prod. Engr., General Steel Wares Ltd. For mail: R.R. No. 5, London, Ont. (S.1940. Jr.1944)
Dunn, Thos. Hamilton 181 Gilmour St., Ottawa. (M.1916)
Dunne, Chas. Vincent Chief Engr., Standard Gravel & Surfacing Co. Ltd., 5340-1st St. S.W., Calgary, Alta. (Jr.1937. M.1943)
Dunne, Gerald J. Asst. to Plant Supt., Frank W. Horner Co. Ltd., Montreal. For mail: 2142 Bordeaux St., Montreal. (S.1944. Jr.1946)
Dunphy, K. A. Divn. Engr., Canadian Pacific Railway, Winnipeg. For mail: Wardlow Apts., Winnipeg, Man. (A.M.1920. M.1940)
Dunphy, K. R. (S.1938)
Dunsmore, R. L. Mgr. of Refineries, International Petroleum Co. Ltd., 56 Church St., Toronto. (A.M.1924. M.1939)
Duperron, Arthur Asst. Gen. Mgr., Montreal Tramways Co., 159 Craig St. W., Montreal. (A.M.1919. M.1928.)
Duplessis, Jacques 7454 St. Denis St., Montreal 10. (S.1944)
Dupre, H. A. 119 Powell Ave., Ottawa. (A.M.1914. M.1920)
Dupuis, J. J. Elec. Supt., Consolidated Paper Corp., Belgo Divn., Shawinigan Falls. For mail: 2158 Royal Blvd., Shawinigan Falls, Que. (Jr.1945)
Dupuis, Philippe-Auguste Asst. Chief Engr., Dept. of Public Works, Parliament Bldgs., Quebec. (A.M.1934. M.1936.)
Dupuis, René Dir., Dept. of Elec. Engrg., Faculty of Science, Laval University, Quebec. (A.M.1934. M.1940)
Dupuy, Harry E. G. Mgr., Western Br., Babcock-Wilcox & Goldie-McCulloch Ltd., 805 Electric Railway Chambers, Winnipeg, Man. (S.1938. M.1945)
Dupuy, René Constrn. Engr., Cie. de Pouvoir du Bas St. Laurent, Rimouski, Que. (S.1936. Jr.1939)
Duquette, Roland Charles Elec. Engr., Quebec Hydro-Electric Comm., Montreal. For mail: 5132 Park Ave., Montreal 8. (S.1940. Jr.1943. M.1945)
Duquette, Roland R. Cons. Engr., McDougall & Friedman, Montreal. For mail: 262 Outremont Ave., Outremont, Que. (M.1943)
Duranceau, C. A. Civil Engr. & Mgr., Charles Duranceau Ltd., Montreal. For mail: 4578 Marcil Ave., Montreal 28. (S.1937. M.1943)
Durand, Edwin J. Cons. Engr.'s. Asst. H. H. Angus & Associates Ltd., Toronto. For mail: 45 Taylor St., Toronto. (S.1946)
Durand, Louis 5025 Christophe-Colomb, Montreal 34. (S.1944)
Durant, Wm. C. Summerside, P.E.I., (S.1944)
Durley, Richard J. Secretary Emeritus, The Engineering Institute of Canada. For mail: 3174 The Boulevard, Westmount, Que. (A.M.1897. M.1904)
Durley, Thos. R. Field Engr., Manufacturers Mutual Fire Insurance Co., 411 Confederation Bldg., Montreal. (S.1926. Jr.1931. A.M.1936. M.1940)
Durnin, Edward J. Constrn. Engr., Saskatchewan Power Commission, Regina. For mail: 2049 Robinson St., Regina, Sask. (Jr.1930. A.M.1939. M.1940)
Durnin, Gorge R. 97 Balmoral Place, Winnipeg, Man. (S.1946)
Durrant, Morgan P. 1167 Henleaze Ave., Moose Jaw, Sask. (S.1943)
Dury, Jean J. Project Engr., Canadian Car & Foundry Co. Ltd., Montreal. For mail: 2225 St. Joseph Blvd. E., Montreal 34. (S.1941. M.1945)
DuSablon, Gilbert George 170 Dufferin Road, Hampstead, Que. (S.1944)
Dusel, Frank Joseph 2065 Reynolds St., Regina, Sask. (S.1944)
Dussault, Jean Town Engr., Ville St. Laurent. For mail: 146 Filiatrault St., Ville St. Laurent, Que. (S.1937. Jr.1941. M.1945)
Dustan, E. B. Station Design Dept., Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (Jr.1921. A.M.1926. M.1940)
Dutton, Vernon LeRoy Constrn. Supt., Mountain Road Builders Ltd., Birtle, Man. (S.1942. Jr.1946)
Dutton, Wm. Lawrason Engr., Union Gas Co. of Canada Ltd., Chatham, Ont. (S.1930. Jr.1935. M.1946)
Dwyer, F. R. Strl. Design, Stress Dept., Douglas Aircraft Co., Los Angeles. For mail: 4005 West 104th St., Inglewood, Calif., U.S.A. (S.1941. Jr.1946)
Dwyer, Michael Cons. to Dominion Govt., New Glasgow, N.S. (A.M.1925 M.1940)
Dyck, J. E. Indust. Engr., Aluminum Co. of Canada, Arvida. For mail: 842—6th St., Arvida, Que. (M.1945)
Dyer, E. G. Land Surveyor & Mfr.'s Agent, 84 Charles St., Halifax, N S. (M.1940)
Dyer, F. C. 133 Raglan Ave., Toronto 10. (M.1920)
Dyer, F. Frank Engr., Imperial Oil Ltd., Sarnia. For mail: 322 Blanche St., Sarnia, Ont. (M.1941)
Dyer, John H. Elec. Engr. on Plant Design, Sutcliffe Co. Ltd, New Liskeard. For mail: Box 601, New Liskeard, Ont. (S.1928. Jr.1937. M.1942)
Dyer, Joseph W. Vehicles Engr., Western Area, Bell Telephone Co. of Canada, 76 Adelaide St. W., Toronto. (S.1921. Jr.1926. A M.1930. M.1940)
Dyer, Wm. E. S. Cons. Engr. & Arch., Crosby Bldg., Franklin & Mohawk Sts., Buffalo 2, N.Y., U.S.A. (M.1942)
Dyer, W. G. Engr. of Track, Canadian Pacific Railway, Windsor Station, Montreal (A.M.1934. M.1940)
Dyke, F. I. L. 614 Huron St., Toronto 5. (M.1945)
Dyke, Frederick Stanley Asst. Engr., Waterworks Dept., City of Calgary. For mail: 211—38th Ave. W., Calgary, Alta. (A M.1915 M.1940)
Dyke, John M. Boiler Design Engr., John Inglis Co. Ltd., Toronto. For mail: 88 Woodside Ave., Toronto. (S.1943. Jr.1946)
Dyment, Arthur Elliott Mgr., Tech. Dept., Explosives Divn., Canadian Industries Ltd., Beaver Hall Hill, Montreal. (A.M.1939. M.1940)
Dyment, John T., Engrg. Supt., Trans-Canada Air Lines, Winnipeg, Man. (S.1925. A.M.1936. M.1940)

E

Eadie, Robt. S. Chief Engr., Eastern Divn., Dominion Bridge Co. Ltd., Lachine. For mail: 4380 Mayfair Ave., Montreal. (S.1914. Jr.1920. A.M.1926. M.1936)
Eager, Norman A. Gen. Mgr., Burlington Steel Co. Ltd., Sherman Ave. N., Hamilton, Ont. (Jr.1925. A.M.1934. M.1940)
Eagles, Norman B. Asst. City Elec. Engr., Moncton, N.B. (S.1935. Jr.1940. M.1942)
Eardley-Wilmot, Trevor Special Prod. Serv. Mgr., Northern Electric Co. Ltd., Montreal. For mail: 37 Lakeshore Road, Beaconsfield, Montreal 33. (Jr.1916. A.M.1919. M.1940)
East, Lawrence A. W. Chief Engr. of Comm., Canadian Pacific Railway, 204 Hospital St., Montreal. (M.1944)
Eastlake, W. H. Mgr., Wire & Cable Divn., Northern Electric Co. Ltd., 1261 Shearer St., Montreal 22. (A.M.1921. M.1940)
Eastman, James H. Atlin, B.C. (S.1946)
Easton, Frank S. Acting Gen. Mgr., Mexico Tramways Co., Ppartado 124 Bis, Mexico D.F., Mexico. (A.M.1915. M.1922)
Easton, Wallace M. Works Engr., Naugatuck Chemicals, Elmira. For mail: 31 Water St., Elmira, Ont. (M.1942)
Eastwood, G. Peter Sr. Asst., Geological Survey of Canada, Maycroft, Alta. (S.1943. Jr. 1946)
Edmonds, Chas. W. Plant Supt., Canada Cement Co. Ltd., Fort Whyte, Man. (S.1914. Jr.1921. A.M.1924. M.1940)
Edmunds, F. Harrison Cons. Geologist & Prof. University of Saskatchewan, Saskatoon, Sask. (M.1945)
Edson, Ralph E. Apparatus Sales Engr., Canadian General Electric Co., 1000 Beaver Hall Hill, Montreal. (S.1937. M.1946)
Edwards, C. P. Deputy Minister of Transport, Dominion Govt., Ottawa. (A.M.1916. M.1940)
Edwards, Frank H. 79 Victoria Ave., Longueuil, Que. (S.1942)
Edwards, G. Robt. Jr. Engr., W. T. Brickenden & Associates, 1018 Federal Bldg., Toronto 1. (S.1942. Jr.1946)
Edwards, Herbert M. Stress Analyst, Canadair Ltd., Cartierville. For mail: 5282 Queen Mary Road, Montreal. (S.1943. Jr.1946)
Edwards, J. B. 120-8th St. E., Saskatoon, Sask. (S.1941. Jr.1946)
Edwards, John B. Royston, B.C. (S.1946)
Edwards, Milton C. Design Engr., Canadian Westinghouse Co. Ltd., Hamilton. For mail: 475 Wentworth St. S., Hamilton, Ont. (S.1937. Jr.1943)
Edwards, Norman I., Lt. Cdr. (E), 79 Victoria Ave., Longueuil, Que. (A.M.1921. M.1940)
Edwards, Owen C. Lawrence Manufacturing Co. Ltd., Vancouver. For mail: 937-West 16th Ave., Vancouver, B.C. (S.1946)
Egan, E. J. Dept. of Public Works of Canada, Halifax, N.S. (M.1940)
Eggertson, E. G. Elec. Engr., E. G. Eggertson Inc., 27 William St., New York 5, N.Y. (S.1924. A.M.1930. M.1940)
Eggertson, S. H. Distribution Engr., Winnipeg Electric Co. For mail: 906 Dominion St., Winnipeg, Man. (M.1946)
Ehly, L. J. Pavement Engrg., City of Vancouver, 120 Union St., Vancouver, B.C. (S.1930. Jr.1941. M.1943)
Eisenhauer, D. A. Prod. Engr., E. Leonard & Sons Ltd., 381 York St., London, Ont. (S.1943)
Eisenhauer, Martin A. Branch Mgr., Sales & Service, Canadian Atlas Diesel Engines Ltd., 76 Upper Water St., Halifax, N.S. (S.1942. Jr.1946)
Eland, Frank E. 70 Superior Ave., Mimico, Toronto 14. (S.1946)
Elderkin, K. O. Mgr., Crossett Paper Mills, Crossett, Ark., U.S.A. (S.1920. Jr.1920. A.M. 1929. M.1938)
Eldridge, J. Bryson Sales & Estimating, English Electric Co. of Canada, St. Catharines. For mail: 8½ Bond St., St. Catherines, Ont. (S.1936. M.1945)
Eldridge, N. L. Mech. Engr., St. John Sulphite Ltd., P.O. Box 280, Fairville, N.B. (S.1944)
Elley, Fred C. Tech. Asst., Canadian Electrical Manufacturers Association, Toronto. For mail: 89 Breadalbane St., Toronto (S.1921. Jr.1926. A.M.1936. M.1940)
Elford, G. E. Design Engrg., Polymer Corp. Ltd., Sarnia. For mail: R.R. No.1, Corunna, Ont. (M.1946)
Elford, Wesley F. Asst. Engr. Robinson Engineering and Development Co., Calgary. For mail: 806 River Drive, Bowness, Alta. (S.1937. Jr.1940. M.1944)
Elgee, H. A. 9 Copplestone Road, Budleigh, Salterton, Devon., England. (M.1914)
Elkington, Gerald E. Gen. Mgr., East Kootenay Power Co. Ltd., Fernie. For mail: Box 67, Fernie, B.C. (S.1919. Jr.1928. A.M.1933. M.1940)
Elkins, W. H. P. "Ravenswood", Dutch Village Road, Halifax, N.S. (M.1944)
Ellacott, C. H. 487 Victoria St., Kingston, Ont. (S.1888. A.M.1899. M.1921)
Elliot, Donald George Chief Dftsmn., Aluminium Laboratories Ltd., 1800 Sun Life Bldg., Montreal. (S.1930. Jr.1934. A.M.1937. M.1940)
Elliot, L. B. Engr., District Engineer's Office, Dept. Public Works of Canada, New Westminster, B.C. (S.1902. A.M.1909. M.1919)
Elliott, C. W. Overseas. (S.1938. Jr.1940)
Elliott, Don R. 1581 East 12th Ave., Vancouver, B.C. (S.1946)
Elliott, J. Courtenay Designing Engr., E. B. Eddy Co., Ottawa. For mail: 379 Bronson Ave., Ottawa. (S.1934. Jr.1940)
Elliott, John M. Mech. Engr., John Bertram & Sons Ltd., Dundas. For mail: 80 Chedoke Ave., Hamilton, Ont. (S.1936. Jr.1946)
Elliott, R. B. Prod. Planning Supvr., Canadian Industries Ltd., Brownsburg. For mail: Box 586 Brownsburg, Que. (Jr.1944)
Elliott, S. H. Mackenzie Mech Engr., Mathews Conveyer Co. Ltd., Port Hope. For mail: 30 Bruton St., Port Hope, Ont. (S.1944)
Elliott, T. Campbell Instmt. Engr., Imperial Oil Refinery, Calgary. For mail: 349-15th Ave. W., Calgary, Alta. (Jr.1946)
Elliott, Wm. Ira. Halifax Shipyards Ltd. For mail: 296 Quinpool Road, Halifax, N.S. (M.1940)
Ellis, Arthur L. Box 204, University of Manitoba, Winnipeg, Man. (S.1945)
Ellis, D. E. Safety Engr., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (M.1943)
Ellis, D. S. Prof. Civil Engrg. & Dean, Faculty of Applied Science, Queen's University, Kingston, Ont. (S.1909. Jr.1913. A.M.1919. M.1940)
Ellis, David W. Southern Canada Power Co., Drummondville, Que. (S.1946)

Ellis, G. Lionel T. Carborundum Co., Niagara Falls, N.Y. For mail: P.O. Box 362, Niagara Falls, Ont. (S.1940. Jr.1943)
Ellis, Gordon M. Jr. Office Engr., Commonwealth Construction Co., Vancouver. For mail: 1375 Laurier Ave., Vancouver, B.C. S.1944)
Ellis, Harry M. Jr. Elec. Engr., Switchgear, Canadian General Electric, Peterborough. For mail: 546 Gilmour St., Peterborough, Ont. (S.1946)
Ellis, O. W. Dir., Dept. of Engrg. & Metlgy., Ontario Research Foundation, 43 Queen's Park, Toronto. (A.M.1922. M.1940)
Ellis, W. E. 600 Hardlaw Ave., Winnipeg, Man. (S.1946)
Elsey, Wilbert Roy Elec. Test Course, Canadian General Electric Co., Peterborough, Ont. (S.1943. Jr.1946)
Emerson, R. A. Dist. Engr., Canadian Pacific Railway, Vancouver, B.C. (S.1929. Jr.1932. M.1942)
Emery, Chas A. Teacher, Arch. Dftg. & Bldg. Constrn., Board of Education, Sault Ste. Marie. For mail: Technical School, Wellington St., Sault Ste. Marie, Ont. (Affil.1944)
Emery, C. L. Teacher, Port Arthur Board of Education. For mail: 30 Prospect Ave., Port Arthur, Ont. (M.1943)
Emery, Donald J. Elec. Engr., Canadian General Electric Co., Peterborough. For mail: 589 King St., Peterborough, Ont. (S.1927. A.M.1937. M.1940)
Emery, Roy W. Asst. Chief Engr., Marathon Paper Mills of Canada Ltd., Marathon, Ont. (A.M. 1938. M.1940)
Emmerson, John O. Canadair Ltd., Montreal. For mail: 1817 Dorchester St. W., Montreal 25. (S.1944. Jr.1946)
Emond, Amable 4271 Berri St., Montreal 34. (S.1944)
Emrey, D. J. County Engr., County of Waterloo, Ont. For mail: 11 Weber St. W., Kitchener, Ont. (S.1914. Jr.1920. A.M.1922. M.1940)
Enarson, O. E. Jr. Engr., Calgary Power Co. Ltd., Barrier Development, Seebe, Alta. S.1943)
Engel, N. L. Elec. Engr., Quebec Hydro Electric Commission, Montreal. For mail: 414 Grosvenor Ave., Westmount, Que. (A.M.1921. M.1940)
Engholm, F. G. Pres. & Gen. Mgr., The Macotta Co. of Canada Ltd., 83 Main St., S., Weston, Ont. (A.M.1914. M.1940)
Engler, Chas. R. 17 Nelson St., Kingston, Ont. (Jr. 1937)
English, W. J. 932 University Drive, Saskatoon, Sask. (S.1941)
Ennis, Leo E. Exchange Engr., Eastern Area, Bell Telephone Co. of Canada, Montreal. For mail: 4352 Westhill Ave. Montreal. (S.1922. A.M.1931. M.1940)
Enouy, Wm. G. Sales Mgr., H. H. Robertson Co. Ltd., 22-26 McNab St. S., Hamilton, Ont. (A.M.1938. M.1940)
Eon, L. G. Lt. Col. Radar Research, Dept. of National Defence (Army). For mail: 189 Hawthorne Ave., Ottawa. (M.1945)
Epstein, Norman, 615 Bloomfield Ave., Outremont, Que. (S.1944)
Ericson, C. G. Mech. Engr., Canada Machinery Corp. Ltd., Toronto. For mail: 58 Alvin Ave., Toronto. (A.M.1921. M.1940)
Erickson, Peter O. M. Aero Meters Ltd., Leaside, Ont. (S.1939. M.1944)
Eriksen, Gudmund Asst. Engr., City of Port Arthur. Public Utilities Bldg., Port Arthur Ont. (A.M.132. M.1940)
Ernst, C. A. Asst. to Chief Engr., Smart-Turner Machinery Co., Hamilton. For mail: 233 Victoria Ave. N., Hamilton, Ont. (M.1944)
Esdaile, Hector Milton Combustion Engineering Corp., 540 Dominion Square Bldg., Montreal. (S.1934. Jr.1939. M1943)
Estabrook, Howard A. Supt., Indust. Engrg. Dept. Aluminum Co. of Canada, Arvida. For mail: 111 Castner St., Arvida, Que. (S.1941)
Estabrook, James P. Tech. Asst., Aluminum Co. of Canada, Arvida. for mail: The Saguenay Inn, Arvida, Que. (Jr.1941)
Estabrooks, Donald S. Civil Engr., Price Bros. & Co. Ltd., Riverbend, Que. (M.1941)
Estlin, F. E. Mgr. & Sales Engr., Canadian General Electric Co. Ltd., Regina. For mail: 2900 Hill Ave., Regina, Sask. (A.M.1938. M.1940)
Etkin, Bernard, Lecturer, University of Toronto. For mail: 53 Hilton Ave. Toronto. (S.1941. Jr.1945)
Eull, Leander Frank, Asst. Hydraulic Engr., P.F.R.A., Dom. Dept. of Agriculture, 910 McCallum Hill Bldg., Regina, Sask. (Jr.1940)
Evans, B. A. Project Engr., Canadian Industries Ltd., 1135 Beaver Hall Hill, Montreal, Que. (A.M.1937. M.1940)
Evans, Chas. 3000—15th St., Detroit, Mich., U.S.A. (S.1946)
Evans, D. A. Res. Mgr., Pulp & Paper, Powell River Co. Ltd., Powell River, B.C. (S.1909. A.M.1914. M.1920)
Evans, D. E. 161-24th Ave., Lachine, Que. (S.1930. A.M.1938. M.1940)
Evans, Edwin Ronald Asst. Engr., Canadian National Railways, Moncton. For mail: Lewisville, Westmorland Co., N.B. (A.M.1920. M.1934)
Evans, George Wayne Asst. Engr., Rideau Canal, Dept. of Transport. For mail: 1213 St. Clair Ave. W., Toronto. (S.1946)
Evans, J. E. Training Course, Steel Co. of Canada, Hamilton. For mail: 37 Dundurn Cres., Toronto. (S.1946)
Evans, L. M. Overseas. (S.1936)
Evans, Maurice John Logging Engrg. & Timber Cruising, Vancouver. For mail: 4183 Cypress St., Vancouver, B.C. (S.1921. Jr.1922. A.M.1932. M.1940)
Evans, O. A. Assayer, Algoma Central Railway, Sault Ste. Marie. For mail: 159 Upton Road, Saut Ste. Marie, Ont. (Jr.1934)
Evans, Philip N. 352 Kitchener Ave., Westmount, Que. (S.1933)
Evans, Robt. E. 839 Charlotte St., Fredericton, N.B. (S.1943)
Evans, Thomas O. Asst. Supt., Stations & Trans. Lines, Quebec Hydro-Electric Commission, Montreal. For mail: 4362 Beaconsfield Ave., Montreal 28. (A.M.1935. M.1940)
Everall, R. S. Res. Engr., Highways Br., Dept. of Public Works, Dauphin. For mail: McCreary, Man. (S.1945)
Everall, Wm. M. 1392 Rockland, Victoria, B.C. (S.1906. A.M.1911. M.1940)
Everett, F. E. Engr., G. D. Peters & Co. of Canada Ltd., Montreal. For mail: 3425 St. Famille St. Montreal. (S.1944. Jr.1946)
Evers, Donald H. 237 Second Ave., N.E. Calgary, Alta. (Jr.1941)
Ewart, Frank R. Partner, Ewart, Armer & Byam, 36 Toronto St., Toronto. (M.1921)
Ewart, George R. (S.1898. A.M.1909. M.1940)
Ewart, J. Albert Architect, 165 Sparks St., Ottawa. (A.M.1907. M.1940)
Ewart, Philippe Traffic Engr., Quebec Dept. of Roads, Montreal. For mail: 121 Second Ave., Verdun, Que. (S.1941)
Ewens, F. G. Asst. Prof. of Mech. Engrg. University of Toronto. For mail: 300 St. Clair Ave. E., Toronto 5. (M.1942)
Ewing, Harlan T. Engrg. Research, Massey Harris Co. Ltd., Toronto. For mail: 1407 King St. W. Toronto. (S.1943)
Ewing, K. H. 19 Stratford Road, Hampstead, Montreal 29. (S.1944)
Ewing-Chow, G. Engrg. Bldg., McGill University, Montreal. (S.1945)
Extence, Alan Barr Graduate House, Massachusetts Institute of Technology, Cambridge, Mass., U.S.A. (S.1941. Jr.1943)
Eyre, Alan M. Planning Engr., B.C. Electric Railway Co., Vancouver. For mail: 4054 West 16th Ave., Vancouver, B.C. (S.1941)
Eyre, Robt. Thornton Operations Mgr., Canadian Oil Companies, Toronto. For mail: 408 Briar Hill Ave., Toronto. (A.M.1928. M.1940)

F

Fagan, J. W. Mgr., Telephone Divn., Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (S.1920. A.M.1930. M.1940)
Faguy, Jean-Paul 8541 Ontario St. E., Montreal 5. (S.1944)
Fainstat, Michael M. Mech Engr., National Heating Products Ltd., Montreal. 4533 Esplanade Ave., Montreal. (S.1945. Jr.1946)
Fair, J. L. Research Engr., W. C. Wood Co. Ltd., 123 Woolwich St., Guelph, Ont. (Jr.1938)
Fairbairn, J. M. R. 424 Wood Ave., Westmount, Que. (A.M.1899. M.1908)
Fairbairn, John MacFarlane Vice-Pres., Chas. Warnock & Co. Ltd., 485 McGill St., Montreal 1. (S.1921. A.M.1931. M.1940)
Fairfield, Robt. C. Partner, Murray & Fairfield, Architects, 128 Bloor St., W., Toronto. (Jr.1943)
Fairley, R. D. P.O. Box 338, Sackville, N.B. (S.1944)
Fairlie, Howard W. Pres., Electric Switchgear Ltd., 3550 St. Antoine St., Montreal 30. (A.M.1920. M.1940)
Falkner, John Wm. Asst. Engr., Hydro Electric Power Commission of Ontario, 620 University Ave., Toronto 2. (A.M.1922. M.1940)
Fanjoy, W. T. Asst., Industrial Control Elec. Engr., Canadian General Electric Co., Peterborough. For mail: 678 George St., Peterborough, Ont. (S.1925. Jr.1929. A.M.1936. M.1940)
Fanset, Geo. R. Chief Engr., Ducks Unlimited (Canada), Winnipeg. For mail: Charleswood, Man. (M.1940)
Farago, Wm. J. Mech. Engr., Product Design, Dominion Electrohome Industries Ltd., Kitchener. For mail: 61 Charles St., Waterloo, Ont. (S.1941. Jr.1944)
Farand, H. Paul 2612 Côte St. Catherine Road, Montreal. (S.1942)
Farand, L. C. Quebec Land Surveyor, 2293 Harvard Ave., Montreal. (Affil.1940)
Farish, Frank J. Adanac Apts., Winnipeg, Man. (S.1942. Jr.1946)
Farley, Sidney E. Partner, Farley & Cassels, 18 Rideau St., Ottawa. (S.1905. A.M.1911. M.1940)
Farmer, Alan T. Distribution Engrg., Shawinigan Water & Power Co., Ameau Bldg., Three Rivers, Que. (S.1943)
Farmer, Eric W. Chief Factory Engr., Canadian Marconi Co., Town of Mount Royal, Que. For mail: 174 Montée Sanche, Ste. Thérèse de Blainville, Que. (S.1922. A.M.1928. M.1940)
Farmer, John T. Mech. Engr., Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (S.1897. A.M.1905. M.1919)
Farmer, Phillip J. 13 Midland St., St. Catharines, Ont. (S.1939. Jr.1946)
Farmer, R. E. Divn. Engr., Canadian Pacific Railway Co., P.O. Box 847, Smith's Falls (M.1942)
Farmer, Rupert W. Transmission Engr., Quebec Hydro-Electric Comm., Montreal. For mail: 136 Hillcrest Ave., Montreal 28. (A.M.1930. M.1940)
Farnam, A. Bruce Field Surveys Engr., Stadler, Hurter & Co., Shreiber, Ont. For mail: 614 University Drive, Saskatoon, Sask. (S.1943)
Farnsworth, A. L. Howard Smith Paper Mills, Cornwall. For mail: 206 Fifth St. W., Cornwall, Ont. (S.1921. Jr.1925. A.M.1929. M.1940)
Farnsworth, R. H. Engrg. Dept., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. For mail: 2 Lemesurier Ave., Que. (Jr.1921. A.M.1930. M.1940)
Farquharson, A. G. Mgr., Refining Dept., McColl-Frontenac Oil Co. Ltd., 360 St. James St. W., Montreal. (M.1945)
Farrar, Norman Design Engr. & Asst. Chief Engr. of Mill Developt. Dept., Canadian Johns-Manville, Co. Ltd., Asbestos. (M.1945)
Farrell, Alfred J. Tech. Sales Engr., Gunite & Waterproofing Ltd., Montreal. For mail: 384 Metcalfe Ave., Westmount, Que. (S.1924. Jr.1926. A.M.1938. M.1940)
Farrell, J. W. D. Supt. Waterworks, City of Regina. For mail: 3025 Rae St., Regina, Sask. (Jr.1920. A.M.1921. M.1935)
Farrow, R. C. Chief Hydraulic Engr., Water Rights Branch, Dept. Lands & Forests of B.C., Victoria. For mail: McKenzie Farm, Box 1725, R.R.3, Victoria, B.C. (A.M.1933. M.1938)
Farstad, Charles Mech. Supt., Burns & Co., Edmonton, Alta. (Jr.1941)
Fast, Morris Sales Devlpt. Engr., Aluminum Co. of Canada Ltd., 1700 Sun Life Bldg., Montreal. (S.1937. Jr.1943)
Faubert, Guy Albert 4926 Westmore Ave., Montreal. (S.1942)
Faucher, J. A. Roland Mill Supt., Sullivan Consolidated Mines Ltd., Sullivan, Que. (M.1945)
Fawcett, Sydney D. Surveys Engr., Dept. of Mines & Resources, Ottawa. For mail: 120 Belmont Ave., Ottawa. (S.1907. Jr.1915. A.M.1922. M.1940)
Fawkes, A. W. E. City Engineer, Moose Jaw, Sask. For mail: 1022 Redland Ave., Moose Jaw, Sask. (A.M.1938. M.1940)
Fead, J. W. N. Instructor, Dept. of Civil Engrg., University of Alberta, Edmonton. For mail: 10835 86th Ave., Edmonton, Alta. (S.1945)
Fear, W. D. Asst. Engr., E. A. Ryan, Montreal. For mail: 3590 University St., Montreal 2. (M.1946)
Fee, Arthur E. 61 Park Ave., Ottawa. (S.1946)
Fee, H. Russel System Operating Engr. Aluminum Co. of Canada, Shipshaw. For mail: 836 6th St., Arvida, Que. (M.1943)
Fee, J. Kenneth Elec. Engr., Gatineau Power Co., 140 Wellington St., Ottawa. (S.1944. Jr.1946)
Feetham, Edward J. Divn. Engr., City of Halifax. For mail: 25 School Ave., Armdale, P.O. 624, Halifax, N.S. (M.1943)
Feiffer, Fred Prod. Tech., Canadian Arsenals Ltd., Leaside. Ont. For mail: 398 Spadina Road, Toronto. (Jr.1943)
Feldman, David 628 Gloucester St., Cornwall, Ont. (S.1944)
Fellows, Howard Chief Engr., Nova Scotia Power Commission, P.O. Box 910, Halifax, N.S. (A.M.1930. M.1940)
Fenn, Wm. Edward Dist. Radio Engr., Radio Divn., Dept. of Transport, 200 Canada Permanent Bldg., Winnipeg, Man. (M.1944)
Fenner, Thomas H. Admin. & Supvr., The General Accident Assurance Co. of Canada, 357 Bay St., Toronto 1. (A.M.1922. M.1940)
Fennis, A. M. Chief Engr., Macdonald Engineering Co. of Canada Ltd., 502 C.P.R. Bldgs., Toronto. (A.M.1931. M.1940)
Fenton, Stuart W. C. 185 William St., Kingston, Ont. (S.1945)
Fenwick, J. R. Sales Mgr., Research Products, Northern Electric Co. Ltd., Montreal. For mail: 697 Victoria Ave., Westmount, Que. (S.1922. A.M.1927. M.1940)
Fenwick, Kenneth H. 442 George St., Fredericton, N.B. (S.1945)
Ferguson, Alexander Port Manager, Montreal Harbour. For mail: 642 Murray Hill, Westmount, Montreal 6. (S.1905. A.M.1907. M.1914)
Ferguson, A. A. Pictou Foundry & Machine Co. Ltd., Pictou, N.S. (S.1929. A.M.1938. M.1940)
Ferguson, A. W. Cons. Engr., 218 St. Andrews St., Victoria, B.C. (S.1910. Jr.1914. A.M.1921. M.1940)

Ferguson, David Allan Land Surveying, Underwood & McLellan, 502 Grain Bldg., Saskatoon, Sask. (S.1943)
Ferguson, Donald S. 65 Yorke St., Glace Bay, N.S. (S.1944)
Ferguson, George Hendry Chief, Public Health Engrg. Divn., Dept. National Health & Welfare, 635 Jackson Bldg., Ottawa. (S.1906. A.M.1909. M.1919)
Ferguson, Hardy Smith Partner, Hardy S. Ferguson & Co., 200 Fifth Ave., New York 10, N.Y. (M.1903)
Ferguson, James Divn Engr., Canadian National Railway. For mail: 96 Windsor Ave., London, Ont. (Jr.1913. A.M.1916. M.1940)
Ferguson, James Bell Vice-Pres., Pictou Foundry & Machine Co. Ltd., P.O. Box 260, Pictou, N.S. (S.1932. A.M.1939. M.1940)
Ferguson, John Henry G/C, Commanding Officer, No. 2 Equipt. Depot, R.C.A.F., Vancouver. For mail: 1595 East 33rd Ave., Vancouver, B.C. (S.1931)
Ferguson, Ralph M. Tech. Officer, Dominion Water & Power Bureau, 744 West Hastings St., Vancouver, B.C. (S.1946)
Ferguson, R.N. Asst. to Chief Engr., Canadian Celanese Ltd., Drummondville, Que. (S.1937. M.1946)
Ferguson, William P. Director & Western Mgr., Peacock Bros. Ltd., 325 Howe St., Vancouver. B.C. (A.M.1930. M.1940)
Fergusson, H. B. G. A. Harvey & Co. (London) Ltd., London, England. For mail: 8 Hawthorn Road, Bickley, Kent, England. (A.M.1910. M.1915)
Ferland, Germain 4429 St. Hubert St., Montreal 34. (S.1944)
Ferraro, Silvio 7166 Casgrain St., Montreal. (S.1942)
Ferrier, A. Air Vice Marshal, R.C.A.F., Air Transport Board, No. 3 Temporary Bldg., Ottawa. (S.1919. A.M.1922. M.1940)
Ferrier, John A. Plant Engr., Spruce Falls Pulp & Paper Co. Ltd., Kapuskasing. For mail: Box 489, Kapuskasing, Ont. (Jr.1939. M.1944)
Fetherstonhaugh, Edward P. Dean of Engrg. & Arch., University of Manitoba, Winnipeg, Man. (S.1899. A.M.1908. M.1920)
Fetherstonhaugh, Wm. S. (A.M.1907. M.1914)
Fiander, Leslie Owen Traffic Engr., Dept. of Highways of Ontario, Toronto. For mail: 1188 Gerrard St. E., Toronto. (S.1946)
Field, R. H. Chief. Metrology Section, National Research Council, Ottawa. For mail: 564 Hillsdale Road, Rockcliffe Park, Ont. (A.M.1922. M.1940)
Fielding, G. Parker Jr. Engr., A. V. Roe Canada Ltd., Malton, Ont. For mail: 16 Dingwall Ave., Toronto. (S.1945)
Fife, Thomas Cdr. (E), R.C.N., Canadian Fleet Mail Office, Glasgow, Scotland. (M.1944)
Fife, W. M. Assoc. Prof., Massachusetts Institute of Technology, Cambridge 39, Mass. (Jr.1914. A.M.1927. M.1940)
Filiatrault, J. Roméo 3327 Albani Ave., Montreal 26. (S.1944)
Filiatrault, Robt. M. 742 Jarry St., Montreal 10, (S.1944)
Filion, Marcel Chem. Engr., Flintkote Co. of Canada Ltd., 5th Ave. & Canal Bank, Ville St. Pierre, Que. (S.1944. Jr.1946)
Filion, Paul Engr., Fire Prevention, Reed Shaw & McNaught Ltd., 360 St. James St. W., Montreal. (S.1936. M.1942)
Finch, Gordon H. Elec. Engr., Sales, Canadian Westinghouse Co. Ltd., Box 794, 56 Sparks St., Ottawa. (M.1943)
Finch, John C. 5125 Westbury Ave., Montreal. (S.1946)
Finch. W. H. 629 Johnson St., Kingston, Ont. (S.1946)
Findlater, R. H. Sr. Inspr., Chem. & Explosives, War Assets Corp. Ltd., No. 4 Bldg., Lyon St., Ottawa. (M.1935)
Findlay, Allan C. Prod. Engr., Standard Brands Ltd., Montreal. For mail: 5633 Cote des Neiges Road, Montreal. (S.1937. Jr.1945)
Findlay, Reginald Hudson Mech. Engr., Eastern Divn., Dominion Bridge Co. Ltd., Box 280, Montreal. (A.M.1920. M.1932)
Finlayson, A. W. Asst. to Chief Engr., Pressure Pipe Co. of Canada, Montreal. For mail: 4450 Coronation Ave., Montreal. (S.1922. A.M.1930. M.1940)
Finlayson, H. M. Sr. Asst. Engr., Water Resources Dept., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (M.1942)
Finlayson, John Norison Dean, Faculty of Applied Science, University of British Columbia, Vancouver, B.C. (S.1908. A.M.1912. M.1919)
Finley, Wallace Charles Spruce Falls Power & Paper Co. Ltd. For mail: Kapuskasing Inn, Kapuskasing, Ont. (S.1946)
Finn, John R. 1225 Bernard Ave., Outremont, Que. (S.1944)
Finnemore, H. F. Chief Elec. Engr., Canadian National Railways, C.N. Express Bldg., Montreal. (A.M.1921. M.1940)
Finnie, N. W. Jr. Engr., Canadian General Electric Co. Ltd., Peterborough. For mail: 302 Hunter St., Peterborough, Ont. (Jr.1944)
Finnie, O. S. 235 Sherwood Drive, Ottawa. (A.M.1912. M.1921)
Fish, A. D. Designing Engr., Hydraulic Machinery Co. Ltd., Montreal. For mail: 5215 Victoria Ave., Apt. 2, Montreal 26. (S.1937. M.1945)
Fish, A. W. 1321 2nd St. N.W., Calgary, Alta. (S.1942. Jr.1946)
Fisher, Charles B. Cons. Engr., F. T. Fisher's Sons Ltd., 6202 Somerled Ave., Montreal. (S.1927. A.M.1936. M.1940)
Fisher, Earl Lubric. & Sales Engr., McColl-Frontenac Oil Co. Ltd., London. For mail: 540 Adelaide St., London, Ont. (S.1943. Jr.1946)
Fisher, Ralph E. Sub. Lieut. (L) Royal Canadian Navy, Halifax. For mail: Grantham's Landing, B.C. (S.1946)
Fisher, S. T. Vice-Pres. & Director, Rogers Radio Tubes Ltd. & Special Prod. Mgr. Roger Majestic Ltd., Toronto. For mail: 3445 Glencoe Ave., Montreal. (S.1927. Jr.1935. M.1942)
Fisher, W. I. Asst. Divn. Engr., Dept. of Highways & Public Works, New Glasgow, N.S. (M.1940)
Fitzgerald, John G. 1963 Kent Ave., Montreal. (S1942)
Fitzgibbon, J P. 4716 Adam St., Montreal. (S.1944)
Fitz-James, H. C. VicePres. & Mgr., Pacific Coast Pipe Co. Ltd., 1551 Granville St., Vancouver, B.C. (A.M.1919. M.1940)
Flaherty, B. G. Chief Engr., Marine Industries Ltd., Montreal. For mail: 936 Laurier Ave., Montreal. (M.1932)
Flanagan, Oliver L. 86 Chaplin Crescent, Toronto. (A.M.1913. M.1940)
Flavell, George 257 Oakwood Ave., Winnipeg, Man. (S.1946)
Flay, A. David Overseas (S.1942)
Flay, W. H. G. Branch Mgr., Dominion Structural Steel Ltd., Ottawa. For mail: 386 Sunnyside Ave., Ottawa. (A.M.1921. M.1940)
Fleischmann, A. C. Indust. & Bldg. Engr., 34 Maple Ave., Shawinigan Falls, Que. (A.M.1939. M.1940)
Fleming, A. G. Chief Chemist & Tech. Cons., Canada Cement Co. Ltd., Canada Cement Bldg., Montreal. (M.1928)
Fleming, C. D. Sales Engr., Alexander Murray & Co. Ltd., Toronto. For mail: 1510 Bathurst St., Toronto. (S.1924. Jr.1928. A.M.1932. M.1940)
Fleming, Donald C. Instr. in Radio Theory, Institute of Technology & Art, Dept. of Education, Alta. For mail: 1228 15th Ave. W., Calgary, Alta. (M.1944)
Fleming, Frederick A. Sheppard Electrical Laboratories, 104 Sparks St., Ottawa. (Jr.1938. M.1943)
Fleming, J. Murray Pres. & Gen. Mgr., C. D. Howe Co. Ltd., Cons. Engrs., 710 Whalen Bldg., Port Arthur., Ont. (S.1919. A.M.1928. M.1940)
Fleming, John P. Overseas (S.1941)
Fleming, Robt. Partner & Vice-Pres., Wood, Fleming & Co. Ltd., 504 Royal Bank Bldg., Toronto. (M.1921)
Flemming, C. P. Asst. Engr. i/c Constrn. & Mtce., United Service Corp. Ltd., Halifax. For mail: 130 Quinpool Road, Halifax, N.S. (M.1941)
Flemming, John A. P.O. Box 119, Sackville, N.B. (S.1944)
Flemming, Wm. D. Jr. Mech. Engr., Canadian International Paper Co., Gatineau. For mail: 310 Blackburn Ave., Ottawa. (S.1942)
Fletcher, A. G. 2746 West 37th Ave., Vancouver, B.C. (S.1946)
Fletcher, Wm. J. Cons. Engr. & Land Surv., 610 Security Bldg., Windsor, Ont. (A.M.1919. M.1940)
Flett, F. P. Dist. Mgr., Truscon Steel Co. of Canada Ltd., 124 Bloor St. W., Toronto. (M.1943)
Fleury, Maurice Sales Engr., Babcock-Wilcox & Goldie-McCulloch Ltd., Canada Cement Bldg., Montreal. (S.1934. Jr.1937. M.1945)
Flint, Chas. Supvr., Veterans Placements for Ont., Dept. of Labour, Toronto. For mail: 23 Kennedy Park Road, Toronto. (S.1909. A.M.1912. M.1920)
Flitton, Ralph C. Sales Mgr., Canadian Vickers Ltd., Montreal. For mail: 571 Chester Ave., Town of Mount Royal, Que. (Jr.1914. A.M.1920. M.1940)
Flood, A. J. 86 Baby Point Road, Toronto 9. (M.1939)
Flood, John N. Pres., John Flood & Sons Ltd., 111 Princess St., Saint John, N.B. (Jr.1920. A.M.1923. M.1940)
Flook, Samuel Evert City Engr., Port Arthur. For mail: 380 Dawson St., Port Arthur, Ont. (M.1936)
Floud, J. Rhys Dominion Oilcloth & Linoleum Co. Ltd., Montreal. For mail: 4985 Cote des Neiges Rd., Montreal 26. (S.1941)
Floyd, Edward Cons. Mining Engr., and Director, West Coast Collieries, Vancouver. For mail: 1431 Robson St., Vancouver, B.C. (M.1943)
Flynn, A. E. Prof. of Mining Engrg., Nova Scotia Technical College, Halifax, N.S. (M.1940)
Fodor, Nicholas Cons. Engr., 25 Roxborough St. East, Toronto 5. (M.1945)
Fogarty, Orville Rigaud, Que. (M.1922)
Fogarty, J. Wm. P. Rev. Prof. of Engrg., St. Francis Xavier University, Antigonish, N.S. (S.1929. M.1941)
Fokschaner, Peter Elec. Engr., Canadian Hoosier Engineering Co. Ltd., Montreal. For mail: 4414 Girouard Ave., Montreal. (S.1946)
Foley, M. A. Asst. Engr., Fisheries Equipt. Research, Fisheries Research Board, Halifax. For mail: 34 Larch St., Halifax, N.S. (S.1943. Jr.1946)
Foley, W. J. Dist. Mgr., Standard Paving Ltd., Hull, Que. For mail: 366 Frank St., Ottawa. (M.1944)
Folger, Collamer C. Gen. Mgr., Public Utilities Commission, 19 Queen St., Kingston, Ont. (M.1941)
Follett, D. J. 490 Pine Ave. W., Montreal 18. (S.1945)
Follows, Alan G. 345 Gloucester St., Cornwall, Ont. (S.1943, Jr.1946)
Fontaine, Roland Engr., Tech. Divn., City of Montreal. For mail: 6612 Casgrain St., Montreal. (M.1944)
Foote, S. D. Res. Engr., British American Oil Co. Ltd., Calgary. For mail: 1039 1st Ave. N.W., Calgary, Alta. (Jr.1939)
Forbes, Cyril R. (S.1944)
Forbes, Donald A. Asst. Chief Engr., Fraser Companies Ltd., Edmundston, N.B. (Jr.1936. M.1942)
Forbes, H. D. Jr. Metallurgist, Deloro Smelting & Refining Co. Ltd., Deloro, Ont. (Jr.1944)
Forbes, J. Eric Dist. Engr., Marine Br., Dept. of Transport, Halifax. For mail: 32 Pleasant St., Dartmouth, N.S. (M.1940)
Forbes, John H. Right of Way & Lease Agent, Canadian Pacific Railway Co., Montreal. For mail: 420 Wiseman Ave., Outremont, Que. (A.M.1919. M.1940)
Forbes, James M., Director of Assessments, Dept. of Municipal Affairs of Alta. For mail: 10547—125th St., Edmonton, Alta. (A.M.1920. M.1940)
Forbes, Kenneth A. Mech. Engr., Dept. Highways & Public Works of N.S., Halifax. For mail: 162 Pepperell St., Halifax, N.S. (M.1940)
Forbes-Roberts, Herbert Mgr., Newfoundland Light & Power Co. Ltd., P.O. Box 976, St. John's, Nfld. (A.M.1938. M.1940)
Ford, Arthur L. Haliburton Road, Royal Oak, B.C. (A.M.1908. M.1914)
Ford, Ernest A. Asst. Contract Engr., Dominion Bridge Co. Ltd., Winnipeg. For mail: 80 Niagara St., Winnipeg, Man. (M.1945)
Ford, George 951 Forest Ave., Palo Alto, Calif., U.S.A. (S.1941. Jr.1943)
Ford, John F. Constrn. Engr., Russell Construction Co., Toronto. For mail: 162 Essex St., Toronto. (S.1939. Jr.1940)
Ford, J. N. Asst. Transmission & Distribution Engr., Calgary Power Co. Ltd., Insurance Exchange Bldg., Calgary, Alta. (Jr.1940. M.1942)
Ford, J. W. H. Supt., No. 4 Divn., Shawinigan Chemicals Ltd., Box 200, Bedford, Que. (S.1911. Jr.1916. A.M.1919. M.1940)
Ford, Robt. Chief Engr., Dominion Rubber Co. Ltd., Montreal. For mail: 24 Dufferin Road, Hampstead, Montreal 29. (S.1921. Jr.1923. A.M. 1925. M.1940)
Ford Wm. B. Canadian Engineering & Contracting Co. Ltd., 506 Imperial Bldg., Hamilton, Ont. (A.M.1899. M.1940)
Ford, Wm. Rex Civil Engr., Shawinigan Chemicals Co. Ltd., Shawinigan Falls. For mail: 30 Dutch St., Bedford, Que. (Jr.1946)
Ford-Smith, Percy Pres. & Gen. Mgr., Ford-Smith Machine Co. Ltd., Hamilton. For mail: Ancaster, Ont. (A.M.1928. M.1930)
Foreman, John L. Hydrographic Surveys Engr., Dept. Mines & Resources, Confederation Bldg., Ottawa (S.1914. A.M.1921. M.1940)
Forest Clément, 47-a, St. Louis St., Valleyfield, Que. (S.1939. Jr.1942)
Forgan, David Constrn. Engr., Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (A.M.1932. M.1940)
Forgie, James Cons. Engr., 8374 117th St., Kew Gardens, New York 15, N.Y. (M.1910)
Forgues, J. A. Mgr., Rural Electrification Bureau, Montreal Office, 89 Notre Dame St. E., Montreal. (M.1946)
Forgues, Robert 2168 Sherbrooke St. W., Montreal 25. (S.1945)
Forrester, Robt. A. Overseas (S.1940. Jr.1946)
Forsberg, Clarence R. Asst. Prof. of Civil Engrg., University of Saskatchewan, Sask. (S.1931. A.M.1939. M.1940)
Forster. A. M. Elec. Engr., Aluminum Co. of Canada, 1700 Sun Life Bldg., Montreal. (S.1938. Jr. 1946)
Forster, D. H. 20 Young St. S., Sudbury, Ont. (Affil. 1940)
Forster, J. W. 11144 87th Ave., Edmonton, Alta. (S.1943. Jr. 1946)
Forsythe, Marshall A. Shawinigan Engineering Co. Ltd., Montreal. For mail: 3524 Hutchison St., Montreal 18. (S.1937. Jr.1941)
Forté, Gaston Jean 509 William David St., Montreal 4. (S.1944)
Fortin, Bernard Designing & Estimating, Dominion Bridge Co. Ltd., Lachine. For mail: 2086 Darling St., Montreal. (S.1944)
Fortin, Eugene, 11932 St. Joseph St., Pointe-aux-Trembles, Montreal 5. (A.M.1923. M.1940)

Fortin, Eugène-C. Engr., Elec. Divn., Dept. Public Works, City of Montreal. For mail: 10791 St. Lawrence Blvd., Montreal 12. (M.1945)
Fortin, Joachim Supt. Engr., Mountain Crest Mines Ltd., La Malbaie, Que. (S.1908. A.M.1913. M.1940)
Fortin, J. J. i/c Elec. Engrg. Design, Aluminum Co. of Canada, Arvida. For mail: 817 3rd St., Arvida, Que. (Jr.1935. M.1945)
Fortin, René Cons. Engr. & Prof., Ecole Polytechnique, Montreal. For mail: 3581 Northcliffe Ave., Montreal 28. (M.1942)
Fosness, Arthur W. Vice-Pres. & Chief Engr., Commonwealth Construction Co. Ltd., 300 Royal Bank Bldg., Winnipeg, Man (A.M.1921. M.1927)
Foss, C. L. Fairville, St. John Co., N.B. (A.M.1920. M.1940)
Foss, Leiv Project Engr., Foundation Co. of Canada, Baie Comeau, Que., (M.1945)
Foss, W. L. Project Engr., i/c Design & Constrn., P.F.R.A., Dom. Dept. of Agriculture, 418 Public Bldg., Calgary, Alta. (A.M.1938. M.1940)
Foster, Ian McL. Overseas. (S.1937. Jr.1941)
Foster, J. S. Jr. Engr., Montreal Engineering Co. Ltd., 244 St. James St., Montreal. (S.1943. Jr.1946)
Foster, V. S. Induction Motor Engr., Canadian General Electric Co., Peterborough, Ont. (A.M.1920, M.1940)
Fotheringham, W. W. Mgr., Canadian Brown Steel Tank Co. Ltd., Brandon, Man. (Jr.1937. M.1940)
Foulis, A. D. Foulis Engineering Sales Co., Halifax. For mail: 27 Oakland Road, Halifax, N.S. (Jr.1931. M.1941)
Foulkes, Thos. Indust. Engr., E. B. Eddy Co., Hull. For mail: 368 Huron Ave., Ottawa. (S.1925 Jr.1929. A.M.1937. M.1940)
Fournier, Arthur Pres. & Gen. Mgr., Fournier & Papillon Ltd., 92 St. Roch St., Quebec. (M.1945)
Fournier, Emmanuel J. Cons. Engr., 509—3rd Ave., Que. (M.1943)
Fournier, Gaston 454 St. Georges St., St. Jerome, Que. (S.1944. Jr.1946)
Fournier, Jean-Marc 7476 Christophe-Colomb, Montreal 10. (S.1945)
Fournier, Jean-Paul 312 St. John St., Quebec. (S.1945)
Fournier, R. N. Mgr., Supply Divn., Halifax Dist. Office, Canadian General Electric Co. Ltd., Hollis St., Halifax, N.S. (M.1945)
Fournier, Victor A. Estimator & Chief Engr., Dansereau Ltd., Outremont. For mail: 860 Dunlop Ave., Outremont, Montreal 8. (S.1913. A.M.1923. M.1940)
Fowler, Charles A. Cons. Engr. & Arch., C. A. Fowler & Co., Capitol Bldg., Halifax, N.S. (A.M.1919. M.1923)
Fowler, C. A. 1007 Lakeshore Road, New Toronto, Ont. (S.1946)
Fowler, Chas. A. E. Box 132, University of Manitoba, Winnipeg, Man. (S.1943. Jr.1946)
Fowler, Chas. E. (M.1904)
Fowler, F. S. Mgr. & Sec. Treas., Nelson River Constrn. Ltd., 607 Union Trust Bldg., Winnipeg, Man. (A.M.1915. M.1940)
Fowler, J. S. Chief Engr., University of Saskatchewan, Saskatoon. For mail: 1005 Melrose Ave., Saskatoon, Sask. (A.M.1939. M.1940)
Fox, C. Harry Special Engineer, Canadian Pacific Railway, Winnipeg, Man. (S.1907. A.M.1913. M.1921)
Fox, Chas. J. Engrg. Bldg., Mcill University, Montreal. (S.1944)
Fox, E. C. Evans Field Engr., John T. Hepburn Ltd., Toronto. For mail: Wyndmoor, York Mills, Toronto. (S.1921. Jr.1923)
Fox, J. C. Engr. i/c Stress Analysis, DeHavilland Aircraft of Canada, Toronto. For mail: P.O. Box 505, Fort Erie, Ont. (Jr.1944)
Fox, John H. Mgr., Commercial Controls Divn., Minneapolis-Honeywell Regulator Co. Ltd., Vanderhoof Ave., Toronto 12. (S.1926. Jr.1930. A.M.1935. M.1940)
Foy, Albert Joseph, Cons. Engr., Fire Prevention & Safety Engrg., 71 Clandeboye Ave., Westmount, Montreal 6. (S.1925. A.M.1931. M.1940)
Fraikin, Léon A. Vice-Pres. & Gen. Mgr., Franki Compressed Pile Co. of Canada Ltd., Montreal. For mail: 4055 Van Horne Ave., Montreal. (A.M.1939. M.1940)
Frame, Alxeander Supt. of Highway Constrn., Dept. of Public Works of Alta., Edmonton, Alta. (M.1941)
Frame, Stanley Howard Hydraulic Engr., Water Rights Branch, Dept. of Lands & Forests, Parliament Bldgs., Victoria, B.C. (S.1903. A.M.1911. M.1936)
Francis, J. A. Climax, Sask. (S.1943)
Francis, J. B. Works Engr., Canadian Industries Ltd., Brownsburg. For mail: P.O. Box 189, Brownsburg, Que. (S.1928. Jr.1937. M.1943)
Francis, Jas. Scott Jr. Engr., Northern Electric Co. Ltd., Montreal. For mail: 3434 McTavish St., Montreal. (S.1943. Jr.1946)
Francis, T. F. Dist. Engr., Constrn., Dept. of Highways of Ont., Toronto. For mail: 231 Inglewood Drive, Toronto. (A.M.1920. M.1936)
Francis, W. E. 349 Brock St., Kingston, Ont. (S.1946)
Francoeur, Georges Dist. Admin., Dept. of Veterans Affairs, 15 Blvd. des Capucins, Quebec. (M.1946)
Francoeur, Roland 1297 St. Christophe, Montreal 24. (S.1945)
Franklin, Edward Mech. Supt., Donnacona Pulp & Paper Co. Ltd. For mail: P.O. Box 86, Donnacona, Que. (Affil.1940)
Franklin, R. L. Col., Chief Inspr. Armament, Vehicles & Fire Instruments, Inspection Board of Canada, 58 Lyons St., Ottawa. (S.1928. Jr.1934. M.1944)
Franklin, Raymond William Res. Engr. for constrn., American Brake Shoe Co., 50 Colborne St. E., Lindsay, Ont. (Jr.1945)
Frappier, Forrest H. Detail Dftsmn., Matthews Conveyor Co., Port Hope. For mail: 93 Russell Ave., Ottawa. (S.1946)
Fraser, Archibald N. Sr. Radio Engr., Dominion Dept. of Transprt, Ottawa. For mail: 11 Rockcliffe Way, Ottawa. (A.M.1926. M.1940)
Fraser, A. S. Plant Mgr., Canada Starch Co. Ltd., Cardinal, Ont. (A.M.1925. M.1940)
Fraser, Campbell Asst. Highway Engr., Dept. Highways of Ont., Ontario St., Stratford, Ont. (S.1930. Jr.1936)
Fraser, Chas. E. Pres., Fraser-Brace & Co., 10 East 40th St., New York, N.Y. (S.1899. M.1909)
Fraser, Christopher E. Engr., McNamara Construction Co. Ltd., Toronto. For mail: 78 Falcon St., Toronto 12. (S.1916. Jr.1920. A.M.1922. M.1940)
Fraser, Donald Arthur Asst. to Divn. Engr., Canadian Pacific Railway, Regina. For mail: 2134 Cornwall St., Regina, Sask. (S.1943)
Fraser, Daniel M. Pres. & Gen. Mgr., D. M. Fraser Ltd., Toronto. For mail: 499 Oriole Parkway, Toronto 12. (M.1920)
Fraser, Daniel M. Brewmaster, National Breweries Ltd., 15 St. Nicholas St., Quebec. (S.1944. M.1945)
Fraser, F. W. Constrn. Foreman, McColl-Frontenac Oil Co. Ltd., Langman Bldg., Calgary, Alta. (S.1941. Jr.1942)
Fraser, Innes M. Prod. Control Engr., Imperial Oil Ltd., Dartmouth. For mail: 35 Church St., Dartmouth, N.S. (Jr.1935. M.1941)
Fraser, I. Matheson Prof. of Mech. Engrg., University of Saskatchewan, Saskatoon, Sask. (Jr.1920. A.M.1928. M.1939)
Fraser, J. Douglas Plant Engr., Moirs Ltd., 128 Argyle St., Halifax, N.S. (S.1925. Jr.1929. A.M.1930. M.1940)
Fraser, J. H. Gen. Supt., Steel Divn., Dominion Steel & Coal Corp., Sydney. N.S. (M.1941)
Fraser, J. F. Asst. Project Engr., Canadian Industries Ltd., Montreal. For mail: 5549 Queen Mary Road, Montreal. (M.1944)
Fraser, John P. Asst. Chief Engr., B.C. Electric Railway Co., Vancouver. For mail: 6037 Churchill St., Vancouver, B.C. (A.M.1929. M.1936)
Fraser, K. W. Canadian Westinghouse Co. Ltd., 720 Dominion Square Bldg., Montreal. (M.1943)
Fraser, R. P. Asst. to Distribution Engr., Winnipeg Electric Co. For mail: 1026 Grosvenor Ave., Winnipeg, Man. (S.1930. Jr.1937. A.M.1939. M.1940)
Fraser, Thomas Bryant Supt. of Constrn., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1922. Affil. 1942)
Fraser, Wm. Mech. Supt., Aluminum Co. of Canada, Arvida. For mail: 917 Coulomb St., Arvida, Que. (M.1945)
Fraser, W. L. Operational Engr., Nova Scotia Power Commission, Halifax, N.S. (M.1944)
Fraser, W. L. Dist. Engr., Works & Bldgs. Br., Dept. of National Defence, Naval Service, Halifax. For mail: Wolfville, N.S. (M.1940)
Fraser, Wm. M. 331 Spring Garden Road, Halifax, N.S. (S.1942. Jr.1946)
Fraser, W. S. Dist. Engr., Canadian Westinghouse Co. Ltd., 320 8th Ave. W., Calgary, Alta. (A.M.1939. M.1940)
Fraser, W. T. Mgr., Vancouver Iron Works Ltd., 1155 6th Ave. W., Vancouver, B.C. (M.1936)
Frattinger, P. A. Plant Engr., Pacific Mills Ltd., Ocean Falls, B.C. (M.1945)
Fréchette, Gaston, Combustion Engr., Dominion Bridge Co., Lachine. For mail: 268 Argyle Ave., Verdun, Que. (S.1938. Jr.1943)
Fréchette, J. A. Chief Tech. Bureau. Dept. of Colonization, Quebec. For mail: 6 Dufferin Terrace, Quebec. (M.1942)
Fredenburg, Wm. 44 Glebeholme Blvd., Toronto (S.1946)
Freeberg, Jas. A. 3 Devonshire Place, Toronto. (S.1946)
Freeborn, Frank Constrn. Commander, R.C.N.V.R., 368 Morris St., Halifax, N.S. (M.1943)
Freeland, John A. Engr., Canadian International Paper Co., Temiskaming. For mail: P.O. Box 9, Temiskaming, Que. (A.M.1908. M.1940)
Freeman, George L. Partner, Moran, Proctor, Freeman & Mueser, Cons. Engrs., 420 Lexington Ave., New York, N.Y. (M.1920)
Freeman, John E. Jr. Engr., N.B. International Paper Co., P.O. Box 1, Dalhousie, N.B. (S.1942. Jr.1946)
Freeman, J. Reginald Sr. Asst. Engr., Dept. of Public Works, P.O. Box 1417, Saint John, N.B. (S.1904. A.M.1910. M.1918)
Freeman, J. R. Asst. Engr., Chief Engr's Office, Canadian National Railway, Moncton. For mail: 108 Mountain Road, Moncton, N.B. (A.M.1921. M.1940)
Freeman, Paul O. Strl. Designer, Dominion Bridge Co. Ltd., Montreal. For mail: 7330 Maynard Ave., Montreal 16. (S.1940. Jr.1946)
Freeman, R. G. Jr. Engr., Hydro-Electric Power Commission of Ont., Toronto. For mail: Yarker, Ont. (S.1946)
Freeman, Rex M. Mech. Engr., Northern Electric Co. Ltd., Montreal. For mail: 2095 Lincoln Ave., Montreal. (S.1940. Jr.1946)
Freeman Robt. P. 2095 Lincoln Ave., Montreal. (A.M.1919. M.1940)
Freeman, W. A. 1 Maple Ave., Hamilton, Ont. (S.1946)
Fregeau, J. H. Divn. Mgr., Shawinigan Water & Power Co., Power Bldg., Three Rivers, Que. (A.M.1928. M.1940)
French, John K. Staff of D.M.E., N.D.H.Q., Ottawa. For mail: 495 Prince Arthur St. W., Montreal. (S.1939. Jr.1946)
French, Philip B. Sales Mgr., Ahlberg Bearings Canada Ltd., 4000 Namur St., Montreal. (S.1934. M.1940)
French, R. DeL. Prof. Highway & Munic. Engrg., Faculty of Engrg., McGill University, Montreal 2. (A.M.1913. M.1918)
Fricker, W. Roy Dist. Engr., Canadian Westinghouse Co. Ltd., Montreal. For mail: 4812 Madison Ave., Montreal. (A.M.1938. M.1940)
Friebel, W. A. Distribution Engr., Elec. Dept., City of Saskatoon. For mail: 602 Albert Ave., Saskatoon, Sask. (M.1943)
Friedman, Ferdinand J. Mech. Engr., McDougall & Friedman, 1235 McGill College Ave., Montreal. (A.M.1920. M.1923)
Frigon, Augustin Gen. Mgr., Canadian Broadcasting Corp., 1440 St. Catherine St. W., Montreal. (S.1907. A.M.1913. M.1931)
Frigon, E. R. 2495 Park Row East, Montreal. (S.1944)
Frigon Raymond A. Reg. Repr., Research & Devlpt. Branch, Dept. of Reconstruction & Supply, Montreal. For mail: 125 Pagnuelo Ave., Outremont, Montreal 8. (S.1937. Jr.1942)
Frigon, Rosario Cons. Engr., Papineau & Frigon, 60 St. James St. W., Montreal (M.1945)
Frisch, John Mech. Supt., Canadian International Paper Co., Temiskaming. For mail: 330 Ketchen St., P.O. Box 133, Temiskaming, Que. (M.1940)
Frisken, O. J. Asst. Engr., De Laval Co. Ltd., Peterborough. For mail: 607 Homewood Ave. W., Peterborough, Ont. (S.1926. Jr.1937)
Fritsch, K. H. Mech. Equipt. Engr., Trans Canada Air Lines, Hangar No. 2, Dorval, Que. (S.1943. Jr.1946)
Frith, Hugh W. Chief Engr., for Vancouver, National Harbours Board. For mail: 5362 Granville St., Vancouver, B.C. (A.M.1919. M.1925)
Frizzle, H. R. Costs Engr., Cables Conduits & Fittings Ltd., St. Johns. For mail: 312 Notre Dame St., St. Johns, Que. (S.1935. Jr.1946)
Frombach, M. F. Engr., Natural Sodium Products Ltd., Bishopric, Sask. (M.1946)
Fromson, Sam. Prod. Engr., Canadian Vickers Ltd., Montreal. For mail: 1226 Crescent St., Montreal. (S.1937. Jr.1939)
Frost, Clifford E. Engr., Chief Engr's Staff, Bell Telephone Co., Montreal. For mail: 62 Cardinal St., Ville St. Laurent. (A.M.1936. M.1940)
Frost, John G. Chief Engr., G. Lorne Wiggs & Co., Montreal. For mail: 3680 St. Urbain St., Montreal. (M.1943)
Frost, Louis Asst. Chief Mining Engr., Dominion Coal Co. Ltd., Sydney. For mail: Sydney River, Cape Breton, N.S. (M.1946)
Frost, Paul Joseph Chem. Engr., Prod. & Devlpt., Speer Carbon Co. Ltd., St. Mary's, Pa., U.S.A. (S.1941. Jr.1946)
Frost, Stanley R. North American Cyanimid Ltd., on loan to W.P.T.B., 1235 McGill College Ave., Montreal. (A.M.1919. M.1940)
Fry, A. E. Mech. Engr., Dominion Glass Co Ltd., Montreal. For mail: 37 Dufferin Road, Hampstead, Que. (A.M.1928. M.1940)
Fry, E. B. Overseas (A.M.1935. M.1940)
Fry, J. D. Partner, McDougall & Friedman, 1235 McGill College Ave., Montreal 2. (M.1945)
Fugère, Euclide Drainage Office, Quebec. For mail: 886 Chemin Ste-Foy, Quebec. (S.1944)
Fulcher, E. L. Dftsmn., Ontario Paper Co. Ltd., Thorold. For mail: 53 Church St., St. Mary's. Ont. (S.1946)
Fuller, Harold A. Tropical Oil Co Ltd., Cali, Colombia, South America. (Jr.1939. M.1942)
Fuller, Harold Paul Roadmaster, Canadian National Railways, North Battleford. For mail: 1381-98th St., North Battleford, Sask. (A.M.1919. M.1940)
Fuller Robt. W. 168 University St., Kingston, Ont. (S.1946)
Fullerton, Roland M. Project Engr., Station Section, Hydro-Electric Power Comm. of Ont., Toronto. For mail: 1 Beaufield Ave., Leaside, Toronto 12. (S.1946)

Fulton Edward A. Cons. Engr., 3 South Meramec Ave., St. Louis 5, Mo., U.S.A. (M.1940)
Fulton, F. F. Northern Electric Co. Ltd., Montreal. For mail: 452 Stanstead Road, Town of Mount Royal, Montreal 16. (S.1923. A.M.1934. M.1940)
Fultz, S. L. Asst. Chief Engr., Nova Scotia Power Commission, Halifax. For mail: 16 Cherry St., Halifax, N.S. (S.1919. Jr.1922. A.M.1926. M.1940)
Funk, John A. Instructor, University of Saskatchewan, Saskatoon, Sask. (S.1945)
Furanna, A. L. Engr., London Public Utilities Comm. For mail: 732 Wellington St., London, Ont. (S.1939 Jr 1942. M.1944)
Furlong, H. W. Strl. Engr., Stone & Webster Engineering Corp., Boston. For mail: 67 Cedar St., Wollaston, Mass. (A.M.1924. M.1940)
Furnival, G. M. Director of Mines, Manitoba Dept. of Mines & Natural Resources, 318a Law Courts Bldg, Winnipeg, Man. (M.1944)
Fyen, Roger Engr. Designer, Brouillet & Carmel, Cons. Engrs., Montreal. For mail: 4086 St. Hubert St., Montreal. (S.1944)
Fyfe, H. D. Plant Engr., Semet-Solvay Co., Buffalo. For mail: 106 Enola Ave., Kenmore 17, New York. (Jr.1912. A.M 1920. M.1940)
Fyfe, J. C. Res. Engr., Dept. of Highways, Regina. For mail: 21 Angus Cresc., Regina, Sask. (Jr.1944)
Fyfe Robt. John Mgr., R. J. Fyfe Equipment, 1148 Osler St, Regina, Sask. (A.M.1930. M.1940)
Fyshe, T. M. Cons. Engr., 200 Bay St., Toronto, Ont. (M.1935)
Fytche, Eugene L. 685 Charlotte St., Fredericton, N.B. (S.1946)

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Gabias, Pierre-Maurice 2407 Coursol St., Montreal. (S.1942)
Gaboury, L. F. Cons. Engr., 3708 Park Ave., Montreal. (M.1940)
Gaby, Frederick A. Exec. Vice-Pres., British American Oil Co., 1400 Royal Bank Bldg., Toronto. (M.1919)
Gads, Leonard E. Asst. Prof. Civil Engrg., University of Alberta, Edmonton, Alta. (S.1937. Jr 1941)
Gaffney, Oliver J. Design & Constrn. Engr., Ball Bros. Ltd., 49 King St. E., Kitchener, Ont. (S.1943. Jr.1946)
Gage, E. V. Pres., A. F. Byers Construction Co Ltd., 5675 Western Ave., Montreal 28. (S.1914. A.M. 1919. M.1940)
Gagné, J. Germain Plumbing & Heating, Granby. For mail: St-Cesaire, Rouville, Que. (S.1940)
Gagnon, Adrien (S.1942)
Gagnon, Elmore G. Equipt. Service Supt., Northern Electric Co. Ltd., Montreal. For mail: 1045 Mount Royal Blvd., Outremont, Que (S.1925. A.M.1937. M.1940)
Gagnon, Luc 10636 Laverdure St., Montreal 12. (S.1944)
Gagnon, Ludger Asst. City Engr., Quebec. (A.M.1935. M.1940)
Gagnon, Maximin 1708 Letourneux St., Montreal 4. (S.1944)
Gagnon, Paul 386 Wiseman Ave., Outremont, Que. (S.1942)
Gagnon, Paul E. Director, Dept. of Chem. Engrg., Laval University, Quebec. (M.1942)
Gahan, Hugh N. Designing & Strl. Engr., Dept. Public Works of B.C., Victoria. For mail: 265 Moss St., Victoria, B.C. (A.M.1909. M.1940)
Gaherty, G. A. Pres., Montreal Engineering Co. Ltd., P.O. Box 2400, Place d'Armes, Montreal. (A.M.1921. M.1940)
Galbraith, G. H. Mech. Engr., Shell Oil Co. of Canada, Calgary. For mail: P.O. Box 416, Bowness, Alta. (S.1943. Jr.1946)
Galbraith, John D. (S.1945)
Galbraith, John Head, Community Planning Divn., National Housing Administration, Ottawa. For mail: R.R. No. 1, York Mills, Ont. (S.1910. A.M 1917. M.1940)
Gale, Alfred V. Vice-Pres. & Gen. Mgr. Hull Electric Co., Hull. For mail: 117 Main St., Hull, Que. (A.M.1916. M.1940)
Gale, Fred T. Supt., Rural Electrification, Calgary Power Co. Ltd., 504 Insurance Exchange Bldg., Calgary, Alta. (Jr.1940 M.1943)
Gale, G. Gordon Pres. Gatineau Power Co. and E. B. Eddy Co., Ottawa. (A.M.1908. M.1916)
Gale, M. L. Strl. Engr. & Supvr. of Constrn., Armstrong & Monteith Construction Co. Ltd., Vancouver. For mail: 3176 W. 34th Ave., Vancouver, B.C. (A.M.1935 M.1940)
Gall, Wm. J. C. Jr. Chem. Engr., Canada & Dominion Sugar Co. Ltd., Chatham. For mail: 268a Victoria Ave., Chatham, Ont. (S.1946)
Gallaher, Ernest E. Dftsmn., Arthur Pearson, Cons. Engr., Vancouver. For mail: 25 E. 48th Ave., Vancouver, B.C. (S.1944)
Galler, Leon Atlas Construction Co., Montreal. For mail: 4869 Victoria Ave., Montreal. (A.M.1927. M.1940)
Galletly, James Simpson Engr. & Sec-Treas., Malvern Construction Co. Ltd., Toronto. For mail: 107-27th St., Long Branch, Ont. (A.M.1918. M.1940)
Galli, Joseph N. Reinf. Conc. Design., Foundation Co. of Canada, Montreal. For mail: 4951 Coronet Ave. (S.1941. Jr.1945)
Galloway, H. Sydney Jr. Engr., Canadian Industries Ltd., Plastics Works, Brownsburg. For mail: 5199 Gilbert Ave., Montreal 29. (S.1943)
Galloway, Leslie C. Engrg. Apptce., Canadian Westinghouse Co., Hamilton. For mail: 163 Jackson St. W., Hamilton, Ont. (S.1945)
Gamble, Clarke W. R.M.D. No. 1, Sidney, B.C. (S.1906. A.M.1909. M.1928)
Gamble, Samuel G. Topog. Engr., Bureau of Geology & Topography, Dept. Mines & Resources, Museum, Ottawa. (S.1933. Jr.1946)
Gandy, John M. 45 Seely St., Fredericton, N.B. (S.1945)
Gans, Nathan 77 Marie Anne W., Montreal 18. (S.1945)
Ganter, E. L. Mgr. for Cape Breton, Canadian General Electric Co., 512 George St., Sydney, N.S. (M.1945)
Gantz, A. 2051 University St., Montreal 2. (M.1945)
Garceau, J. Gilles Tech. Dept., Canadian Industries Ltd., Shawinigan Falls. For mail: 50-10th St., Shawinigan Falls, Que. (S.1943. Jr 1946)
Garcia, A. F. Asst. Reduction Plant Supt., Permanente Metals Corp., Mead Works, Spokane 14, Wash. (Jr.1945)
Gardner, A. C. Dist. Engr., Dept. of Public Works, Court House, Medicine Hat, Alta. (A.M 1922. M.1940)
Gardner, C. James Commodity Officer, Dept. Trade & Commerce of Canada, Ottawa. For mail: 667 Cumberland St., Ottawa. (M.1943)
Gardner, Donald Canadian General Electric Co. Ltd., New Liskeard, Ont. (Jr.1943)
Gardner, Wm. McG. Supt. of Constrn. & Mtce, Montreal Tramways Co., 159 Craig St. W., Montreal. (S.1916. Jr.1919. A.M.1923. M.1939)
Gareau, Eugène A. Sr. Tech., Shawinigan Water & Power Co., Rapide Blanc, Que. (S 1941. Jr.1946)
Gareau, Grégoire Prof., Faculty of Science, Laval University, Blvd. de L'Entente, Quebec. (S.1944. Jr.1946)
Gargas, John Jr. Dominion Engineering Works, Lachine. For mail: 6835 Iberville St., Montreal. (S.1944)
Gariépy, Jacques 34 Phipps St., Sorel, Que. (S.1944)
Garland, Cecil J. 74 Gordon St., Moncton, N.B. (S.1944)
Garland, H. R. (S.1945)
Garner, Albert Coleman Chief Surveyor, Land Titles Office of Sask. For mail: 2133 Cameron St., Regina, Sask. (S.1904. A.M.1908. M.1916)
Garner, A. G. Cons. Engr., 335 Douglas St., Stratford, Ont. (M.1945)
Garnett, Chas. E. Pres. & Mgr., Gorman's Ltd., 10238—104th St., Edmonton, Alta. (A.M.1931. M.1936)
Garon, Louis-Charles 3831 St. Denis St., Montreal. (S.1945)
Garrett, Cyril R.C.N.V.R., Overseas. (S.1940. Jr.1944)
Garrett, Julian Vice-Pres. & Gen. Mgr., Northwestern Utilities Ltd., 10124—14th St., Edmonton, Alta. (A.M.1907. M.1935)
Garrett, Richard H. Partner, Essex & Co., Vancouver. For mail: 1245 Haywood Ave., West Vancouver, B.C. (S.1939. Jr.1944)
Garrett, Roy W. Asst. City Engr., City Hall, London, Ont. (A.M.1923. M.1940)
Garriock, Mrs. L. A. 279 Pearl St., Port Arthur, Ont. (S.1946)
Garton, J. M. Imperial Oil Ltd., Sarnia, Ont. For mail: General Delivery, Sarnia, Ont. (S.1942. Jr.1945)
Garvin, Albert L. Dftsmn., Consolidated Mining & Smelting Co., Tadanac. For mail: 2156 Daniel St., Trail, B.C. (M.1945)
Garvock, A. G. 136 Lewis St., Ottawa. (S.1933. Jr.1946)
Gascon, Gérard 137 St. Louis St., Terrebonne, Que. (S.1944)
Gathercole, J. W. Plant Engr., Dominion Silk Dyeing & Finishing Co., Drummondville, Que. (S.1927. Jr.1931. A.M.1936. M.1940)
Gaudefroy, Henri Asst. to Dean, and Registrar, Ecole Polytechnique, 1430 St. Denis St., Montreal. (Jr.1934. M.1942)
Gaudet, Frederick M. 1455 Drummond St., Montreal. (M.1903)
Gaudette, Edgar City Engr., City Hall, St. John, Que. (M.1944)
Gaudette, Guy Marcel Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Gaudreau, Marcel Frédéric Engr., Eastn. Dist., L'Air Liquide Society, Montreal. For mail: 3861 Hochelaga St., Montreal. (S.1941. Jr.1946)
Gauer, Edward Private Practice, Land Surveyor & Munic. Engr., 275 Evanston St., Winnipeg, Man. (S.1924. A.M.1935. M.1940)
Gaulin, Jacques Chem. Engrg., Ayerst, McKenna & Harrison Co. Ltd., Ville St. Laurent. For mail: 4400 St. André St., Montreal. (M.1946)
Gauthier, E. A. 645 Querbes Ave., Outremont, Montreal. 8. (S.1942)
Gauthier, G. Albert Teacher. For mail: 171 St. Catherine St. W., Montreal. (S.1945)
Gauthier, Gaston-C. Mtce. Engr., Marine Industries Ltd., Sorel. For mail: P.O. Box 215 St. Joseph de Sorel, Que. (S.1939. Jr.1944. M.1945)
Gauthier, L. P. 3458 Belmore Ave., Montreal. (S.1945)
Gauthier, P. G. Cons. Engr. & Quebec Land Surveyor, 645 Querbes Ave., Outremont, Montreal 8. (S.1919. Jr.1922. A.M.1928. M.1935)
Gauthier, René Rural Electrif. Dept., Quebec Hydro-Electric Comm., Montreal. For mail: 5202 Trans-Island Ave., Montreal 29. (S.1936. M.1945)
Gauthier, Russel 4559 DeLanaudière St., Montreal 34. (S.1944)
Gauthier, Raymond C. Strl. Engr., Lalonde & Valois, 527 Canada Cement Bldg., Montreal. (S.1940. M.1944)
Gauvin, Hervé A. Supt., A. Belanger Ltd., Montmagny. For mail: P.O. Box 369 Montmagny, Que. (S.1925. Jr.1928. A.M.1937. M.1940)
Gauvin, Maurice 1272 Dorion St., Montreal 24. (S.1944)
Gauvreau, Charles-Aimé 7979 Drolet St., Montreal 10. (S.1944)
Gavan, J. L. 11911 Reed Blvd., Montreal (M.1945)
Gavlas, Edward H. R R. No. 1, Melville, Sask. (S.1940. Jr.1946)
Gawley, H. N. Box 69, Weyburn, Sask. (S.1943)
Gayfer, A. J. Box 1384, Kelowna, B.C. (A.M.1905. M.1916)
Gaymer, J. E. I. Lt.-Col., Elec. Industries Section, Control Commission for Germany. For mail: c/o Royal Bank of Canada, 2 Cockspur St., London S.W., England. (A.M.1939. M.1940)
Geale, C. N. Canal Supt., Dept. of Transport, Welland Ship Canal, Humberstone. For mail: 232 Clarence St., Port Colborne, Ont. (S 1915. A.M.1930. M.1940)
Geary, B. H. Transf. Design Engr., Canadian General Electric Co., Toronto. For mail: 18 Tichester Rd., Toronto 10. (S.1940. Jr.1946)
Geddes, A. B. Local Mgr., National Supply Co. Ltd., Calgary. For mail: 4716 Elbow Drive, Calgary, Alta. (M.1942)
Geddes, W. Robt. Mapping & Surveying, Variometer Surveys Ltd., 428-67 Yonge St., Toronto. (S.1944)
Geiger, D. G. Transm. Engr., Western Area, Bell Telephone Co. of Canada, 76 Adelaide St. W., Toronto. (S.1922. A.M 1928. M.1938)
Geldard, P. W. Asst. Engr. of Distribn. Consumers Gas Co., 19 Toronto St., Toronto. (Jr.1928. A.M.1932. M.1940)
Gélinas, Charles Edouard Engr., Supt. of Constrn., City of Montreal. For mail: 4053 Vendome Ave., Montreal. (A.M.1924. M.1940)
Gélinas, Emile Heating and Ventilg. Engr., J. A. Y. Bouchard, 97 Côte d'Abraham, Quebec. (S.1944)
Gélinas, Jean-Paul 1276 Marie-Anne E., Montreal 34. (S.1944)
Gendron, Henri General Electric Sociedad Anonima, Rio de Janeiro, Brazil S.A. (M.1944)
Gendron, Laurent 157 Sherbrooke St. E., Montreal 18. (S.1944)
Gendron, Lucien J. 334 Gouin Blvd. E., Montreal 12. (S 1942)
Genest, Adrien Traffic Engr., City Planning Dept., Montreal. For mail: 8518 Henri-Julien, Montreal 10. (M.1943)
Genet, J. E., Brig., Overseas. (A.M.1936. M.1940)
Genge, Gordon M. 1243 Davie St., Vancouver, B.C. (S 1946)
Genge, J. P. Service Engr., Combustion Engineering Corp. Ltd., 540 Dominion Square Bldg., Montreal. (S.1941)
Gent, W. J. Shawinigan Engineering Co. Ltd., Montreal. For mail: 1455 Drummond St., Montreal. (Jr.1940)
Gentles, Allan S. Mgr., Pacific Divn., Dominion Bridge Co. Ltd., P.O. Box 160, Vancouver, B.C. (M.1930)
George, J. D. Cons. Engr., 675 Oxford St., Toronto 14. (Jr.1937. A.M.1939. M.1940)
Gérin, Maurice Mgr., Diesel & Pump Divns., Canadian Fairbanks-Morse Co. Ltd., Montreal. For mail: 1740 Ducharme Ave., Outremont, Que. (Jr.1923. A.M.1932. M.1940)
Gérin-Lajoie, Pierre 58 Elmwood Ave., Montreal 8. (S.1944)
Germain, Walter E. Chief Dftsman., Hill-Clark-Francis Ltd., New Liskeard, Ont. (Jr.1944)
German, A. M. Asst. Mgr. & Gen. Supt., Canadian Dredging Co. Ltd., 302 Harbour Commission Bldg., Toronto. (M.1934)
German, Horace Henry Naval Architect, German & Milne, 1010 St. Catherine St. W., Montreal. (M.1939)

Gerow, C. Dist. Mgr., Coal Sales, Dominion Coal Co. Ltd., 217 Bay St., Toronto. (A.M.1931. M.1940)
Gerrard, James H. Instrmn., Foundation Co. of Canada, Baie Comeau, Que. (S.1943. Jr.1946)
Gerrish, Arnold H. Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (S.1943)
Gershfield, Max. Sr. Plant Clearance Inspr., War Assets Corporation, Regina. For mail: 371 College Ave., Winnipeg, Man. (S.1937. Jr.1940)
Gershuny, Mitchell Elec. Engr., Standard Electric Co. Ltd., 77 Victoria St., Toronto. (S.1945)
Gersovitz, B. Designer & Detailer, Truscon Steel Co. of Canada, Montreal. For mail: 3010 Westmount Blvd., Montreal 6. (M.1945)
Gersovitz, Frank 3980 Cote des Neiges Rd., Montreal (S.1930. Jr.1938)
Gervais, Aimé Engr., Provincial Electricity Board, 132 St. James St. W., Montreal. (S.1936. Jr.1940. M.1945)
Giachino, D. M. Mining Engr., P.O. Box 697, Noranda, Que. (M.1945)
Giauque, Louis F. Mech. Engr., Spruce Falls Power & Paper Co., Kapuskasing. For mail: 8 Empire Ave., Kapuskasing, Ont. (S.1941. Jr 1942. M.1945)
Gibb, Sir Alexander Sr. Partner, Sir Alexander Gibb & Partners, Cons. Civil Engrs., Queen Anne's Lodge, Westminster, London, S.W.1, England. (M.1932. Hon. M.1937)
Gibb, R. J. 9337-93rd Ave., Edmonton, Alta. (A.M 1910. M.1914)
Gibbon, H. S. V. 4880 Westmount Ave., Montreal 6. (Jr.1927. A.M.1939. M.1940)
Gibbs, Maxwell Cons. Engr., 1927 W. 6th St., Los Angeles 5, Calif., U S.A. (M.1945)
Gibeau, H. A. Dir., Dept of Public Works, City of Montreal. For mail: 5618 Phillips Ave., Montreal 26. (A.M.1915. M.1940)
Gibson, C. M. Chief Engr., Forano Ltd., Montreal. For mail: 129 Dobie Ave., Town of Mount Royal, Que. (M.1942)
Gibson, D. H. Engr. Rep., Canadian Military Mission, Washington. For mail: c/o Col. Colin Gibson, 22 Homewood Ave., Hamilton, Ont. (Jr.1946)
Gibson, John McIntyre Bridge & Strl. Engr., Dept. of Highways of Ontario, Toronto. For mail: 154 Wright Ave., Toronto. (Jr.1914. A M.1919. M.1940)
Gibson, Norman R. Vice-Pres. & Dir., Buffalo Niagara Electric Corp., 600 Electric Bldg., Buffalo, N.Y., U.S.A. (A.M.1907. M.1921)
Gibson, Philip E. 477 Prince Arthur St. W., Montreal (S.1943)
Gibson, R. F. Jr. Engr., Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (S.1943. Jr.1945)
Gibson, Ronald T. Jr. Stress Analyst, Glenn L. Martin Co., Baltimore. For mail: 4001 Garrison Blvd., Baltimore 15, Md., U.S.A. (S.1944)
Gidney, Samuel J. Mink Cove, Digby, N.S. (S.1945)
Gifford, Francis Darrell Sr. Res. Engr., Air Services, Civil Aviation, Dept. of Transport, Hamilton. For mail: 1008 Copeland St., North Bay, Ont. (Jr.1922. A.M.1927. M.1940)
Gignac, Jean-Paul 3483 Laval St., Montreal. (S.1944)
Gilbert, Edgar 291 Notre Dame St., Thetford Mines, Que. (S.1944)
Gilbert, Edgar V. Sr. Asst. Engr., Dept. Public Works of Canada, 1002 Union Trust Bldg., Winnipeg, Man. (S.1920. Jr.1924. A.M.1928. M.1940)
Gilbert, G. M. Greater Vancouver Water District, Sun Bldg., Vancouver, B.C. (A.M.1934. M.1935)
Gilbert, Marc Cons. Engr., 5 Bois Joli St., Quebec. (M.1945)
Gilchrist, John Chief Engr., Somerville Ltd., London, Ont. (Jr.1934. A.M.1937. M.1940)
Gilchrist, T. E. Elec. Engr., Canadian General Electric Co., Peterborough. For mail: 168 Brock St., Peterborough, Ont. (A.M.1919. M.1940)
Giles, Drummond Exec. Vice-Pres., Courtaulds (Canada) Ltd., Cornwall, Ont. (Jr.1929. M.1939)
Giles, J. O. E. Inspr. High Pressure Equipt., Imperial Oil Ltd., Sarnia, Ont. (S.1937. Jr.1941)
Gill, J. Emile Asst. Engr., Quebec Streams Commission, Montreal. For mail: 5353 Monkland Ave., Montreal. (M.1940)
Gillean, Ian Jr. Engr., Devlpt. Dept., Canadian Marconi Co., Town of Mount Royal, Que. For mail: 104 Beaudet St., Ville St. Laurent, Que. (Jr.1946)
Gillett, George Herbert Sales Engr., Canadian General Electric Co. Ltd., 1000 Beaver Hall Hill, Montreal. (S.1924. A.M.1936. M.1940)
Gillies, Jas. R. Asst. Outside Plant Engr., New Brunswick Telephone Co. Ltd., Saint John. For mail: 237 Duke St., Saint John, N.B. (S.1944)
Gillis, Harold G. Sub. Lieut. (E), R.C.N.V.R. For mail: Whycocomagh, Inverness Co., N.S. (S.1944. Jr.1946)
Gilmore, John Beaton's Mills, P.E.I. (S.1946)
Gilmore, Ross E. A/Chief, Divn. of Fuels, Dept. of Mines & Resources, Fuel Research Laboratory, 562 Booth St., Ottawa. (M.1926)
Gilmour, Stuart S. Mining Engr., W. B. Milner, Vancouver. For mail: 4443 West 3rd Ave., Vancouver, B.C. (Jr.1940)
Gilmour, Wm. A. Sec., Walter G. Hunt Co. Ltd., Montreal. For mail: 118 Dobie Ave., Town of Mount Royal, Que. (M.1945)
Gilmour, W. A. T. Chief Engr., Smart-Turner Machinery Co. Ltd., 191 Barton St. E., Hamilton, Ont. (S.1924. Jr.1930. A.M.1936. M.1940)
Gingras, Marcel Plant Supt., Canadian Bituminous Co. Ltd., 11451 Sherbrooke St. E., Montreal East, Que. (S.1944)
Gingras, R. H. Volcano Ltd., St. Hyacinthe. For mail: 1710 Duvernay St., St. Hyacinthe, Que. (S.1943)
Girard, Arnold T. Mech. Engr., Brown Corporation, La Tuque. For mail: 99 Castelneau St., La Tuque, Que. (Jr.1944)
Girard, Roger Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Girdwood, Arthur J. Designing Engr., Canadian General Electric Co. Ltd., Peterborough. For mail: 493 Thompson Ave., Peterborough, Ont. (S.1931. Jr.1936. M.1945)
Girouard, Laurent Cons. Engr., J. A. Lalonde & Co., 958 Dunlop Ave., Montreal 8. (S.1940. Jr.1943)
Giroux, Léopold Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1942)
Giroux, Maurice Valuation Engr., Cherrier Plant, Canadian Arsenals Ltd., St. Paul l'Hermite. For mail: 8113 St. Gérard St., Montreal. (A.M.1939. M.1940)
Gisborne, Hartley 288 East 23rd Ave., Vancouver, B.C. (A.M.1887. M.1892)
Gisborne, L. L. Works Supt., Mtce. & Design, Niagara Parks Commission. For mail: 1811 Prince Edward Ave., Niagara Falls, Ont. (A.M.1919. M.1940)
Gislason, S. I. Asst. Design Engr., Defence Industries Ltd. For mail: 12391 Reed St., Cartierville, Que. (Jr.1938. M.1942)
Gladney, W. E. Asst. Examiner of Plans, Factory Inspection Branch, Dept. of Labour of Ontario, Toronto. For mail: 131 Stibbard Ave., Toronto 12. (S.1944. Jr.1946)
Glance, Earl I. Cons. Engr., Montreal. For mail: 806 McEachran Ave., Montreal 8. (Jr.1940)
Glassman, Alex 1584 Badeaux St., Three Rivers, Que. (S 1944)
Glen, L. André Asst. Engr. to Plan Examiner, Bldg. Inspt. Dept., City of Montreal. For mail: 4459 Des Erables St., Montreal. (S.1942. Jr.1946)
Glenn, C. H. 655 Mulvey Ave., Winnipeg, Man. (S 1941. Jr.1946)
Glenn, D. J. 17 Eastbourne Crescent, Mimico, Toronto 14. (S.1946)
Glenn, Jack B. Sales Engr., Dietrich & Collins Ltd., 890 S.W. Marine Drive, Vancouver, B.C. (Jr.1941)
Glickman, Saul 55 Charlotte St., Sydney, N.S. (S.1945)
Gliddon, W. G. Claude Chief Engr., Gatineau Power Co., 140 Wellington St., Ottawa, Ont. (A.M.1930. M.1940)
Glover, T. Stanley Ferres Advertising Service, Hamilton. For mail: Port Nelson, Ont. (S.1914. Jr.1922. A.M.1926. M.1940)
Glynn, Walter S. Jr. Strl. Engr., Chapman, Oxley, Facey, Marani & Morris, Toronto. For mail: 126 St. Helen's Ave., Toronto 4. (S.1942)
Gnaedinger, J. B. Mining Engr., Aluminum Works Ltd., 1700 Sun Life Bldg., Montreal. (M.1945)
Goby, Thomas Sales Mgr. for Indiana, Armco Drainage & Metal Products Inc., Indianapolis. For mail: R.R. No 3, Bloomington, Ind., U.S.A. (S.1921. Jr.1931. A.M.1934. M.1940)
Godbout, Adolphe G. (S.1941)
Godbout, Serge Road Constrn, Dept. of Mines, Quebec. Box 568 Val d'Or, Que. (S.1944)
Goddard, A. R. 687 Beresford Ave., Winnipeg, Man. (S.1937. Jr.1942)
Goddard, R. W. 105 Ronan Ave., Toronto. (S.1946)
Godfrey, J. A. Supvr. of Apptces., Atlantic Region, Canadian National Railways, Moncton. For mail: 163 Dominion St., Moncton, N.B. (A.M.1939. M.1940)
Godfrey, John K. Distribn. Supt., Truro Elect. Comm. For mail: 44 Smith Ave., Truro, N.S (M.1940)
Godfrey, W. R. Supt. Water & Sewerage, City of Saint John, 74 Carmarthen St., Saint John, N.B. (Jr.1938. M.1944)
Godin, Camille R. Asst. Prof. Maths., Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (M 1944)
Godin, Hubert F. 153 Maplewood Ave., Outremont, Que. (S.1946)
Gohier, Ernest Chief Engr., Dept of Roads, Quebec. For mail: 1321 Sherbrooke St. W., Montreal. (M.1934)
Gohier, R. E. Gas Distribn. Dept., Quebec Hydro-Electric Comm, Montreal. For mail: 241 Simcoe Ave., Town of Mount Royal, Montreal 16. (S.1937. Jr.1942)
Gold, M. T. 3295 Ridgewood Ave., Montreal. (S.1943. Jr.1946)
Gold, Wm. J. Power Line Engr., Calgary Power Co. Ltd., 504 Insurance Exchange Bldg., Calgary, Alta (S.1933. Jr.1936. M.1940)
Goldenstein, A. (Affil.1942)
Golding, A. C. Res. Engr., Dept. of Transport, P.O. Box 38, Moncton, N.B. (M.1942)
Goldman, H. A. 1125 Lajoie Ave., Outremont, Que. (Jr.1915 A.M.1918. M.1940)
Goldwag, David Cons. Mech. Engr., 1290 Bernard Ave., Outremont, Que. (M.1944)
Goleman, Robt. 974 West 16th Ave., Vancouver, B.C. (S.1944)
Gooch, Peter W. Chief Engr., Canadair Ltd., Montreal. For mail: 5581 Bradford Place, Montreal 26. (M 1946)
Good, Earl F. Strl. Engr., Canadian Kodak Co. Ltd., Toronto. For mail: 2520 Bloor St. W., Toronto. (S.1920. A.M.1930. M.1940)
Goodall, D. P. Admin, Petroleum & Natural Gas Conservation Board, 514-11th Ave. West, Calgary, Alta. (M.1941)
Goodall, E. Lorne Mgr. & Engr., Provincial Paper Ltd., Port Arthur, Ont. (S.1924. Jr.1929. A.M.1934. M.1940)
Goode, J. D. 178 Cote St. Antoine Rd., Montreal 6, Que. (S.1946)
Goodfellow, Hodgson Major D.E.M.E., M.D. No. 10, Winnipeg, Man. (S.1939)
Goodfellow, J. Bruce G. Fire Protn. Engr., Grinnell Co. of Canada Ltd., Montreal. For mail: 134 Cornwall Ave., Town of Mount Royal, Que (S.1942)
Goodman, H. B., H. E. McKeen & Co. Ltd., Montreal. For mail: 5653 Hutchison St., Montreal 8. (S.1928. Jr.1937)
Goodman, J. E. Pres., J. E. Goodman Sales Ltd., Toronto. For mail: 64 Walmsley Blvd., Toronto. (Jr.1931. A.M.1934. M.1940)
Goodspeed, Frederick G. Suptg. Engr., Dept. Public Works of Canada, Hunter Bldg., Ottawa. (A.M.1909. M 1918)
Goodspeed, H. N. Mtce. Elec., International Nickel Co., Carson, Ont. (S.1934. Jr.1941)
Goodwin, E. A. Asst. Mech. Engr., Montreal Engineering Co Ltd., 244 St. James St. W., Montreal. (A.M.1934. M.1940)
Goodwin, F. L. Jr. Geol. Asst., Ontario Dept. of Mines, Geraldton. For mail: 133 King St. E., Kingston, Ont. (S.1946)
Goodwin, Martin Jerome Bldg. Contractor & Engr., 3515 Durocher St., Montreal. (S.1945)
Goor, J. H. 116 Wellington Crescent, Winnipeg, Man. (S.1946)
Gordon, A. Dept of Transport, P.O. Box 38, Moncton, N.B. (M.1942)
Gordon, Abraham I. 736 McEachran Ave., Montreal 8. (S.1941)
Gordon, A. I. E. Designing Engr., City of Vancouver. For mail: 578-West 23rd Ave., Vancouver, B.C. (M.1944)
Gordon, C. Howard Vice-Pres. & Mng. Dir., Atlas Construction Co. Ltd., 679 Belmont St., Montreal, Que. (Jr.1925. A M.1931. M. 1940)
Gordon, H. C. M. Pres & Gen. Mgr., Acadia Coal Co. Ltd., & Old Sydney Collieries Ltd., Stellarton, N.S. (Jr.1924. M.1945)
Gordon, H. J. Asst. Engr., Canadian Pacific Railway, Windsor Station, Montreal. (S.1933. Jr.1938)
Gordon, I. P. Engrg. Dept., Canadair Ltd., Box 6087, Montreal. (S.1943. Jr.1946)
Gordon, John Elec. Engr., Canadian National Railways, Union Station, Winnipeg, Man. (A.M.1920 M.1940)
Gordon, John A. Engr., Canadian General Electric Co. Ltd., Peterborough, Ont. (S.1941. M.1946)
Gordon, J. E. (S.1935)
Gordon, J. Keith Strl. Engr., Dominion Structural Steel Ltd., Ottawa. For mail: 268 Sunnyside Ave, Ottawa. (S.1943)
Gordon, James Patton Sidewalk & Pole Location Engr., City of Hamilton. For mail: 133 Hyde Park Ave., Hamilton, Ont. (S.1907. A.M.1913. M.1940)
Gordon, Lynn M. 203 St. Paul St. W., Kamloops, B.C. (S.1942)
Goring, G. R. Asst. Divn. Engr., Consolidated Paper Corp., Grand'Mere, Que. (M.1945)
Gorman, John Alvin Asst. Engr., New Brunswick Electric Power Commission, Newcastle Creek. For mail: Minto, Queen's Co., N.B. (M.1944)
Gorman, J. J. Res. Engr., Civil Aviation Dept., Moncton, N.B. (M 1942)
Gorman, Wm. E. Company Engr., Standard Paving Maritime Ltd., Lady Hammond Road, Halifax, N.S. (M.1945)
Gorowski, Chas. S. 961 Broadview Ave., Toronto 6. (Jr.1941. M.1945)
Gosh, Eugene 539 Albert St., Kingston, Ont (S.1946)
Gosset, Max Emile Engrg. Asst., Bell Telephone Co. of Canada, Montreal. For mail: 7430 Durocher St., Montreal. (S.1944. Jr.1946)
Gougeon, Elzéar N. Works Mgr. & Engr., Dominion Containers Ltd., 6240 Park Ave., Montreal 8. (M.1944)

Gould, Jack Exec. Asst. to Chief Engr., Gas Turbine Divn., A. V. Roe Canada Ltd., Malton. For mail: 192 Prince Edward Drive, Toronto 9. (A.M.1939. M.1940)
Gould, W. Murray Pres., Standard Construction Co. Ltd., 10 Upper Water St., Halifax, N.S. (M.1945)
Goulet, Emile Cons. Engr., 578a Lindsay St., Drummondville, Que. (M.1945)
Goulet, Gaston Rm. 627, Y.M.C.A., 1441 Drummond St., Montreal 25. (S.1944)
Gourdeau, Guy 3377 St. Urbain St., Montreal. (S.1946)
Gove, Harry E. Jr. Research Physicist, National Research Council, Chalk River. For mail: 1014 Portage Road, R.R. No. 3, Niagara Falls, Ont. (S.1943. Jr.1946)
Gow, Kenelm V. Plant Devlpt. Engr., Aluminum Co. of Canada Ltd., Arvida. For mail: Saguenay Inn, Arvida, Que. (Jr.1944)
Gow, William University of Manitoba, Winnipeg, Man. (S.1946)
Grabill, Dayton L. Plant Mgr., Johnson & Johnson Ltd., 7101 Notre Dame St., Montreal, Que. (M.1945)
Graeb, J. W. Instrument Engr., Polymer Corporation Ltd., Sarnia. For mail: 290 George St., Sarnia, Ont. (M.1946)
Graham, Andrew George Supvr., Regional Planning Divn., Bureau of Reconstruction of B.C., Parliament Bldgs., Victoria, B.C. (A.M.1919. M.1940)
Graham, Frank C. Asst. City Engr., Port Arthur. For mail: 157 College St., Port Arthur, Ont. (A.M.1921. M.1940)
Graham, George Irish & Maulson Ltd., 20 Victoria St., Toronto. (Jr.1937. M.1941)
Graham, Harry M. Instr., University of Saskatchewan, Saskatoon, Sask. (S.1944)
Graham, Kenneth C. Pres & Gen. Mgr., National Light & Power Co. Ltd., Moose Jaw For mail: 1031-Fifth Ave. N.W., Moose Jaw, Sask. (A.M.1939. M.1940)
Graham, Osmond Res. Engr., Constrn. Sewage Pumping Station, Arthur Surveyer & Co., 6 St. Andrew St., Quebec. (M.1945)
Graham, R. J. 506 Sanford Ave., St. Lambert, Que. (S.1940. Jr.1946)
Graham, V. A. 3292 Notre Dame St., Lachine, Que. (S.1945)
Graham, W. D. Asst. Chief Operator, Nova Scotia Power Commission, P.O. Box 34, Antigonish, N.S. (M.1942)
Graham, Walter P. Tech. Serv. Engr., Lubrication, Imperial Oil Ltd., Battery Point, Sydney, N.S. (M.1943)
Graham, W. W. Shawinigan Engineering Co., Montreal. For mail: 5995 Terrebonne Ave., Montreal. (S.1923. Jr.1928. A.M.1935. M.1940)
Grahame, F. B. P.O. Box 246, University of Manitoba, Winnipeg, Man. (S.1946)
Gramoli, L. Asst. Engr., Canada Malting Co. Ltd., 5022 St. Ambroise St., Montreal. (S.1944)
Grandmont, Bruno Dist. Engr., Dept. Public Works of Canada, P.O. Box 430, Upper Town, Quebec. (S.1913. A.M.1917. M.1940)
Grange, E. R. Vice-Pres., Delamere & Williams Ltd., Pres., Machinery Designs & Rentals Ltd., and Sec. Treas. Vacu-Draft Ltd., 18-32 Hook Ave., Toronto. (S.1914. A.M.1922. M.1940)
Granger, A. Dominion Bridge Co. Ltd., 1266 Haro St., Vancouver, B.C. (A.M.1921. M.1940)
Granger, J. M. Fraser-Brace Engrg. Co., 360 St. James W., Montreal. (M.1945)
Granich, Jos. E. Inspr., Automatic Plant, Western Lines, Communications Dept., Canadian Pacific Railway, 368 Main St., Winnipeg, Man. (M.1940)
Gransaull, L. R. Land Surveyor, St. Joseph, Trinidad, B.W.I. (S.1905. A.M.1911. M.1940)
Gransaull, Paul Roderick Road Officer, Tacarigua Local Road Board, Trinidad. For mail: "Paspebiac", Tunapuna, Trinidad, B.W.I. (S.1905. A.M.1911. M.1940)
Grant, Alex. G. Engrg. Designer, Hydro-Electric Power Commission of Ont., Toronto. For mail: 54 Golfdale Road, Toronto 12. (S.1927. Jr.1930. A.M.1938. M.1940)
Grant, Alex. J., Sr. 66 Rosemount Crescent, Westmount, Que. (A.M.1891. M.1901)
Grant, Alex. J., Jr. Pres., Grant-Mills Ltd., Montreal. For mail: 66 Rosemount Crescent, Westmount, Que. (S.1925. Jr.1931. A.M. 1938. M.1940)
Grant, Eric Sr. Dftsmn., Gas Distribution, Quebec Hydro-Electric Commission, 107 Craig St. W., Montreal. (Jr.1935. A.M.1938. M.1940)
Grant, Frank A. 95-54th Ave., Lachine, Que. (S.1940. Jr.1946)
Grant, Gordon 334 Russell Hill Road, Toronto 5. (A.M.1898. M.1906)
Grant, J. R. Cons. Engr., 500 Beatty St., Vancouver, B.C. (S.1903. A.M.1911. M.1914)
Grant, L. F. Assoc. Prof., Queen's University, and Royal Military College, Kingston. For mail: 105 Gore St., Kingston, Ont. (S.1908. A.M.1913. M.1927)
Grant, P. Stuart 3581 University St., Montreal 2. (S.1945)
Grant, R. E. 1815-A, 8th Ave., South Lethbridge, Alta. (S.1943. Jr.1946)
Grant, W. J. Gen. Supvn. of Oil & Gas Testing, British American Oil Co. Ltd., Toronto. For mail: 95 Symington Ave., Toronto. (S.1946)
Grant, Wilfrid J. 731 Notre Dame W., Montreal. (S.1921. Jr.1931. M.1942)
Granville, F. X. Serv. & Research Engr., Aluminum Laboratories Ltd., P.O. Box 84, Kingston, Ont. (S.1930. A.M.1939. M.1940)
Gratton, Alphonse Asst. Chief Engr., Quebec Roads Dept., Montreal. For mail: 469 Clarke Ave., Westmount, Montreal 6. (M.1935)
Gratton, Jean 4537 Parthenais St., Montreal 34. (S.1944)
Grav, B. Plant Engr., Canadian International Paper Company, Temiskaming, Que. (A.M.1927. M.1940)
Gravel, Charles-Edouard Civil Engr., Fabius Ruel, Montreal. For mail: 121 Blvd. Levesque, Abord-à-Plouffe, Co. Laval, Que. (S.1943)
Gravel, Maurice Divn. Engr., Dept. of Roads of Quebec, New Carlisle, Bonaventure Co., Que. (Jr.1941. M.1945)
Graves, Arthur H. 167 Hopewell Ave., Ottawa. (S.1945)
Graves, H. B. R. 1230 Argyle Ave., West Vancouver, B.C. (S.1943)
Gray, Alex 28 Garden St., Saint John, N.B. (A.M.1907. M.1916)
Gray, C. J. Lighting Engr., Canadian General Electric Co., Toronto. For mail: 1520 Bathurst St., Toronto 10. (S.1939. Jr.1946)
Gray, Donald A. Engr., English Electric Co. of Canada Ltd., Montreal. For mail: 4827 Melrose Ave., Montreal 29. (M.1945)
Gray, F. W. 759 Mountjoy Ave., Victoria, B.C. (A.M.1921. M.1924)
Gray, Harry Alden Res. Engr., Prov. Dept. of Mines, Quebec. For mail: Cote à Gignac (Sillery), Quebec. (Jr.1937. M.1941)
Gray, J. J. Chief Inspr. of Steam Boilers, Dept. of Labour of N.S., Highways Mechanical Bldg., Halifax, N.S. (M.1940)
Gray, J. J. Robt. Chem. operator, Naugatuck Chemicals, Elmira, Ont. For mail: 168 Woburn Ave., Toronto 12. (S.1946)
Gray, J. Lorne Montreal Armature Works Ltd., 276 Shannon St., Montreal 3. (S.1938. M.1940)
Gray, Nesbit Sub-Station Design & Supvn. of Constrn., Shawinigan Water & Power Co., Three Rivers, Que. (M.1941)
Gray, R. J. Metallurgical Research, Consolidated Mining & Smelting Co., Trail. For mail: 1436 Ash St., Trail, B.C. (S.1946)
Gray, Samuel Wilson Engr., Nova Scotia Power Commission, Hollis St., Halifax, N.S. (A.M.1920. M.1940)
Gray, Walter D. Hydraulic Engr., P.F.R.A., Dom. Dept. of Agriculture, Eskine, Alta. For mail: P.O. Box 66, Stettler, Alta. (M.1940)
Gray, Wilfrid J. Distribn. Supt. & Safety Engr., Canadian Western Natural Gas Co., 215-6th Ave. W., Calgary, Alta. (M.1941)
Gray, Wm. M. 3581 Price St., Vancouver, B.C. (S.1946)
Graydon, Edgar Ross Chief Designing Engr., Ontario Divn., Dominion Bridge Co. Ltd., Toronto. For mail: 82 Hillcrest Drive, Toronto. (M.1942)
Gray-Donald, E. Donald Chief Engr., Quebec Power Co. & Quebec Railway Light & Power Co., P.O. Box 1607 Quebec. (S.1922. Jr.1926. A.M. 1934. M.1939)
Gréber, Jacques H. Consultant to the National Capital Planning Committee, Ottawa. For mail: Rideau Club, Ottawa. (M.1939)
Green, Claude Elson Plant Engr., Merck & Co. Ltd., Montreal. For mail: 7551 Querbes Ave., Montreal. (S.1940. Jr.1946)
Green, Donald H. International Equipment, 360 St. James St. W., Montreal. (S.1944)
Green, Frank Compton Surveyor General of B.C. For mail: 347 Foul Bay Road, Victoria, B.C. (M.1914)
Green, G. H. 446 Ave. T. South, Saskatoon, Sask. (S.1943)
Green, John Cons. Engr., 1915 West 14th Ave., Vancouver, B.C. (M.1936)
Green, J. J. Chief Research Aeron. Engr., Air Transport Board, Ottawa. For mail: 85 Union St., Ottawa. (M.1945)
Green, John S. P.O. Box 127 Hagersville, Ont. (S.1931. Jr.1941. M.1944)
Green, Leonard Sales Engr., Crane Ltd., Calgary. For mail: 738 Boulevard N.W., Calgary, Alta. (A.M.1923. M.1940)
Greenaway, N. E. 24 East Boulevard, Eburne, B.C. (S.1945)
Greenberg, Louis Engr. & Contr., New York City. For mail: 123 West 57th St., New York 19, N.Y. (S.1892. A.M.1899. M.1940)
Greene, John F. Ford, Bacon & Davis Inc., 39 Broadway, New York, N.Y. (A.M.1918. M.1919)
Greene, Michael S. Asst. to Sales Devlpt. Mgr., Dominion Bridge Co. Ltd., P.O. Box 280, Montreal. (S.1944. Jr.1946)
Greene, P. W. Designing Engr., Parsons, Brinckerhoff, Hogan & Macdonald, New York. For mail: P.O. Box 807, Denville, N.J., U.S.A. (S.1908. A.M.1912. M.1940)
Greenfield, Paul N. 496 Anderson Ave., Winnipeg, Man. (S.1946)
Greening, E. O. 10351-73rd Ave., Edmonton, Alta. (A.M.1931. M.1940)
Greenlaw, J. W. Cons. Engr. & Partner, Greenlaw & Trott, 301 Electric Railway Chambers, Winnipeg, Man. (M.1945)
Greenlees, A. A. 153 Wortley Road, London, Ont. (S.1946)
Greenlees, T. C. 153 Wortley Road, London, Ont. (S.1946)
Greenwood, F. D. Mech. Engr. & Designer, Chromium Mining & Smelting Corp. Ltd., Sault Ste. Marie. For mail: 40 Coulson Ave., Sault Ste. Marie, Ont. (S.1928. Jr.1935)
Gregg, D. Garrett 67 Willow St., Truro, N.S. (S.1944)
Gregg, E. E. Private Practice, Forest Engr., 709 Metropolitan Bldg., Vancouver, B.C. (M.1945)
Gregg, J. W. Petrol. Engr., Denton-Spencer Co. Ltd., 206 Lancaster Bldg., Calgary, Alta. (Jr.1946)
Grégoire, A. E. Quebec Streams Commission, Montreal. For mail: 3674 Hochelaga St., Montreal. (S.1935. A.M.1939. M.1940)
Gregor, Michael (M.1938)
Gregory, Art. H. (S.1939)
Gregory, Alex Watson Asst. Engr., Dept. Public Works of Canada, Federal Bldg., Halifax, N.S. (Jr.1912. A.M.1919. M.1940)
Gregory, John 8232-101st St., Edmonton, Alta. (S.1945)
Gregory, P. G. Canadian International Paper Co., Gatineau Mills, Que For mail: 12 Tormey St., Ottawa. (S.1944)
Gregory, Philip S. Vice-Pres. i/c Power Sales, Shawinigan Water & Power Co., Montreal. For mail: 1227 Sherbrooke St. W., Montreal. (A.M.1920. M.1925)
Greig, Alex. R. University Grounds, Saskatoon, Sask. (S.1895. A.M.1909. M.1919)
Greig, J. M. M. Designer, Sanborn & Bogert, New York. For mail: 101 Fairview Ave., Port Washington, L.I., N.Y. (A.M.1913. M.1940)
Greig, Wm. B. Asst. City Engr., City Hall, Vancouver, B.C. (A.M.1911. M.1940)
Grenier, Francois Asst. Project Engr., Rolland Paper Co., St. Jérome. For mail: 5340 Mentana St., Montreal 34. (S.1941)
Grenier, Guy Strl. Designer, Foundation Co. of Canada, Montreal. For mail: 4251 Delorimier Ave., Montreal. (S.1942. Jr.1946)
Grenier, Pierre 142 Brown Ave., Quebec. (S.1945)
Grenon, John F. Cons. Engr., 38 Chemin St. Louis, Quebec. (S.1907. A.M.1909. M.1940)
Grenon, Jean-Joseph Dist. Engr., Dept. of Colonization, Chicoutimi. For mail: 2 St. Charles St., Chicoutimi, Que. (S.1944)
Grenzebach, S. L. 198 St. Leonards Ave., Toronto. (S.1920. A.M.1927. M.1940)
Grey, N. W. (M.1942)
Grieve, John Sales Promotion Mgr., Imperial Varnish & Color Co. Ltd., Morse St., Toronto. (S.1909. A.M.1915. M.1923)
Griesbach, B. Constrn. Supt., Foundation Co. of Canada Ltd., 1538 Sherbrooke St. W., Montreal. (S.1923. A.M.1927. M.1940)
Griesbach, Robt. J. Designing Engr., Arthur Surveyer & Co., Cons. Engrs., Ciba Bldg., McGill College Ave., Montreal. (S.1942. Jr.1945)
Griesbach, Walter Chief Engr., Foundation Co. of Canada Ltd., Sherbrooke St. W., Montreal. (S.1912. Jr.1916. A.M.1922. M.1940)
Griffin, Augustus Mgr., Dept. of Natural Resources, Canadian Pacific Railway, Calgary, Alta. (M.1925)
Griffin, Frank F. Elec. Engr., Winnipeg Electric Company, 610 Electric Railway Chambers, Winnipeg, Man. (S.1907. A.M.1913. M.1940)
Griffin, Geo. J. 111 Cornwall Ave., Montreal 16. (S.1946)
Griffin, G. W. Asst. Engr., Canadian Pacific Railway, Saint John, N.B. (M.1942)
Griffin, V. O. Indust. Engr., Tire & Tube Divn., B. F. Goodrich Rubber Co. of Canada, Kitchener. For mail: 245 Highland Road, Kitchener, Ont. (S.1940. Jr.1946)
Griffiths, Garth Asst. Engr., British Columbia Power Commission, Box 606, Victoria, B.C. (M.1946)
Griffiths, George E. Asst. Meter & Relay Engr., Hydro Electric Power Comm. of Ont., Niagara Falls. For mail: Box 385, Thorold, Ont. (A.M.1933. M.1940)
Griffiths, Geo. G. Head, Constrn. Divn., L'Air Liquide Society, 1111 Beaver Hall Hill, Montreal 1. (S.1935. M.1945)
Griffiths, Geo. M. 24 Willcocks St., Toronto. (S.1944)
Grignon, André A. 23 Ste. Helene St., Hull, Que (S.1946)
Grimble, Louis G. Asst. Bridge Engr., Dept. Public Works of Alberta, Edmonton. For mail: 11618-96th St., Edmonton, Alta. (S.1942. Jr.1945)
Grimble, Wilf G. Jr. Engr., British Columbia Power Commission, Victoria. For mail: 2259-West 3rd Ave., Vancouver, B.C. (S.1941. Jr.1946)
Grime, L. Employee Relations, Imperial Oil Ltd., Toronto. For mail: 10 Burnham Road, Toronto 12. (Jr.1928. A.M.1937. M.1940)

Grimmer, Allan K. Town Dept. Engr., Canadian International Paper Co., Temiskaming, Que. (A.M.1910. M.1920)

Grisdale, Simpson V. Indust. Engr., Canadian General Electric Co. Ltd., 129 Hollis St., Halifax, N.S. (M.1946)

Groleau, Arnold J. Gen. Traffic Engr. Bell Telephone Co. of Canada, 1050 Beaver Hall Hill, Montreal. (S.1928. Jr.1937)

Groudines, J. Léon 1431 Joliette St., Montreal. (S.1942. Jr.1946)

Gronlund, Max D. Time Study Engr., Otis-Fensom Elevator Co. Ltd., Hamilton. For mail: 76 East Ave N., Hamilton, Ont. (S.1945)

Groom, C. A. 1342 Avenue Road, Toronto, Ont (S.1946)

Gross, Philip Norcross Pres., Anglin-Norcross Corp. Ltd., 892 Sherbrooke St. W., Montreal. (A.M.1932. M.1940)

Grosvenor, Frank Asst. Engr., Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (M.1946)

Grothé, Pierre 3741 Hutchison St., Montreal 18. (S.1945)

Grothé, P. André Engrg. Dept., Quebec Hydro Electric Comm., Montreal. For mail: 400 Kensington Ave., Westmount, Que. (S.1940. M.1943)

Grou, Marcel 15 Roy St., Ville St. Laurent, Montreal 9. (S.1945)

Groundwater, Jas. R. Pres., J. R. Groundwater Inc., New York. For mail: 8 East 9th St., New York 3, N.Y. (A.M.1939. M.1940)

Grout, R. E. Elec. Design. Engr., Shawinigan Engineering Co. Ltd., 107 Craig St. W., Montreal. (S.1936. Jr.1942)

Grove, Humphrey S. Design. Engr., Power Corp. of Canada Ltd., 355 St. James St. W., Montreal. (Jr.1913. A.M.1918. M.1940)

Groves, F. W. Cons. Engr., Box 136, Kelowna, B.C. (M.1913)

Gruenig, E. Constrn. Engr., City of Montreal. For mail: 506 Pine Ave. W., Montreal. (A.M. 1929. M.1940)

Grummitt, Edmund Design. Engr., International Nickel Co., Port Colborne. For mail: 14 Elm St., St. Catharines, Ont. (A.M.1917. M.1940)

Gruner, M. H. N. Mgr., M. H. N. Gruner & Co., Contractors, 394 Victoria Ave., Montreal 6. (M.1945)

Grunsten, A. W. Project Engr., Canadian Industries Ltd., P.O. Box 10, Montreal. (Jr.1928)

Guard, Donald E. Asst. Surveyor, Dept. Mines & Natural Resources of Manitoba, Winnipeg. For mail: 466 Beaverbrook St., Winnipeg, Man. (S.1944)

Guay, Robt. A. General Construction, Montreal. For mail: 10598 Grande Allée, Montreal. (M.1945)

Guénette, Paul Indust. Engr., Ammunition Divn., Canadian ndustries Ltd., Brownsburg. For mail: P.O. Box 129, Brownsburg, Que. (S.1936. Jr.1941. M.1942)

Guihan, W. B. 555 Viau St., Montreal 4. (S.1936)

Guildford, Jos. R. Private Practice, 22 Groveland St., Buffalo 14, N.Y., U.S.A. (A.M.1938. M.1940)

Gumley, F. Stewart Mgr., Strl. & Bridge Works, Burn & Co. Ltd., Howrah, Bengal, India. (A.M.1931. M.1940)

Gunn, G. J. T. Elec. Engr., R. A. Hanright, Cons. Engr., Toronto. For mail: Glynmill Inn, Corner Brook, Newfoundland. (M.1942)

Gunn, Wm. W. Engr., Ont. Divn., Dominion Bridge Co. Ltd., Toronto. For mail: 251 Lytton Blvd., Toronto 12. (A.M.1917. M.1940)

Gunning, M. P. Elec. Engr., Quebec Hydro Electric Comm., Montreal. For mail: 7 Argyle Ave., St. Lambert, Que. (S.1935. M.1940)

Gunter, Allan N. Ranching & Farming, Burnside Farm, Box 298, Medicine Hat, Alta. (S.1939. Jr.1940)

Gurney, E. Holt Pres., Gurney Foundry Co. Ltd., 4 Junction Road, Toronto. (M.1945)

Gusen, Aaron Overseas (S.1939. Jr.1946)

Gussow, Wm. C. Chief Geologist, Shell Oil Co. of Canada Ltd., 186 Slater St., Ottawa. (M.1945)

Guthrie, J. Constrn. Engr., Saskatchewan Power Commission, Regina. For mail: 614 Walmer Road, Saskatoon, Sask. (Jr.1939. M.1943)

Guttormson, B. F. Lieut., R.C.N.V.R., c/o Mrs. Bates, 2850 Colquitz Ave., Victoria, B.C. (S.1943. Jr.1946)

Guy, Ross T. Prod. Mgr., Collett-Sproule Ltd., Toronto. For mail: 168 Kingsway, Toronto 9. (S.1940. Jr.1943)

Guy, Richard W. Sr. Examiner, Elec. & Gas Inspn. Board, Dept. of Trade & Commerce, Ottawa. For mail: 275 Springfield Road, Ottawa. (S.1914. Jr.1920. A.M.1930. M.1940)

Gwyer, Wm. K. Yale, B.C. (A.M.1909. M.1913)

H

Haacke, Ewart M. Editor, Electrical News & Engineering, 347 Adelaide St. W., Toronto. (S.1941. Jr.1945)

Haakonsen, H. Teacher, Shawinigan Technical Institute. For mail: 259 St. Maurice Blvd., Shawinigan Falls, Que. (S.1943. Jr.1944)

Haanel, Benj. F. C. Chief of Divn., Fuels, Mines & Geology Branch, Dept. Mines & Resources, Ottawa. For mail: 236 First Ave., Ottawa. (M.1916)

Haberl, Herbert W. Protection Engr., Design Divn., Quebec Hydro-Electric Commission, Montreal. (M.1945)

Haberman, J. A. P.F.R.A., Dept. of Agriculture, 419 Public Bldg., Calgary, Alta. (M.1943)

Haddin, John Cons. Engr., Haddin & Miles Ltd., Argyle Court, Calgary, Alta. (A.M.1911. M.1913)

Haddow, A. W. City Engineer, City Engr's. Office, Edmonton, Alta. (A.M.1916. M.1940)

Hadekel, Daniel c/o Mrs. R. Hadekel, 47 Tudor Close, Belsize Ave., London, N.W.3, England. (M.1942)

Hadley, Arthur Designing Dftsmn., Hydro-Electric Power Comm. of Ontario, Toronto. For mail: 25 Webb Ave., Toronto. (A.M.1921. M.1940)

Hadley, W. Fraser Property Management, 45-2 Main St., Hull, Que. (S.1914. Jr.1919, A.M.1930. M.1940)

Hager, Fritz (S.1943)

Hagerman, B. H. Bridge Engr., Dept. Public Works of N.B., Fredericton. For mail: 62 Alexandra St., Fredericton, N.B. (Jr.1923. A.M.1936. M.1940)

Hague, E. C. Mgr., Metallizing Co. of Montreal Ltd., 54 Nazareth St., Montreal, 3. (S.1922. A.M.1930. M.1940)

Hahn, H. G. Tech. Supvn., Engrg. Divn. Canadian Vickers Ltd., Maisonneuve, Montreal. (Jr.1944)

Hahn, Jack Layout Dftsmn., Arthur Surveyer & Co., Montreal. For mail: 1145 Lajoie Ave., Montreal. (S.1945)

Haiblen, Alfred H. D. Demonstrator, McGill University, Montreal. For mail: 635 Grosvenor Ave., Westmount, Que (S.1944)

Haig, Douglas E. Asst. Distbn. Engr., Manitoba Power Comm. For mail: 163 Martin Ave., Winnipeg. (S.1944. Jr.1946)

Haight, Harry V. 49 Portland Ave., Sherbrooke, Que. (M.1920)

Hailey, A. Roberts T. Asst. D. C. Design Engr., Canadian General Electric Co., Peterborough. For mail: 353 Monaghan Road, Peterborough, Ont. (Jr.1942)

Haimes, James City Waterworks Engr., City Hall, Lethbridge, Alta. (A.M.1925. M.1940)

Haines, N. S. Asst. Engr., Hydro Electric Power Comm. of Ontario, Toronto. For mail: 373 Broadway Ave., Toronto. (Jr.1936. M.1943)

Hairsine, S. Elec. Engr., Dept. of Transport, Rm. 320, Hunter Bldg., Ottawa. (A.M.1932. M.1940)

Haldane, D. E. Canwood, Sask. (Jr.1944)

Hale, Fredk. J. (M.1942)

Hale, G. R. Elec. Engr., Shawinigan Water & Power Co., P.O. Box 6072, Craig St. W., Montreal. (A.M.1927. M.1940)

Haliburton, George MacD. Engr. in Training, Canadian Liquid Air Co. Ltd., Montreal. For mail: 310 Jubilee Rd., Halifax, N.S. (S.1943. Jr.1946)

Haliburton, James Lieut., R.C.E. For mail: 360 Rankin Blvd., Windsor, Ont. (S.1944. Jr.1946)

Hall, A. H. 95 Charlotte St., Ottawa. (S.1942. Jr.1946)

Hall, D. B. Cupar, Sask. (S.1944. Jr.1946)

Hall, Gordon Hudson 88 London St., Peterborough, Ont. (S.1937. Jr.1945)

Hall, John G. Asst. to Vice-Pres., Combustion Engineering Corp. Ltd., 69 Yonge St., Toronto 1. (S.1919. A.M.1924. M.1931)

Hall, K. L. Lieut., E.M.E. Officer, Vancouver. For mail: 1075 West 15th Ave., Vancouver, B.C. (S.1940)

Hall, Norman M. Cons. Engr. & Prof., Mech. Engrg., University of Manitoba, Winnipeg, Man. (S.1907. A.M.1913. M.1923)

Hall, Per Designing Engr., Foundation Co. of Canada, Montreal. For mail: 46 Summit Circle, Westmount, Que. (M.1944)

Hall, Wm. B. Illumination Engr., Canadian General Electric Co., Toronto. For mail: 88 London St., Peterborough, Ont. (S.1946)

Hall, W. E. 2 Edward St., Truro, N.S. (A.M.1921. M.1944)

Hall, Wm. F. Jr. Engr., P.F.R.A., Dom. Dept. of Agriculture, Post Office Bldg., Medicine Hat, Alta. (S.1941. Jr.1944)

Hall, Wm. S. Cons. Engr., 53 Gerrard St. W., Toronto. (Jr.1929. A.M.1934. M.1940)

Hallé, Paul 184 St. Joseph St., Lauzon, Co. Levis, Que. (S.1937. Jr.1946)

Halliday, John C. Mech. Supt., Beaver Wood Fibre Co. Ltd., Thorold. For mail: 21 Carleton St., Thorold, Ont. (Affi.1936)

Halme, Sulo E. Elec. Engr., Bolivian Power Co. Ltd., Casilla 353, La Pas, Bolivia, South America. (S.1944. Jr.1946)

Halpenny, M. B. Designer, Dominion Bridge Co. Ltd., Montreal. For mail: 4935 Connaught Ave., Montreal 29. (S.1923. A.M.1931. M.1940)

Haltalin, Clifford P. Supvg. Engr., Winnipeg Electric Co. For mail: 369 Kingston Cresc., St. Vital, Man. (S.1927. A.M.1934. M.1940)

Halter, G. Sydney 22 Murray Block, Fort William, Ont. (S.1945)

Halter, John L. Elec. & Mech. Equipt., Massey-Harris Co. Ltd., Toronto. For mail: 579 Bathurst St., Toronto. (S.1945)

Haltrecht, Arnold Cons. Elec. Engr., National Research Council, Ottawa. (Affil.1940. M.1942)

Halyard, R. H. Design Engr., Fraser-Brace Engr. Co. Ltd., 360 St. James St. W., Montreal. (M.1946)

Hamel, Joseph Traffic Engr., Quebec Dept. of Roads. For mail: 402-3rd Ave., Quebec. (Affil.1942)

Hamel, J. René Research Engr., Shawinigan Chemicals Co., Shawinigan Falls. For mail: 82D-3rd St., Shawinigan Falls, Que. (S.1944. Jr.1946)

Hamelin, Douglas F. Mgr., Western Water Wells, Donegal Mansions, Calgary, Alta (A.M.1939. M.1940)

Hamelin, J. C. R. Westmount Tool Works, Defence Industries Ltd., Westmount. For mail: 8892 Berri St., Montreal. (S.1937. Jr.1946)

Hamilton, Alex. D. Control Engr., Ontario Paper Co. Ltd., Thorold, Ont. (S.1939. Jr.1946)

Hamilton, Chester B., Jr. Pres., Hamilton Gear & Machine Co., 62-100 Van Horne St., Toronto 4. (M.1918)

Hamilton, Chas. T. Cons. Civil & Strl. Engr., 615 West Hastings St., Vancouver, B.C. (A.M.1917. M.1940)

Hamilton, Geoffrey C. Instructor, University of Saskatchewan, Saskatoon, Sask. (S.1943. Jr.1946)

Hamilton, Harry I. Mech. Engr., Demarara Bauxite Co., Mackenzie, British Guiana, South America. (S.1941. Jr.1945)

Hamilton, H. Percy Design Engr., Consolidated Mining & Smelting Co. Ltd., Trail. For mail: Box 163, Trail, B.C. (Jr.1938. M.1945)

Hamilton, J. Bruce Cons. Engr., 401-20th St. W., Prince Albert, Sask. (A.M.1938. M.1940)

Hamilton, John B. Mgr., Crows Bar Dredging Co. Ltd., Vancouver. For mail: 153-18th St. E., North Vancouver, B.C. (A.M.1921. M.1940)

Hamilton, John C. Chief Supvr., Canadian Resins & Chemicals, Shawinigan Falls, Que. (S.1942. Jr.1944)

Hamilton, Parker C. Asst. Mgr., Construction Equipment Co. Ltd., 135 Lower Water St., Halifax, N.S. (S.1932. Jr.1937. M.1941)

Hamilton, R. W. Engr., Canadian Marconi Co., Montreal. For mail: 3166 The Boulevard, Westmount, Que. (S.1925. A.M.1935. M.1940)

Hamilton, V. C. Asst. Gen. Supt., Canada Cement Co. Ltd., Philips Sq., Montreal. (A.M.1935. M.1940)

Hamilton, W. Garrison. For mail: 1499 Bishop St., Montreal. (S.1930. Jr.1938)

Hamlin, D. L. B. Civil Engr., Steel Co. of Canada Ltd., Hamilton. For mail: 77 Stibbard Ave., Toronto. (S.1943. Jr.1946)

Hammerschmid, Leo John Engr., Bell Telephone Co. of Canada, Montreal. For mail: 3505 St. Famille, Montreal. (S.1944)

Hammersley-Heenan, John Cons. Engr., 4104 Farmdale Ave., North Hollywood, Calif., U.S.A. (A.M.1911. M.1940)

Hammond, Ernest Roy Engr., H. E. McKeen & Co., Montreal. For mail: 1489 Bishop St., Montreal. (S.1936. Jr.1940. M.1946)

Hammond, R. E. Mgr., Radio & Comm. Divn., Dominion Electrohome Industries Ltd., Kitchener. For mail: P.O. Box 412, Kitchener, Ont. (S.1931. Jr. 1941. M.1946)

Hampton, Stanley J. Jr. Elec. Engr., City of Edmonton. For mail: 10950-83rd St., Edmonton, Alta. (S.1946)

Hanchet, W. H. D. 139 Fentiman Ave., Ottawa, Ont. (S.1945)

Hand, Carl E. Asst. Elec. Supt., Quebec North Shore Paper Co., Baie Comeau, Que. (Jr.1944)

Hand, Dennis H. Capt., R.C.E.M.E., Service Design Engr., Dept. of National Defence (Army) Rm. 2411, Army Bldg., Ottawa, Ont. (S.1942. Jr.1946)

Hand, George W. Valuator, Molson Lobley & Co. Ltd., Montreal. For mail: 478 Victoria Ave., Westmount, Que. (Affil.1943)

Hand, Norman Pres., S. Morgan Smith Canada Ltd., 350 Bay St., Toronto. (M.1940)

Handley, John. P.O. Box 54, Noranda. (S.1904. A.M.1907. M.1940)

Hango, J. R. Gen. Engrg., Quebec Hydro Electric Commission, Montreal. For mail: 4745 Grosvenor Ave., Montreal 6. (S.1928. A.M.1935. M.1940)

Hanham, D. E. 26 Glendonwynne Road, Toronto. (S.1946)

Hankin, E. A. Asst. to Pres., Francis Hankin & Co. Ltd., 2028 Union Ave., Montreal. (S.1934. A.M.1940. M.1940)

Hankin, Francis Pres., Francis Hankin & Co. Ltd., 2028 Union Ave., Montreal. (Affil.1920)

Hanlon, John E. (M.1943)

Hanly, A. F. P.O. Box 1124, Place d'Armes Station, Montreal. (A.M.1920. M.1940)

Hanly, J. Bruce Cons. Supt., Canada Cement Co. Ltd., Montreal. For mail: 219 Charles St., Belleville, Ont. (S.1930. M.1941)

Hanna, H. B. Supvg. Indust. Engr., Canadian Industries Ltd., Montreal. For mail: 4836 Westmore Ave., Montreal, Que. (S.1922. Jr.1926. A.M.1931. M.1940)
Hanna, J. Jeffery Supt., Calgary Refinery, Imperial Oil Ltd. For mail: 1122 Frontenac Ave., Calgary, Alta. (A.M.1917. M.1940)
Hanna, John Newton Instructional course, Massey-Harris Co. Ltd., Toronto. For mail: 40 Close Ave., Toronto. (S.1944)
Hannaford, Arthur R. Bldg. Commr., City Hall, Hamilton, Ont. (A.M.1920. M.1940)
Hannah, M. Russell 223 Fourth Ave., N.E., Calgary, Alta. (S.1943. Jr.1946)
Hannon, M. S. 465 Avenue Road, Toronto, Ont. (S.1943. Jr.1946)
Hanrahan, F. E. Elec. Lieut., Naval Service H.Q., Ottawa. For mail: 81 Spadina Ave., Ottawa. (M.1945)
Hansen, D. A. Commercial Supt., Calgary Power Co. Ltd., Calgary, Alta. (A.M.1934. M.1940)
Hansen, H. E. Asst. Mgr., British American Oil Co., Box 279, Calgary, Alta. (M.1945)
Hansen, R. J. 415-B Roncesvalles Ave., Toronto 3. (S.1946)
Hanson, Myron W. Chief Design Engr., Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh 19, Pa. (M.1927)
Harakas, Peter Res. Engr., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. (Jr.1944)
Harbell, Joseph L. 3841 West 31st Ave., Vancouver, B.C. (S.1946)
Harbert, E. T. Asst. to Wks. Mgr., Canadian Ingersoll-Rand Co. Ltd., Box 728, Sherbrooke, Que. (S.1920. Jr.1928. A.M.1936. M.1940)
Hardcastle, Sydney Chief Engr., Ottawa Branch, Dominion Bridge Co. Ltd. For mail: 115 Sunnyside Ave., Ottawa. (S.1920. A.M.1931. M.1940)
Harding, C. M. Elec. Engr., Calgary Power Co. Ltd., 504 Insurance Exchange Bldg., Calgary, Alta. (S.1936. Jr.1941)
Harding, C. P. Lieut. Cdr. (E), R.C.N.R., P.O. Box 1001, Station "B", Ottawa, Ont. (Affil.1925. M.1938)
Harding, J. H. Res. Engr., Pothole Project, P.F.R.A., Post Office Bldg., Lethbridge, Alta. (S.1939. Jr.1943)
Harding, Harvey J. Ground Rod Tester, Manitoba Power Commission, Winnipeg. For mail: 91 Kanata St., Transcona, Man. (S.1945)
Harding, Laurenz F. City Electn., Dept. of Works, Saint John, N.B. For mail: 152 Watson St., Saint John, N.B. (Affil.1940)
Harding, Sidney Land Surveyor, 410 Westman Chambers, Regina, Sask. (A.M.1921. M.1940)
Harding, W. A. Sunny Brae, N.B. (M.1942)
Hardy, George F. Cons. & Designing, Pulp & Paper Industry, 441 Lexington Ave., New York, U.S.A. (M.1902)
Hardy, Robt. M. Prof. Civil Engrg., University of Alberta, Edmonton, Alta. (S.1928. Jr. 1934. A.M.1937. M.1940)
Hare, Chas. Mackay Town Engr. for Rouyn, Surveyor-Dftsmn. for Noranda. c/o Noranda Mines, Noranda, Que. (S.1928. M.1941)
Hare, Geo. G. 264 St. James St., Saint John, N.B. (S.1894. A.M.1908. M.1920)
Hare, W. Almon Cons. Mech. Engr., Hare Engineering Co., Detroit. For mail: 833 Kildare Rd., Windsor, Ont. (M.1943)
Hare, W. Lester Salesman, Contractor's Equipt., W. A. Hare Co., Ottawa. For mail: 174 Breezehill Ave., Ottawa. (S.1935. Jr.1939. M.1945)
Hargrave, A. R. C. Supvr., Foundation Co. of Canada Ltd., Montreal. For mail: 3181 Maplewood Ave., Montreal. (S.1942. Jr.1946)
Hargrave, H. T. Mgr. of cattle ranch, Hargrave Ranching Co. Ltd., Walsh, Alta. (S.1942. Jr.1946)
Hargrave, John Huxley Strl. Designing Engr., C. D. Howe Co. Ltd., Port Arthur, Ont. (S.1941. Jr.1946)
Hargreaves, W. T. Res. Engr., Highways Divn., Dept. of Public Works, Fredericton. For mail: Hillsboro, Albert Co., N.B. (Affil.1942. M.1946)
Hargrove, Paul Dist. Surveyer & Engr., Dept. Public Works, Edmonton, Alta. (S.1927. Jr.1931. M.1941)
Harisay, Vino Designing Engr., Dominion Engineering Works Ltd., Lachine. For mail: 262 Wood Ave., Westmount, Que. (M.1942)
Harkness, Andrew D. Engr., St. Regis Paper Co. (Canada) Ltd., Montreal. For mail: 2205 Hampton Ave., Montreal. (S.1942. Jr.1943)
Harkness, Aleck L. 9835 LaSalle Rd., LaSalle, Que. (S.1907, A.M.1911. M.1940)
Harkness, Harold Wilson Physics Laboratory, Queen's University, Kingston, Ont. (A.M.1920. M.1931)
Harkness, R. D. Vice-Pres. & Gen. Mgr. Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (M.1939)
Harkness, W. D. Cia Industrial de Atenquique, c/o Abastecimiento Atenquique, Jalisco, Mexico. (Jr.1943)
Harknett, Stewart G. Mgr., Elec. Dept., Mumford Medland Ltd., Winnipeg. For mail: 173 Kingston Row, St. Vital, Man. (A.M.1934. M.1940)
Harkom, J. F. Chief, Divn. Wood Preservation, Forest Products Laboratories, Isabella & Metcalfe Sts., Ottawa. (S.1912. Jr.1918. A.M.1925. M.1940)
Harland, R. T. Elec. Engr., Winnipeg Hydro Electric System, 55 Princess St., Winnipeg, Man. (S.1938. M.1944)
Harley, Gordon G. Shift Boss, Central Patricia Gold Mines Ltd., Central Patricia, Ont. (S.1936. Jr.1946)
Harper, Wm. Henry Engrg. Asst., Bell Telephone Co. of Canada, Montreal. For mail: Wilkie, Sask. (S.1945)
Harrigan, M. A. P. Design Engr., Electric Tamper & Equipment Co. of Canada, Rm. 417, 1440 St. Catherine St. W., Montreal 25. (S.1930. M.1942)
Harrington, A. R. Elec. Engr., Nova Scotia Light & Power Co. Ltd., Halifax. For mail: 26 Walnut St., Halifax, N.S. (M.1942)
Harrington, Arthur W. Dist. Engr., U.S. Geological Survey 528 Federal Bldg., Box 948, Albany 1, N.Y., U.S.A. (M 1937)
Harrington, John M. Supvg. Chemist, Inspection Board of Canada, John & Sussex Sts., Ottawa. (Jr.1945)
Harris, Arthur D. Chief Engr., Ford Motor Co. of Canada Ltd., Windsor. For mail: 2835 Riverside Drive, Riverside, Ont. (M.1943)
Harris, John Leonard Whitney Res. Engr., Highway Constrn., N.B., Dept. of Public Works. For mail: 132 Steadman St., Moncton, N.B. (M.1942)
Harris, J. R. 3581 Durocher St., Montreal 18. (S.1944)
Harris, John T. Plant Engr., Dominion Bridge Co. Ltd, Toronto. For mail: 38 Atlas Ave., Toronto. (M.1942)
Harris, Robt. G. Articled to R. P. Brown, B.C.L.S., Penticton. For mail: Box 721, Penticton, B.C. (S.1945)
Harris, W. F. Sub. Lieut, (E) R.C.N.V.R., 119 Duncan St., Halifax, N.S. (S.1945)
Harris, W. R. (M.1916)
Harrison, Edward H. Private Practice, Sharpstone House, Freshford, Bath, England. (A.M.1906. M.1920)
Harrison, J. A. 463 King St., Peterborough, Ont. (S.1944)
Harrison, Ronald Mgr. & Sec. Treas., Scarborough Public Utilities Comm., Birch Cliff. For mail: 1859 Kingston Rd., Birch Cliff, Toronto 13, Ont. (S.1919. Jr.1921. A.M.1925. M 1936)
Harrison, T. B. Plant Engr., Ontario & Minnesota Pulp & Paper Co., Fort Frances. For mail: 410 First St. E., Fort Frances, Ont. (M.1943)
Harrison, Victor Frank Instr. in Chemistry, Gordon Hall, Queen's University, Kingston. (Jr.1945)
Harrison, Wm. Dist. Mgr., Canadian Westinghouse Co Ltd., Halifax. For mail: 103 Oxford St., Halifax, N.S. (M.1943)
Harrison, W. E. Chief Instrmt. Engr., Imperial Oil Ltd., Sarnia. For mail: 516 London Rd., Sarnia, Ont. (M.1946)
Harshaw, F. Norman Sales Engr., Crouse-Hinds Co. of Canada, 7-21 Labatt Ave., Toronto. (Jr 1938)
Hart, Erwin Edward Devlpt. Engr., John Inglis Co. Ltd., Toronto. For mail: 206 Lakeshore Ave., Centre Island, Toronto. (S.1940. Jr.1944)
Hart, H. T. (S.1930. Jr.1939)
Hart, Reginald V. Topographical & Land Surveys, H.Q., Eastern Air Command, Dept. National Defence For Air, Halifax. For mail: Armdale P.O., Halifax, N.S. (M.1940)
Hartley, Eric L. Overseas (S.1933. Jr.1946)
Hartmann, Nicholas L. Tool Designer, Canadair Ltd., Montreal. For mail: 4999 Cote des Neiges Rd., Montreal 26. (A.M.1938. M.1940)
Hartney, J. R. Lubrication Engr., Imperial Oil Ltd., Toronto. For mail: 57 Glenroy Ave., Toronto 9. (S.1930. A.M.1937. M.1940)
Hartwick, E. F. Engr., Aluminum Co. of Canada, Arvida. For mail: 205 Radin Road, Arvida, Que. (M.1946)
Hartwig, Elmer H. W. Foreman Elect., Canadian Comstock Co. Ltd., Hamilton. For mail: 106 Hyde Park Ave., Hamilton, Ont. (S.1941)
Harvey, E. Allan Elec. Design Group Leader, Canadair Ltd., Cartierville. For mail: 11353 St. Cyr St., Montreal 9. (S.1937. Jr.1940. M.1945)
Harvey, Charles 84 Castle Knock Rd., Toronto. (A.M.1921. M.1940)
Harvey, John Arthur Jr. Resch. Physicist, National Research Council, Chalk River. For mail: Staff Hotel, Deep River, Ont. (S.1944)
Harvey, Roger J. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 5221 LaSalle Blvd, Verdun, Que. (S.1946)
Harvey, Wm. M. Aluminum Co. of Canada, Shawinigan Falls. For mail: 48 Maple Ave., Shawinigan Falls, Que. (S.1922. A.M.1936. M.1940)
Harvie, A. C. Asst. Works Engr., International Nickel Co., Port Colborne. For mail: P O. Box 610, Port Colborne, Ont. (S.1922. Jr.1927. A.M.1939. M.1940)
Harvie, J. D. Engr., Imperial Oil Ltd., Norman Wells, N.W.T. (S.1941. Jr.1945)
Harvie, Thomas A. Design Engr., Canadair Ltd, Cartierville. For mail: 129 Beverley Ave., Town of Mount Royal, Que. (S.1940. Jr.1945)
Harvie, Thos. W. 633 Cote St. Antoine Road, Westmount, Que. (A.M.1911. M.1923)
Harza, Leroy F. Cons. Engr. & Pres., Harza Engineering Co., 205 W. Wacker Drive, Chicago, Ill. (M.1928)
Haselton, W. B. Mgr., W. M. Haselton Granite Quarries, Beebe, Que. (S.1934. M.1943)
Hashim, Robt. Engr., Central Dist., Bell Telephone Co., Montreal. For mail: 6960 Sherbrooke St. W., Montreal (S.1945)
Haskins, R. E. Plant Engr., British Columbia Cement Co. Ltd., Bamberton Works, Tod Inlet P.O., B.C. (M.1944)
Hassell, John V. Outside Plant Engr., Bell Telephone Co., Toronto. For mail: 327 Glenholme Ave., Toronto. (S.1946)
Hastey, W. K. Boss Machine Tender, Belgo Divn., Consolidated Paper Corp., Shawinigan Falls. For mail: 69 Broadway Ave., Shawinigan Falls, Que. (S.1941. Jr.1945)
Hastie, Frank J. Power Plant Oper. & Mtce., East Kootenay Power Co., Coleman, Alta. (S.1936. Jr.1940. M.1941)
Hatfield, Geo. N. Road Engr., City Hall, Saint John, N.B. (S.1909. A.M.1915. M.1940)
Haughton, R. N. E. Elec. Engr., Transmn. Engrg. Dept., Bell Telephone Co., Toronto. For mail: 194 London St. S., Hamilton, Ont. (S.1946)
Hault, G. C. Divn. Engr., Constrn. Dept. Highways & Public Works of N.S., Halifax. For mail: 125 Jubilee Road, Halifax, N.S (M.1940)
Haultain, H. E. T. University of Toronto, Toronto. (M.1901)
Haultain, R. M. Dominion Dept. of Labour, 238 Sparks St., Ottawa. (A.M.1939. M.1940)
Haven, Frank G. Inspecting Engr., Dept. of Mines & Resources of Canada, Banff, Alta. (M.1942)
Havens, Verne Leroy (M.1922)
Hawke, Chas. E. Civil Engr., Marine Divn., McNamara Construction Co. Ltd., 42 Industrial St., Toronto 12. (S.1930. A.M.1937. M.1940)
Hawkes, Horace H. Strl Designer, Dominion Bridge Co. Ltd., Lachine. For mail: 75 Percival Ave., Montreal West. (A.M.1921. M.1940)
Hawkes, John M. Owner, Parisien Beverages, 722 Pitt St., Cornwall Ont. (M.1945)
Hawkeye, Michael Box 28 Limerick, Sask. (S.1943. Jr.1946)
Hawkins, Currie W. Machinist, Motive Power Shop, Can. National Railways, Stratford. For mail: 39 Church St., Stratford, Ont. (Jr.1946)
Hawkins, Stanley H. Project Engr., Irrigation, Dept. of Agriculture, Public Bldg., Calgary, Alta. (S.1909. A.M.1920. M.1940)
Hawkins, Stuart S. Engrg. Dept., Canadian Industries Ltd., Montreal. For mail: 14 Oldfield Ave., Montreal. (Affil.1945)
Hawley, E. F. Northern Electric Co. Ltd., Montreal. For mail: 21 Chesterfield Ave., Westmount, Que. (S.1930. A.M.1937. M.1940)
Hawley, K. T. Engr., Sask. Govt. Telephones, Regina. For mail: 3336 Angus St., Regina, Sask. (M.1946)
Hawthorne, George 34 Elsfield Road, Toronto 9. (A.M.1926. M.1940)
Hay, Alan K. Supt. & Chief Engr., Federal District Commission, 291 Carling Ave., Ottawa. (S.1914. A.M.1919. M.1940)
Hay, C. C. Refinery Supt., Hiway Refineries Ltd., Saskatoon. For mail: 2800 McCallum Ave., Regina, Sask. (M.1942)
Hay, Edward C. Appln. Engr., Can. Westinghouse Co. Ltd., 355 King St. W. Toronto. (S.1928. Jr.1936. A.M.1939. M.1940)
Hay, M. N. Aluminum Co. of Canada, 1700 Sun Life Bldg., Montreal. (Jr.1924. A.M.1927. M.1940)
Haycraft, Alan F. Training Course, Spruce Falls Power & Paper Co. Ltd., Kapuskasing Inn, Kapuskasing, Ont. (S.1946)
Hayes, Elbert H. Comm. Service Engr., Northern Electric Co. Ltd., Montreal. For mail: 4605 Havard Ave., Montreal. (S.1927. A M.1937. M.1940)
Hayes, H. R. Gen. Supvr. of Standards, Burns & Co. Ltd., Calgary, Alta. (S.1933. Jr.1938. M.1943)
Hayes, James Bertram Mgr., Nova Scotia Light & Power Co. Ltd., Halifax, N.S. (A.M.1920. M.1940)
Hayes, R. A. H. Elec. Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1922. M.1942)
Hayes, Roland Earle Mgr., Engrg. Dept., General Supply Co. of Canada Ltd., 356 Sparks St., Ottawa. (Jr.1928. A.M.1936. M.1940)
Hayes, S. J. Mech Supt., Bureau of Mines, Dept. Mines & Resources, Ottawa. For mail: 850 Bronson Ave., Ottawa (S1923, Jr.1926. A.M.1936. M.1940)
Hayhurst, Wm. L. Jasper, Alta. (S.1946)
Hayman, Howard L. Bldg. Cont., John Hayman & Sons Co. Ltd., London. For mail: 220 Base Line Road, London, Ont. (A.M. 1933. M.1940)

Hayman, Wm. M. Asst. Plant Supt., Westeel Products Ltd., Montreal. For mail: 3843 Royal Ave., Montreal 28. (S.1941. Jr.1946)
Hayne, H. L. Location & Constrn. Engr., Dept. Public Works of B.C., 515 Columbia St., Kamloops, B.C. (A.M.1920. M.1940)
Hays, David Walker Gen. Mgr., Canada Land & Irrigation Co. Ltd., Huckvale Block, Medicine Hat, Alta. (M.1918)
Heal, D. G. 3165 Capilano Road, North Vancouver, B.C. (S.1944)
Healey, A. J. Engrg. Apptce., Can. Westinghouse Co., Hamilton. For mail: 76 East Ave. North, Hamilton, Ont. (S.1946)
Heaman, J. A. Kingsville, Ont. (S.1901. A.M.1909. M.1916)
Hearn, Richard L. Chief Engr., Design & Constrn., Hydro-Elec Power Comm. of Ont., 620 University Ave., Toronto. (A.M.1920. M.1925)
Heartz, R. E. Asst. Chief Engr., Shawinigan Engineering Co. Ltd., Montreal. For mail: 203 Portland Ave., Town of Mount Royal, Que. (S.1917. A.M.1926. M.1933)
Heath, Fred J. Transmitter Engr., Can. General Electric Co., Toronto. For mail: 5 du Maurier Blvd., Toronto 12. (S.1938. M.1945)
Heatley, A. Harold Patent Dept., Shawinigan Chemicals Ltd., Shawinigan Falls. For mail: 4 Summit Ave., Shawinigan Falls, Que. (S.1921. Jr.1926. A.M.1931. M.1940)
Heatley, J. P. Prod. Control Dept., Imperial Oil Ltd., Sarnia. For mail: 240 Kathleen Ave., Sarnia, Ont. (M.1946)
Heavysege, B. R. 67b-34th Ave., Lachine, Que. (S.1933. M.1941)
Hébert, Adjutor J. G. Design. Engr., Plessisville Foundry. For mail: 129 St. Calixte St., Plessisville, Que. (Affil. 1941)
Hébert, Camille R. Gen. Mgr., B. & H. Metal Industries Co. Ltd., 1065 Papineau Ave., Montreal. (M.1944)
Hébert, Guy Soils Engr., Quebec Dept. of Roads, Montreal. For mail: 710 Champagneur Ave., Montreal 8. (S.1940. Jr.1944. M.1945)
Hébert, Jacques Foreman on Road Contracts, Abias Pépin Ltée, Longueuil. For mail: 5102 Ste. Marie, Montreal 30. (S.1944)
Hébert, J. C. 362 Murray St., Ottawa. (S.1946)
Heckle, George R. Cons. Engr., 50 Church St., New York, N.Y. (M.1914)
Hector, G. I. 118 Kenmore Blvd., Hamilton Beach, Ont. (S.1946)
Hediger, Louis Divn. Supt., Shawinigan Water & Power Co., Victoriaville, Que. (M.1945)
Heenan, Neil I. S/Lt. (L), R.C.N., Halifax. For mail: 38 Classic Ave., Toronto. (S.1946)
Heinze, L. S. Strl. Steel Designer, Dominion Bridge Co., Ottawa. For mail: 611½ Chapel St., Ottawa. (S.1943. Jr.1946)
Heisler, Harrison H. Engr., Socony-Vacuum Oil Co., Bogota, Columbia, S.A. For mail: 349 Scarborough Ave., Calgary, Alta. (Jr.1941)
Helliwell, Lloyd Testing Engine Labs., Imperial Oil Ltd., Sarnia, Ont. (M.1946)
Hellstrom, Carl A. Wood Handling Engr., Mill Dept., Canadian International Paper Co., Temiskaming, Que. (A.M.1939. M.1940)
Helwig, Carl E. Asst. Prof., University of Toronto. (M.1942)
Hemmerick, George Treas. & Sales Mgr., Dow Chemical of Canada Ltd., Toronto. For mail: 15 Bayview Wood, Toronto 12. (S.1916. A.M.1918. M.1940)
Hemphill, J. Laird Sales Engr., Marine Equipt., John Inglis Co., 14 Strachan Ave., Toronto. (M.1945)
Hemstock, R. A. Chief Engr. (Constrn.) Imperial Oil Ltd., Norman Wells, N.W.T. For mail: 9744-86th Ave., Edmonton, Alta. (S.1945. Jr.1946)
Henderson, Dugald C. M. Asst. Engr., Sewer Sections, Dept. of Works, Toronto. For mail: 108 Sheldrake Blvd., Toronto. (A.M.1939. M.1940)
Henderson, Gordon G. Asst. Gen. Mgr., Canadian Bridge Co. Ltd., Walker Road, Windsor, Ont. (M.1939)
Henderson, Gordon R. Chief Engr., Polymer Corp. Ltd., Sarnia, Ont. (M.1946)
Henderson, Henry B. Pres. & Mgr., Cowin & Co. Ltd., 1137 Pacific Ave., Winnipeg, Man. (M.1921)
Henderson, Ian Balfour Dftsmn. & Engr. i/c field party, Can. National Rlys., Port Arthur. For mail: Dalkeith Apts., Winnipeg, Man. (Jr.1945)
Henderson, Ian Gordon Designing Engr., Can. Refractories Ltd., Montreal. For mail: 4859 Parthenais St., Montreal 34. (S.1925. Jr.1928. A.M.1936. M.1940)
Henderson, J. A. Hamilton Engrg. & Purchg., Canadian International Paper Co., Montreal. For mail: 454 Lansdowne Ave., Westmount, Que. (Jr.1921. A.M.1923. M.1940)
Henderson, J. D. Gen. Mgr., Ottawa Car & Aircraft Ltd., 325 Slater St., Ottawa. (Affil.1944)
Henderson, J. P. Astro Physicist, Dominion Observatory, Ottawa. (A.M.1923. M.1940)
Henderson, R. M. Supt., Transmn. & Distbn., National Light & Power Co., Moose Jaw, Sask. (A.M.1938. M.1940)
Hendrick, Max Morton G/C, Director of Signals, R.C.A.F., Ottawa. For mail: 8 Fisher Ave., Ottawa. (S.1932. Jr.1938)
Hendry, M. C. Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (A.M.1908. M.1920)
Hendry, R. A. Dept. Highways & Public Works, N.S., Halifax. For mail: 182 Windsor St., Halifax, N.S. (M.1940)
Henley, S. L. 9 Poplar St., Halifax, N.S. (M.1940)
Henne, Lawrence E. Tel. Equipt. Engr., Northern Electric Co., Montreal. For mail: 1974 St. Luke St., Montreal. (S.1945)
Henriksen, Ernst Suhr Gen. Supt., J. S. Hewson Ltd., 660 St. Catherine St. W., Montreal. (M.1941)
Henrikson, Gunnthor John Asst. Engr., Transmn. & Distribn., British Columbia Electric Railway Co., Vancouver. For mail: 2776 West 10th Ave., Vancouver, B.C. (Jr.1937)
Henry, C. W. Box 199, Newcastle, N.B. (S.1944)
Henry, D. A. 5 Freeman Road, Toronto 9. (Jr.1939)
Henry, G. R. Stirling Asst. Engr., British American Oil Co. Ltd., Montreal. For mail: 4319 King Edward Drive, Montreal. (S.1937. M.1946)
Henry, R. A. C. Cons. Engr. & Chairman, Air Transport Board, Ottawa. For mail: Royal Bank Bldg., Montreal. (S.1910. A.M.1913. M.1920)
Henry, Thos. Haliburton Constrn. Supt., Sprostons Ltd., Lombard St., Georgetown, British Guiana. (Jr.1922. A.M.1927. M.1940)
Henselwood, E. W. Elec. Engr., Generator Section, Can. General Electric Co., 212 King St. W., Toronto. (S.1936. M.1946)
Henshaw, Frederick R. Gen. Constrn., Como, Que. (A.M.1925. M.1940)
Henson, G. S. G. Engr. of Equipt., Railway Utility, Winnipeg Electric Co. For mail: 537 Sherburn St., Winnipeg, Man. (Jr.1937. M.1941)
Hepinstall, Robt. Robin Pres., Hepinstall Steel Works Inc., New Orleans, La. For mail: Route No. 1, Box 300, Pass Christian, Miss., U.S.A. (S.1914. A.M.1919. M.1940)
Heppner, Selwyn A. Overseas (S.1941. Jr.1946)
Herbert, A. C. (S.1935)
Herbison, Robt. Milliken Mech. Design, Dominion Bridge Co., Lachine, Que. (A.M.1926. M.1940)
Herbison, Wm. Strl. Supt., Dominion Bridge Co. Ltd., P.O. Box 280, Montreal. (A.M.1935. M.1940)
Herd, Chas. E. Mech. Engr., Hyd. Dept., Dominion Engineering Co. Ltd., P.O. Box 220, Montreal. (A.M.1920. M.1940)
Herdman, Robt. 1 Marcell Ave., Corner Brook, Nfld. (S.1945)
Herisch, Peter Alexandre Resch. Chemist, Canadian International Paper Co., Gatineau, Que. (S.1946)
Hermanson, H. J. Dist. Engr., Dept. Public Works, Sask., Canada Bldg., Prince Albert, Sask. (A.M.1938. M.1940)
Hermeston, Ray 1173 Dominion St., Winnipeg, Man. (S.1946)
Heron, Alex. deF. 5184 Mountain Sights, Montreal 29. (S.1941)
Heron, Bruce O. Exec. Asst. to Controller, Inspection Board of Canada, Ottawa. For mail: 387 Holland Ave., Ottawa. (M.1946)
Heron, W. Kenneth 3581 Lorne Ave., Montreal. (S.1939)
Herr, Arthur G. Chief Dftsmn., Packard Electric Co. Ltd., St. Catharines. For mail: 14 Thomas St., St. Catherines, Ont. (A.M.1935. M.1940)
Herring, D. P. Dominion Rubber Co., Kitchener. For mail: R.R. No. 3, Kitchener, Ont. (S.1942. Jr.1946)
Herring, P. S. Instrmn., Dept. Public Works of B.C. For mail. 4405 West 16th Ave., Vancouver, B.C. (S.1945)
Herriot, G. H. Prof. Civil Engrg., University of Manitoba, Winnipeg. For mail: 325 Waverley St., Winnipeg, Man. (A.M.1910. M.1919)
Herrmann, Geo. E. Gen. Mgr., Western Region, Canada Creosoting Co. Ltd., P.O. Drawer 2408, North Vancouver, B.C. (Affil.1927)
Hershfield, Allan A. Project Engr., A. V. Roe Canada Ltd., Toronto. For mail: 137 Barton Ave., Toronto. (S.1943. Jr.1946)
Hershfield, Chas. Cons. Engr., Morrison, Hershfield, Millman & Huggins, 137 Wellington St. W., Toronto. (Jr.1935. M.1943)
Hershman, H. P. 375 Villeneuve St. W., Montreal. (S.1945)
Herzog, G. W. Test Course, Canadian General Electric Co., Toronto. For mail: Delia, Alta. (S.1946)
Heslop, W. G. Assoc. Prof. Civil Engrg., University of British Columbia, Vancouver, B.C. (A.M.1935. M.1940)
Hesse, W. A. Mining Engr., Mineola Road, Port Credit, Ont. (M.1944)
Hession, Fred 59 Morris St., Halifax, N.S. (S.1945)
Hetherington, W. L. Engr., Packard Electric Co. Ltd., St. Catharines, Ont. (S.1939. Jr.1945)
Heuser, Eric R. Chem. Candn. International Paper Co., Hawkesbury, Ont. (S.1944)
Heward, Francis Stephen Beverley Pres. F. S. B. Heward & Co. Ltd., & Heward Production Co. Ltd., 620 Cathcart St., Montreal. (A.M.1923. M.1940)
Hewitt, Herbert E. Chief Engr., International Coal and Coke Co. Ltd., Coleman, Alta. (S.1936. Jr.1940)
Hewitt, Harry Naylor, Inspn. Engr., Shell Oil Co., Montreal. For mail: 5004 Park Ave., Montreal 8. (Jr.1945)
Hewitt, Robt. Vice-Pres., Geo. W. Crothers Ltd., Toronto. For mail: 125 Lyndhurst Ave., Toronto 10. (S.1933. Jr.1940)
Hewlett, Cecil G. 3970 West 22nd Ave., Vancouver, B.C. (S.1946)
Hewson, E. G., Office Engr., Central Region, Can. National Rlys., Toronto. For mail: 41 Hewitt Ave., Toronto. (S.1907. Jr.1914. M.1917)
Hewson, J. S. Pres., J. S. Hewson Ltd., 660 St. Catherine St. W., Montreal. (A.M.1932. M.1940)
Hewson, W. G. Asst. Mgr., Hamilton Street Railway. For mail: 86 Herkimer St., Hamilton, Ont. (M.1920)
Heyland, Kenneth V. Sales Engr., Kent-McLain Ltd., 31 Commissioners St., Toronto. (M.1942)
Heys, Chas H. Chem. Engr., Electronics Divn., Northern Electric Co., Montreal. For mail: 3195 Van Horne Ave., Montreal. (Jr.1944)
Heywood, Don W. McDougall & Friedman, Cons. Engrs., 1235 McGill College Ave., Montreal. (A.M.1938. M.1940)
Heywood, Herbert P. Engr. Agent, J. L. Eve Constrn. Co. Ltd., London, England. For mail: 2 Rosebery Ave., Lincoln, England. (Jr.1917. A.M.1920. M.1940)
Hibbard, Ashley G. Bridge Inspr., Can. Pacific Railway, Windsor Station, Montreal. (S.1937. Jr.1942. M.1945)
Hibbard, David E. Asst. Engr., Dept. Public Works of Canada, Toronto. For mail: R.R. No. 1, Highland Creek, Ont. (S.1942. Jr.1946)
Hibbard, F. H. Supt. & Chief Engr., Quebec Central Railway, 89 Wellington St., Sherbrooke, Que. (S.1909. Jr.1912. A.M.1919. M.1940)
Hicks, Ben C. Protection Engr., Shawinigan Water & Power Co., Montreal. For mail: 3455 Prud'homme Ave., Montreal 28. (S.1921. Jr.1928. A.M.1935. M.1940)
Hicks, Henry B. 6388 Adera St., Vancouver, B.C. (A.M.1920. M.1940)
Hicks, John B. Dftsmn., British Columbia Power Comm. For mail: 6388 Adera St., Vancouver, B.C. (S.1943)
Hicks, James Stewart. Fairmount Apts., Winnipeg, Man. (S.1946)
Hicks, Milledge Stevens Elec. Instr., Canadian Vocational Training, Nova Scotia Technical College, Halifax. For mail: 4 Crescent Slope, Armdale, N.S. (M.1945)
Hicks, Robt. L. Distbn. Engrg. Dept., Toronto Hydro Electric System. For mail: 45 Balmoral Ave., Toronto. (S.1946)
Higgins, Alex. Dir. Engrg., Correspondence Courses, Provincial Institute of Technology, Calgary. For mail: 3620-8A St. West, Calgary, Alta. (M.1940)
Higgins, E. C. Asst. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 2100 Gerrard St., Toronto. (Jr.1921. M.1943)
Higgins, F. C. (A.M.1920. M.1940)
Higgins, T. G. Canadair Ltd., Montreal. For mail: 2168 Sherbrooke St. W., Montreal. (S.1946)
Hill, Alex M. Box 95, Watson, Sask. (S.1946)
Hill, Burton M. Mgr., Consolidated Diversified Standard Securities, 414 St. James St., Montreal. (S.1907. A.M.1912. M.1919)
Hill, E. S. St. Stephen, N.B. (M.1943)
Hill, G Rixon Airway Engr, Dept of Transport, Port Arthur For mail: 115 College St., Port Arthur, Ont. (Jr.1917. A.M.1931. M.1940)
Hill, Stanley C. Dist. Supt., Shawinigan Water & Power Co., Victoriaville, Que. For mail: 125 Monfette St., Victoriaville Que., (S.1919. A.M.1930. M.1940)
Hillary, B. B. Asst. Supt. & Tech. Service, Styron Plant, Dow Chemical of Canada Ltd., Sarnia, Ont. (M.1945)
Hillgartner, H. L. Project Engr., Universal Plumbing & Heating Co. Ltd., Toronto. For mail: Binbrook, Ont. (S,1943. Jr.1946)
Hiller, W. A. Asst. Plants Engr., Burns & Co. Ltd., Calgary. For mail: 820-18th Ave. N.W., Calgary, Alta. (S.1943, Jr.1946)
Hillier, Norman C. 7 Carmelite Rd., Grand Falls, Nfld. (S.1944)
Hillman, Daniel 227 Clarke Ave., Westmount, Que. (M.1914)
Hillman, W. A. Res. Engr., H. G. Acres & Co., Niagara Falls. For mail: 136 Canada Road, Edmundston, N.B. (A.M.1940. M.1940)
Hilton, H. Brian Steel Mill Observer, Atlas Steels Ltd., Welland. For mail: 132 West Main St., Welland, Ont. (S.1946)
Hilts, Ira F. Res. Engr. i/c Constrn. at Saskatoon, Dominion Dept. of Transport. For mail: Kennedy, Sask. (M.1946)
Hind, R. C. Apparatus Sales Engr., Candn. General Electric Co., Calgary. For mail: 1712-12th St. W., Calgary, Alta. (M.1946)

Hindle, Walter Erecting Engr., Service Dept., Canadian Westinghouse Co. Ltd., Hamilton, Ont. (S.1937. Jr.1943)
Hines, Wm. S. Chief Investgn. Engr., Divn. of Fisheries, Dept. of Industry of N.S., Provincial Bldg., Hollis St., Halifax, N.S. (S.1945)
Hink, Anthony A. 155 Chestnut St., Winnipeg Man. (S.1942. Jr.1946)
Hinton, Eric Hydro-Electric Mgr., Bowater's Newfoundland Pulp & Paper Mills Ltd., Deer Lake. Nfld. (Jr.1932. M.1942)
Hinton, Ralph Mtce. Engr.. Supt. of Bldgs. & Grounds, Queen's University & Kingston General Hospital. For mail: 5 Birch Ave., Kingston, Ont. (Affil.1942)
Hinton, Robt. E. 526 Homewood Ave., Peterborough, Ont. (Jr.1919. A.M.1925. M.1940)
Hiscocks, Richard Duncan Design Engr., De Havilland Aircraft Co. Canada Ltd., Toronto. For mail: 523 Glengarry St., Toronto. (M.1946)
Hislop, Richard H. Dftsmn. & Steel Designer, Dominion Bridge Co., Calgary. For mail: c/o Royal Trust Co., Edmonton, Alta. (S.1943. Jr.1946)
Hlibchuk, Walter 3 Popliger Ave., Montreal. (S.1941)
Hoar, C. R. Elec. Engr., Calgary Power Co. Ltd., Insurance Exchange Bldg., Calgary, Alta. (S.1940. Jr.1943)
Hoar, Francis James Vice-Pres. & Gen. Mgr., G. D. Jenssen Co., 363 Eastern Blvd., Watertown, N.Y., U.S.A. (M.1945)
Hoba, Joseph G. Indust. Engr., Kelsey Wheel Co. Ltd., Windsor Ont. (S.1938. Jr.1942)
Hobbs, D. H. Project Engr., Power Sales Devlpt., Aluminum Co. of Canada, Arvida. For mail: 4 Radin Rd., Arvida, Que. (Jr.1945)
Hobbs, Wilfrid E. Asst. Mgr., Lands Dept., Hudson's Bay Company, Winnipeg. For mail: No. 615, R.R 1, Winnipeg, Man. (S.1910. Jr.1912. A.M.1919. M.1940)
Hobner, Robt. Henry Asst. Elec. Engr., Dominion Textiles Ltd., 710 Victoria Square, Montreal. (M.1945)
Hobson, Wm. Lieut., R.C.N.V.R., 7370 Mount Ave., Montreal 16. (S.1940. Jr.1946)
Hoch, Norman F. Alliance Paper Mills Ltd., Merriton, Ont. (Jr.1940)
Hochhausen, Eugene 10036-113th St., Edmonton, Alta. (S.1946)
Hodgson, Ernest A. Chief, Divn. of Seismology, Dominion Observatory, Ottawa. (M.1938)
Hodgson, Ronald Hugh Can. Ingersoll Rand Co., Sherbrooke. For mail: 74 Moore St., Sherbrooke, Que. (S.1940. M.1945)
Hoffer, Arnold Cambridge Hotel, Winnipeg, Man. (S.1945)
Hogarth, Bruce B. Chief Engr., Water Resources Br., Dept. Mines & Resources of Manitoba, Legislative Bldg., Winnipeg, Man. (S.1913. Jr.1915. A.M.1919. M.1940)
Hogarth, C. Earle Dist. Rep. & Engr., Toronto Iron Works Ltd., 1502 St. Catherine St. W., Montreal. (S.1914. Jr.1916. A.M.1919. M.1940)
Hogarth, J. E. 524 Stanstead Ave., Town of Mount Royal, Que. (S.1941)
Hogg, A. D. Asst. Resch. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave, Toronto 2. (Jr.1937. M.1944)
Hogg, Sidney Chief Engr. & Sales Mgr., Western Bridge & Steel Fabricators Ltd., 195 West First Ave., Vancouver, B.C. (A.M.1931. M.1940)
Hogg, Thomas Exec. Asst., British Columbia Power Comm., 918 Government St., Victoria, B.C. (A.M.1937. M.1940)
Hogg, T. H. Chairman, Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (S.1904. A.M.1912. M.1922)
Hogg, Wm. M. Asst. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (M.1944)
Holdcroft, J. B. Asst. Mgr. & Engr., Pacific Coast Pipe Co. Ltd., Vancouver. For mail: 832 Cumberland Crescent, North Vancouver, B.C. (Jr.1912. A.M 1913. M.1936)
Holden, A. H. Prodn. Supvn., Nylon Divn., Canadian Industries Ltd., Kingston. For mail: 307 University Ave., Kingston, Ont. (Jr.1943)
Holden, John C. Royal Alexandra Hotel, Winnipeg, Man. (A.M 1908. M.1919)
Holden, J. Hastie Mgr., Westeel Products Ltd., 4107 Richelieu St., Montreal 30. (S.1921. Jr.1930. A.M.1935. M.1939)
Holden, Otto Hydr. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto 2. (A.M.1921. M.1939)
Holder, Allan S. Works Engr., Can. Industries Ltd., Shawinigan Falls. For mail: 12-A Mercier Ave., Shawinigan Falls, Que. (S.1931. Jr.1939. M.1943)
Holder, George W. Field Engr., Sault Ste. Marie Divn., Abitibi Power & Paper Co. Ltd. For mail: 153 Pim St., Sault Ste. Marie, Ont. (Jr.1921. A.M.1930. M.1940)
Hole, Frederick R. Designing & Dftg., Refrigerated Foods Engineering Ltd. & Industrial Designing Service Ltd., Vancouver. For mail: 7175 Fraser St., Vancouver, B.C. (S.1943)
Hole, H. Engr., Lockerbie & Hole Ltd., Edmonton. For mail: 8112 Jasper Ave., Edmonton, Alta. (S.1943. Jr.1946)
Hole, Herbert Wray Dir., N.B. Gas & Oil Fields Ltd., P.O. Box 194, Moncton, N.B. (M.1942)
Hole, Robt. W. Vancouver Mgr., Lockerbie & Hole Ltd., 1667 West 4th Ave., Vancouver, B.C. (S.1943. Jr.1946)
Hole, W. G. Darling Bros. Ltd., Montreal. For mail: 1765 Graham Blvd., Town of Mount Royal, Que. (M.1941)
Holgate, David C. Engr., Sault Structural Steel Co. Ltd., Box 963, Sault Ste. Marie, Ont. (Jr.1942)
Holgate, W. T. Sales Engr., Can. General Electric Co., Toronto. For mail: 85 Thompson Ave., Toronto 9. (Jr.1931. A.M.1939. M.1940)
Holland, Albert Civilian Garrison Engr., Royal Engineers, War Dept., England. For mail: "Myrtle Cottage", Old Cleeve, Watchet, Somerset, England. (S.1908. A.M.1915. M.1940)
Holland, Alwin Fort St. John, B.C. (Affil.1941)
Holland, Arthur A. Cons. Mining Engr., Grant Hall Hotel, Moose Jaw, Sask. (M.1945)
Holland, Franklin E. Vice-Pres., Murphy Paint Co. Ltd. & Thorp-Hambrock Co. Ltd., 2740 St. Patrick St., Montreal. (A.M.1922. M.1940)
Holland, H. A. Nelson Asst. Engr., Toll Cable, Bell Telephone Co., Montreal. For mail. 1537 Graham Blvd., Montreal 16. (S.1942. Jr.1945)
Holli, Sulo A. Engr. i/c Body Design Divn., Chrysler Corp. of Canada, Windsor. For mail: 2476 Lincoln Road, Windsor, Ont. (S.1940. Jr.1946)
Hollies, Robt. Talbot Asst. Supt., Waterworks Dept., City of Calgary. For mail: 3822—6th St. W., Calgary, Alta. (M.1941)
Hollingshead, R. J. Hillcrest, Alta. (S.1945)
Hollingworth, W. Pres., Hamilton Contracting Co. Ltd. For mail: 180 Hillcrest Ave., Hamilton, Ont. (A.M.1909. M.1914)
Hollis, E. K. Mount Allison University, Sackville, N.B. (S.1944)
Holloway, Arthur F. Instr., Maths., Queen's University, Kingston, Ont. (S.1943. Jr.1946)
Holloway, E. S. Cons. Engr., P.O. Box 205, Ste. Thérèse de Blainville, Que. (S.1905. A.M.1910. M.1928)
Hollyhock, Walter S. Chief Dftsmn., Hawker Aircraft Ltd., Surrey, England. For mail: "Langley", Dorney Grove, Weybridge, Surrey, England. (M.1944)
Holman, C. W. 529 Homewood Ave., Peterborough, Ont. (A.M.1934. M.1940)
Holmes, Archibald Rettie Res. Engr., Housing Project, W. L. Somerville, Toronto. For mail: c/o Canadian Cottons Ltd., Milltown, N.B. (S.1895. A.M.1901. M.1919)
Holmes, L. T. Res. Engr., Sask. Dept. of Highways. For mail: Verwood, Sask. (S.1943. Jr.1946)
Holmes, T. F. Instr., Engrg. Drawing, University of Toronto. For mail: Staff Residence, Univ. of Toronto, Ajax Divn., Ajax, Ont. (Jr.1946)
Holohan, E. J. Civil Aviation Br., Dept. of Transport, Moncton, N.B. (Jr.1946)
Holsten, Alfred British Columbia Electric Railway Co., Vancouver. For mail: 1340 Burnaby St., Vancouver, B.C. (M.1942)
Holt, Wm. George Herbert Sales Engr., Dominion Bridge Co. Ltd., P.O. Box 280, Montreal. (Jr.1937. M.1944)
Holtby, L. Gwynn c/o Can. National Rlys., Prince Rupert, B.C. (S.1946)
Holyoke, D. R. Woodstock, N.B. (S.1945)
Honeywell, W. R. Woodroffe P.O., Ottawa. (Jr.1945)
Hood, G. Leslie Asst. Meter & Relay Engr., Hydro Elec. Power Comm. of Ont. For mail: 9 Hemlock St., Timmins, Ont. (S.1930. Jr.1940. M.1943)
Hooley, Roy F. 2121 MacDonald St., Vancouver, B.C. (S.1945)
Hooper, Wm. H. Mgr., Distn. Equipt. Sales, Amalgamated Electric Corp. Ltd., Toronto. For mail: 251 Dawlish Ave., Toronto 12. (S.1928. Jr.1929. A.M.1936. M.1940)
Hoover, O. H. Dist. Chief Engr., Dominion Water & Power Bureau, Dept. Mines & Resources, Public Bldg., Calgary, Alta. (A.M.1921. M.1935)
Hope, Robt. Leslie Trainee, Sales Engr., Shell Oil Co., 337 Dundas St., London, Ont. (S.1944)
Hope, R. J. S. Tel. Equipt. Engr., Northern Electric Co., Montreal. For mail: The Grove, Beaconsfield, Que. (S.1946)
Hopkins, Alfred Elec. Apparatus, Service Engr., Canadian Westinghouse Co. Ltd., 355 King St. W., Toronto. (S.1937. Jr.1942)
Hopkins, Austin B. Mech. Engr., Spruce Falls Power & Paper Co. Ltd., Kapuskasing Inn, Kapuskasing, Ont. (S.1946)
Hopkins, H. A. 2186-A Dundas St., Toronto. (S.1942)
Hopkins, L. D. Acadia Constrn. Co. Ltd., Halifax. For mail: Bridgewater, N.S. (M.1940)
Hopkins, Peter McMillan 4147 Dorchester St. W., Montreal. (S.1938. Jr.1946)
Hopper, A. E. 482 Alonzo Ave., Ottawa. (M.1923)
Hopper, C. H. Cons. Mining Engr., Boyles Bros. Drilling Co. Ltd., Kirkland Lake. For mail: 79 First St., Kirkland Lake, Ont. (M.1944)
Hopps, John A. Elec. Engr., Radio Branch, National Research Council, Ottawa. For mail: 127 Ste. Marie St., Hull, Que. (S.1941. Jr.1945)
Horgan, Frank J., Jr. 52 Elliott Row, Saint John, N.B. (S.1945)
Horn, J. G. Overseas (Jr.1938)
Hornback, M. E. Asst. Chief Engr., Aluminum Co. of Canada, Montreal. For mail: 2535 Montclair Ave., Montreal. (M.1938)
Horne, Lawrence Fraser Jr. Engr., Consolidated Paper Corp. Ltd., 61 Maple Ave., Shawinigan Falls, Que. (S.1944. Jr.1946)
Horner, George I. Engr. & Partner, Onway Construction Co., 752 St. Clair West, Toronto. (S.1946)
Horner, W. J. Sales Engrg., Babcock-Wilcox & Goldie-McCulloch Ltd. Galt. For mail: 74 Aberdeen Road South, Galt, Ont. (S.1945)
Horricks, J. R. Mtce. Engr., Defence Industries Ltd., Chalk River. For mail: 168 William St., Pembroke, Ont. (S.1944)
Horsburgh, J. G. Asst. Hydro Engr., Water Resources Branch, Manitoba Dept. Mines & Natural Resources, Box 390, The Pas, Man. (S.1939. Jr.1946)
Horton, Everill B. Res. Inspr. i/c Inspn. Dept., Associated Factory Mutual Fire Insurance Co., 607 Stirling Tower, Toronto. (Jr.1936. A.M.1938. M.1940)
Horton, Graydon T. (S.1945)
Horton, J. W. Jr., Can. Industries Ltd., Montreal. For mail: 3351 Cote St. Catherine Road, Montreal 26. (S.1946)
Horwood, Wm. O. Engr., Lyman Tube & Supply Co. Ltd., 920 St. Sophie Lane, Montreal. (S.1937. Jr.1943)
Hoseason, Harry J. Mgr. Toronto Dist., H. H. Robertson Co. Ltd., Metropolitan Bldg., Toronto. (Jr.1941)
Hoskin, E. D. E. Mgr., Hoskin Scientific Specialties, Montreal. For mail: 2009 Mansfield St., Montreal. (S.1946)
Hotte, Paul-André, 525 Aird St., Montreal 4. (S.1944)
Houde, J. Oscar Public Relations & Advertising, Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (Affil.1942)
Houde, Raymond 308 Baldwin St., Montreal. (S.1942)
Hough, A. L. Supt., Substation Divn., Shawinigan Water & Power Co., 107 Craig St. W., Montreal (M.1943)
Houghton, James S. Mech. Design Engr., Dominion Bridge Co. Ltd., Lachine. For mail: 4640 Westmore Ave., Montreal. (S.1938. Jr.1944)
Houghton, J. W. "Arlington", 50 Allandale Ave., Finchley, N.3, England. (A.M.1919. M.1940)
Houghton, T. Walter Asst. Plant Engr., Canada Paper Co., Windsor Mills. For mail: P.O. Box 210, Windsor Mills, Que. (S.1931. Jr.1937. M.1945)
Houlden, James W. Western Sales Mgr., Dominion Ammunition Divn., Canadian Industries Ltd., 650 Somerset Bldg., Winnipeg, Man. (S.1927. Jr.1929. A.M.1937. M.1940)
Houlding, J. D. Electronic Engr., Can. Westinghouse Co., Hamilton. For mail: 18 Beulah Ave., Hamilton, Ont. (S.1946. Jr.1946)
Houle, Roger 8527 St. Denis St., Montreal 10. (S.1944)
Houle, Vianney G. 940 Cherrier St., Montreal 24. (S.1944)
Houston, D. W. Registrar, Assn. Professional Engineers of Saskatchewan. For mail: Box 101, Regina, Sask. (M.1936)
Houston, Gavin N. Cons. Engr., Box 187, Olds, Alta. (M.1914)
Hovey, Chas. M. Supt. Testing Labs., University of Manitoba. For mail: 869 Warsaw Ave., Winnipeg, Man. (Jr.1937)
Hovey, Fred L. Prod. Engr., Coca Cola Ltd., 90 Broadview Ave., Toronto. (S.1946)
Hovey, Lindsay Mansur Elec. Engr., Winnipeg Electric Co. For mail: 208 Niagara St., Winnipeg, Man. (S.1921. A.M.1931. M.1940)
Howard, A. W. Asst. Elec. Engr., Montreal Engineering Co. Ltd. For mail: 81 Cornwall Ave., Town of Mount Royal, Montreal 16. (S.1931. Jr.1941)
Howard, Donald Wm. 4372 Harvard Ave., Montreal 28. (S.1946)
Howard, Ernest E. Sr. Partner & Cons. Engr., Howard, Needles, Tammer & Bergendoff, 921 Walnut St., Kansas City 6, Mo., U.S.A. (M.1943)
Howard, Henry M. University of British Columbia, Vancouver, B.C. (S.1940. M.1941)
Howard, L. H. 141 Rosser Ave., Selkirk, Man. (S.1946)
Howard, Rupert F. Purch. Mgr., Gatineau Power Co., 140 Wellington St., Ottawa. (M.1922)
Howe, C. D. The Right Hon. Minister of Reconstruction & Supply, Parliament Bldgs., Ottawa. (M.1922. Hon.M.1937)
Howe, Harold B. Asst. Chief Engr., Canada Cement Co. Ltd., Phillips Square, Montreal. (S.1935. Jr.1941. M.1944)

Howe, Lloyd G. (S.1942)
Howe, Lawrence M. Operating Supt., Newfoundland Light & Power Co. Ltd., Water St., St. John's, Nfld (A.M.1939. M.1940)
Howells, Wm. C. Dist. Geologist, McColl-Frontenac Oil Co. Ltd., Lancaster Bldg., Calgary, Alta. (M.1941)
Howie, Ross E. Pike River, Que. (Jr.1945)
Howlett, Stephen Brett Engr.-in-Trng., British Columbia Power Commission, Victoria, B.C. (S.1946)
Howley, Jas. T. Canadian Industries Ltd., Beaver Hall Hill, Montreal. (M.1943)
Hubbard, Edward B. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (S.1920. A.M.1927. M.1940)
Hubbard, F. W. Elec. Foreman, Nylon Divn, Can. Industries Ltd., Kingston. For mail: 123 King St. E., Kingston, Ont. (A.M.1919. M.1940)
Hubbard, F. W. Elec. Lieut., R.C.N.V.R., Directorate of Elect. Engrg., N.S.H.Q., Ottawa. For mail: 666 King Edward Ave., Ottawa. (S.1943. Jr 1946)
Hubbard, S. F. Chem. Engr., Donald, Ross & Co., Montreal. For mail: 3429 Peel St., Montreal. (S.1938. M.1942)
Hubble, C. W. Civil Engr., Air Ministry Works Directorate, London. For mail: "Melton", Chessington Road, West Ewell, Surrey, England. (M 1945)
Huber, A. Lloyd Chief Engr., Link-Belt Ltd., 791 Eastern Ave., Toronto. (A.M.1938. M.1940)
Hubley, John S. Chemist & Petroleum Engr., Shallow Water Refining Co., Garden City, Kansas, U.S.A. (S.1940. Jr 1946)
Hudak, Nicholas 2921 Scott St., Vancouver, B.C. (S.1946)
Hudd, B. M. Sr. Dftsmn., Vulcan Iron Works Ltd., Winnipeg. For mail: 141 Spence St., Winnipeg, Man. (S.1945)
Huddleston, Wm. M. Jr. Hydr. Engr., P.F.R.A., Dom. Dept. of Agriculture, Erskine, Alta (S.1943. Jr.1946)
Hudson, Arthur M. Chief of Mech. Divn., War Assets Corp., Montreal. For mail: 8026 Western Ave., Montreal. (A.M.1935. M.1940)
Hudson, George W. Radio Engr, Hammond Manufacturing Co. Ltd., Wellington St., Guelph, Ont. (S.1942. Jr.1945)
Huggard, J. H. Aluminium Laboratories Ltd., Sun Life Bldg., Montreal. (S.1935. Jr.1942)
Huggins, M. W. Dept. of Civil Engrg., University of Toronto, Toronto 5. (Jr.1935. A.M.1939. M.1940)
Hughes, Bernard H. Engrg. Asst., City Engineer's Office, Plymouth, England. For mail: "Trescore", Porthcothan Bay, Padstow, N. Cornwall, England. (S.1914. Jr.1921. A.M.1923. M.1940)
Hughes, Frank Jr. Elec. Engr., International Nickel Co. of Canada, Copper Cliff. For mail: Engineers' Club, Copper Cliff, Ont. (S.1946)
Hughes, C. F. G. Asst. Candn. Govt. Trade Commissioner, Dept. Trade & Commerce, 200 St. Vincent St., Glasgow, Scotland. (S.1940. Jr.1946)
Hughes, Gordon L. Project Engr., Frost & Wood Co. Ltd., Smiths Falls. For mail: P.O. Box 363, Smiths Falls, Ont. (S.1941. Jr.1945)
Hughes, H. T. East Saanich Road, Royal Oak, Vancouver Island, B.C. (A.M.1899. M.1925)
Hughes, J. C. Elfros, Sask. (S.1946)
Hughes, J. W. Gen. Elec. Engr., Can. Pacific Railway, Windsor Station, Montreal. (A.M.1924. M.1940)
Hughes, Philip Bernard Lecturer, University of Toronto. For mail: 15 Linden St., Toronto 5. (S.1927. A.M.1936. M.1940)
Hughes, R. B. Chalmers Apparatus Engr., Canadian General Electric Co., New Liskeard, Ont. (S.1945)
Hughes, W. F. 133 Percival Ave., Montreal West. (S.1937)
Hughson, H. G. Res. Engr. Airport Constrn., Dept. of Transport, Moncton. For mail: P.O. Box 38, Moncton, N.B. (M.1946)
Hughson, John W. Partner, W. C. Hughson & Sons Ltd., Ottawa. For mail: 293 Stewart St., Ottawa. (A.M.1921. M.1940)
Hughson, Thomas L. Dist. Supt. of Bldgs., Dept. Veterans Affairs, London. For mail: 794 Wellington St., London, Ont. (A.M.1919. M.1940)
Hughson, W. R. Box 443, Corner Brook, Newfoundland. (A.M.1921. M.1940)
Hughston, J. F. Supt. Bldgs. & Utilities, Dept. Veterans Affairs, Malton Convalescent Hospital, Malton, Ont. (Affil. 1946)
Hugill, J. T. Chem. Engr., Canadian Liquid Air Co., Montreal. For mail: 5025 MacDonald Ave., Montreal 29. (S.1940. Jr.1943)
Hugli, Edwin E. H. Strl. Design. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto, Ont. (S.1914. Jr.1920. A.M.1923. M.1940)
Hull, Arthur H. Elec. Engr., & Dept. Head, Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto 2. (M.1939)
Hull, R. S. Mng. Engr., Wire & Cable Dept., Can. General Electric Co., Peterborough. For mail: 501 McDonnel St., Peterborough, Ont. (S.1931. Jr.1936)
Hulme, Gordon D. Dept. Mgr., Shawinigan Water & Power Co., 107 Craig St. W., Montreal 1. (S.1928. A.M.1937. M.1940)
Hume, D. C. M. Lecturer, University of Toronto, Ajax Divn., Toronto. (A.M.1923. M.1940)
Humphrey, Ken F. Field Engr., Constrn., Dept. Natural Resources, Regina. For mail: 715 Walmer Road, Saskatoon, Sask. (S.1943. Jr.1946)
Humphries, George E., Partner, M. M. Dillon & Co., Cons. Engrs., 365 Richmond St., London, Ont. (Jr.1930. M.1940)
Hungerford, S. J. Chairman Can. National Rlys., 355 McGill St., Montreal. (M.1919. Hon.M.1937)
Hunt, A. B. Mgr., Electronics Divn., Northern Electric Co., 1261 Shearer St., Montreal 22. (S.1926. Jr.1931. A.M.1936. M.1940)
Hunt, E. H. Chief Geologist i/c Exploration Dept., McColl-Frontenac Oil Co. Ltd., Lancaster Bldg., Calgary, Alta. (M.1942)
Hunt, Fred. Asst. Engr., Can. National Railways, Toronto Terminals Divn. Office. For mail: P.O. Box 425, Lakeview, Ont. (S.1939. Jr.1946)
Hunt, Wm. Harold Dist. Engr., Highways Branch, Dept. Public Works of Manitoba, Winnipeg. For mail: 336 Maplewood Ave., Winnipeg, Man. (M.1945)
Hunt, Wm. Henry Deputy Controller, Roads & Bridges Section, Control Commission for Germany. For mail: c/o North of Scotland Bank, Portree, Isle-of-Skye. (A.M.1910. M.1925)
Hunt, Wm. M. Traffic Engr., Maritime Telegraph & Telephone Co., Halifax. For mail: 74 Jubilee Road, Halifax, N.S. (M.1942)
Hunt, Wm. S. Major R.C.E.M.E., Canadian Staff College, Royal Military College, Kingston, Ont (S.1936. Jr.1940. M.1946)
Hunter, David Sales Engr., Can. Westinghouse Co., 158 Portage Ave. E., Winnipeg, Man. (M.1943)
Hunter, Douglas D. Design Engr., Dominion Bridge Co. Ltd., Lachine For mail: 8a Lilac Ave., Dorval, Que. (S.1940. Jr.1946)
Hunter, Henry G. c/o W. S. Lea, 1226 University St., Montreal. (M.1914)
Hunter, John W. 85 Union Ave., Nutley 10, N.J., U.S.A. (A.M.1907. M.1940)
Hunter, L. M. Mgr., Engrg. Dept., Coca Cola Ltd., 90 Broadview Ave., Toronto. (S.1936. Jr.1942)
Hunter, L. McL. Roadway Engr., City Engrg. Dept, Ottawa. For mail: 7 Willard Ave., Ottawa. (Jr.1913. A.M.1932. M.1940)
Huot, Marcel Engr., Gohier & Dorais, Montreal. For mail: 2475 Maplewood Ave., Montreal. (S.1939. Jr.1944)
Huppé, Lucien 1811 St. André St., Montreal 24. (S.1945)
Hurd, Wm. H. 5944 Waverley St., Montreal. (S.1946)
Hurdle, Harold L. Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (S.1933. Jr. 1938)
Hurley, Jas. J. 17 Lindsay Ave., Toronto. (S.1941)
Hurley, R. P. J. 995 Bathurst St., Toronto. (S.1946)
Hurst, C. K. Asst. Engr., Canals Administration, Dept. of Transport, Hunter Bldg., Ottawa. (S.1937. M.1941)
Hurst, Wm. Pres., Hurst Engineering & Construction Co Ltd., 274 Fort St., Winnipeg, Man. (Affil.1928)
Hurst, W. D. City Engr. & Commr. of Bldgs., 223 James Ave., Winnipeg, Man. (S.1927. A.M.1935. M.1940)
Hurter, Alfred M. Engr.-in-Trng., Spruce Falls Power & Paper Co Ltd., Kapuskasing Inn, Kapuskasing, Ont. (S.1945)
Hurter, A. T. Partner, Stadler, Hurter & Co., Cons. Engrs., Montreal. For mail: 79 Hudson Ave., Town of Mount Royal, Que. (M.1937)
Hurtubise, Jacques E. Assoc. Prof. Civil Engrg., Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1934. Jr.1940. M.1945)
Hurtubise, J. H. Jules Asst. Chief Chem. Engr. of Laboratory, City of Montreal Water Works. For mail: 3192 St. Emile St., Montreal. (M.1945)
Hurtubise, Marc Bernard Steel Designer, Dominion Bridge Co. Ltd., Lachine, Que. (S.1938. Jr.1946)
Hussey, C. H. Service Engr., Can. General Electric Co., Montreal. For mail: 132 First Ave., Verdun, Que (S.1943. Jr.1946)
Hussey, Erwin H. Project Engr., Johns Manville Corp., Manville, N.J. For mail: 182 N. Bridge St., Somerville, N.J., U.S.A. (M.1923)
Hutcheon, N. B. Prof. Mech. Engrg, University of Saskatchewan, Saskatoon, Sask. (A.M.1938. M.1940)
Hutchison, Alexander Vice-Pres., Drummond McColl & Co. Ltd., 930 Wellington St., Montreal. (S.1908. A.M.1914 M.1940)
Hutchison, David Mgr., Transport Dept., Hudson's Bay Co., 10129-103rd St., Edmonton, Alta. (A.M.1932. M.1940)
Hutchison, W. Leslie Plant Mgr., Remington Rand Ltd., Hamilton. For mail: 57 Oak Knoll Drive, Hamilton, Ont. (M.1945)
Hutton, Chas. Hyde Chief Engr., Elec. Power, Hydro Elec. Comm. of Hamilton, 12 King St. E., Hamilton, Ont. (M.1938)
Hutton, Francis S. Asst. Divn. Engr., (London), Can. National Rlys, Richmond & York Sts., London, Ont. (Jr.1938)
Hutton, George A. 218-7th Ave. West, Calgary, Alta. (S.1943)
Hutton, L. A. B. Liaison Officer, Can. Pacific-Can. National Railways, 102 Victoria Bldg., Ottawa. (A.M.1922. M 1940)
Huyck, C. B. Br. Mgr., Rudel Machinery Co. Ltd., 143 East 2nd Ave., Vancouver, B.C. (Affil.1945)
Huza, J. P. 155 Pine Ave. East, Montreal. (S 1946)
Hyde, Ernest 115 Bingham Ave., Toronto. (S.1943. Jr.1946)
Hyman, H. Davison Vice-Pres., Alexander Fleck Ltd., Ottawa. For mail: 31 Madawaska Drive. (Jr.1926. M.1942)

I

Idenden, F. S. Office Engr., Carribean Petroleum Co., Apartado 19, Maracaibo, Venuzuela, S.A. (Jr.1944)
Idsardi, H. Design Engr., John Mitchell, Cons. Engr., Toronto. For mail: Virginiatown, Ont. (S.1902. A.M.1910. M 1940)
Iliffe, F. H. 220 Argyle St., Ottawa. (S.1942. M.1945)
Illaszewicz, Jerzy Mech. Engr., E. B. Eddy Co., Hull For mail: P.O. Box 156, Parent, Que. (S.1945)
Ilovitch, Eli L. Dftsmn. & Student Engr., Jas. A. Kearns, Cons. Engr., 1414 Drummond St., Montreal 25. (S.1944)
Ince, Geoffrey W. 3653 University St., Montreal. (S.1944)
Ingham, Jason H. Factory Mgr., Walter Kidde & Co. of Canada, Montreal. For mail: 63 Arlington Ave., Westmount, Que. (S.1933. A.M.1937. M.1940)
Ingles, C. L. W/C, Sr. Constrn. Engrg. Officer, No. 2 Air Command, R.C.A.F., Winnipeg. For mail: 206 Whytewold Rd., St. James, Man. (S.1932. Jr.1937. M.1941)
Inglis, G. F. Plant Extension Engr., E.A. Bell Telephone Co., Beaver Hall Hill, Montreal. (M.1945)
Inglis, Henry M. B. Capt., R.C.E., & Cons. Mining Engr. & Geologist, Engineer Equipment Depot, R.C.E., Chilliwack, B.C. (M.1941)
Inglis, W. L. Dist. Mgr. for B.C., Housing Enterprises of Canada Ltd., Vancouver. For mail: 3691 West 22nd Ave., Vancouver, B.C. (Jr 1939. M.1943)
Ingraham, Harry A. Cons. Engr., Fort Resolution, N.W.T. (M.1943)
Ingram, W. W. Asst. Supt. & Lead Dept. Foreman, Phillips Electrical Works Ltd., Montreal. For mail: 5590 Jeanne Mance St, Montreal. (S.1938. Jr.1943. M.1945)
Ings, Jasper H. Civil Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1920. Jr.1927. A.M.1930. M.1940)
Inkster, O. Mgr., Driscoll, Knight Coutley & Inkster, C.P.R. Bldg., Edmonton, Alta. (M.1941)
Innes, E. P. Engr., Canadian Canners Ltd., Hamilton. For mail: 82 Stinson St., Hamilton, Ont. ((S.1935. A.M.1938. M.1940)
Innis, Wm. H. 2405 Stanley Ave, Niagara Falls, Ont. (S.1946)
Ireton, J. M. (Jr.1929. A.M.1932. M.1940)
Irvine, Daniel John Sylvester Asst. Resch. Engr., Consolidated Mining & Smelting Co. Ltd., Trail. For mail: Box 344, Rossland, B.C. (M.1946)
Irvine, Frederick Marine Engr., Peacock Bros. Ltd., P.O. Box 6070, Montreal. (AM. 1922. M.1940)
Irvine, J. H. Office & Design. Engr., City Hall, Ottawa. (S.1911. A.M.1917. M.1940)
Irving, T. T. 205 North Eola Drive, Orlando, Fla., U.S.A. (S.1898. A.M.1902. M.1940)
Irwin, G. M. City Engr. & Water Commr., City Hall, Victoria, B.C. (M.1935)
Irwin, H. S. Dominion Bridge Co. Ltd., Toronto For mail: 717 Eglington Ave. W., Toronto. (M.1942)
Irwin, Joseph S. Cons. Petroleum Geologist, Lancaster Bldg., Calgary, Alta. (M.1941)
Isbester, James Emery Asst. Engr., Paper Mill Constrn., Long Lac Pulp & Paper Co. Ltd., P.O. Box 129, Schreiber, Ont. (M.1944)
Isner, B. W. Works Mgr., Can. Gypsum Co. Ltd., Hillsborough, Albert Co., N.B. (M.1946)
Iverson, N. L. Jr. Engr., Water Dvlpt. Br., P.F.R.A., Dept. of Agriculture, Saskatoon, Sask. For mail: 128 9th St. E., Saskatoon, Sask. (S.1943. Jr.1946)
Ives, W. J. 1230 Strathcona St., Winnipeg, Man. (S.1944. Jr.1946)
Izard, Edward Whitaker Gen. Mgr., Yarrows Ltd., Victoria, B.C. (M.1937)
Izard, John Arthur Dftsmn., Yarrows Ltd., Victoria For mail: 572 Newport Ave., Victoria, B.C. (S.1946)

J

Jack, Grant R. City Engr., City Hall, Duckworth St., St. John's, Newfoundland. (A.M.1918. M.1940)

Jackman, A. Howard Jr. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 27 Rathnally Ave., Toronto 5. (S.1946)
Jackson, Arthur Queen's University, Kingston, Ont. (A.M.1920. M.1940)
Jackson, C. B. Dist. Engr., Aluminate Chemicals Ltd., Toronto. For mail: 953 Dominion St., Winnipeg, Man. (M.1943)
Jackson, Carl H. Engr., Canadian Industries Ltd., P.O. Box 10, Montreal. (S.1921. Jr.1923. A.M.1934. M.1940)
Jackson, Chas. H. Pres., Turner & Newall (Canada) Ltd., Montreal. For mail: 4 Richelieu Place, Montreal. (Jr.1928. A.M.1935. M.1940)
Jackson, Hugh Allen Jr. Engr., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 71 Glendonwynne Road, Toronto. (S.1946)
Jackson, J. H. 2190 Gerrard St. E., Toronto. (S.1946)
Jackson, Philip B. Project Director, Odeon Theatre Field Office, Jackson-Lewis Co. Ltd., 80 King St W., Toronto. (Jr.1944)
Jackson, Robin R. Asst. Engr., Indust. Control, Can. General Elec. Co., Peterborough, Ont. For mail: 344 Aylmer St., Peterborough, Ont. (S.1945. Jr.1946)
Jackson, Thos. B. Elec. Engr., Sask. Power Comm., Saskatoon. For mail: 240 Ave. J., North, Saskatoon, Sask. (A.M.1939. M.1940)
Jackson, Walter Dist. Civil Engr., Hydro-Elec. Power Comm. of Ont., Niagara Falls. For mail: 700 Eastwood Cresc., Niagara Falls, Ont. (S.1907. A.M.1913. M.1923)
Jackson, Wm. National Harbours Board, Montreal. For mail: 33 Kings Road, Valois, Que. (A.M.1928. M.1940)
Jackson, Wm. B. Asst. Divn. Engr., St. Lawrence Divn., Can. National Rlys., Montreal. For mail: 828-a Bord de l'Eau, Ste. Dorothée, Que. (S.1943)
Jackson, Wm. H. Prod. Engr., DeHavilland Aircraft of Canada, Toronto. For mail: 85 Ridge Hill Drive. (Jr.1940. M.1942)
Jacobs, Clifford Roy Plant Supt., Kuehne Chemical Co., P.O. Box 165, Elizabeth, N.J., U.S.A. (S.1940. Jr.1943)
Jacobs, Llewellyn C. Constrn. Mgr., Power Corp. of Canada, 355 St. James St. W., Montreal. (S.1908. Jr.1911. A.M.1912. M.1921)
Jacobs, Lionel L. Pres. & Exec. Engr., Automatic Heat Inc., Philadelphia, Pa. For mail: 136 W. Wayne Ave., Wayne, Pa., U.S.A. (A.M.1919. M.1940)
Jacobs, M. Paper Mill Engr., Chas T. Main Inc., 201 Devonshire St., Boston, Mass., U.S.A. (M.1931)
Jacobsen, E. R. Sales Engr., U.S. Steel Export Co., New York. For mail: 80 Gard Ave., Bronxville, N.Y., U.S.A. (S.1928. A.M.1935. M.1940)
Jacoby, M. G. Res. Engr., Dept. of Highways, Regina, Sask. (S.1943. Jr.1946)
Jacques, A. Geo. Asst. Gen. Mgr., St. Lawrence Paper Mills Co. Ltd. & Lake St. John Pulp & Paper Co., Sun Life Bldg., Montreal. (A.M.1936. M.1940)
Jagger, Paul S. Jr. Engr., Barrett Co. Ltd., Montreal. For mail: 684 St. Roche St., Montreal. (S.1941. Jr.1946)
James, A. McK. Nova Scotia Power Commission, Halifax, N.S. (M.1940)
James, David Harries Parceinon, Llanfyrnach, Pem., South Wales. (A.M.1926. M.1940)
James, H. H. Mech. Designer, Foundation Co. of Canada, Montreal. For mail: 2070 Lincoln Ave., Montreal. (A.M.1924. M.1940)
James, L. A. Sales Engr., Rudel Machinery Co., 137 Wellington St. W., Toronto. (S.1942. Jr.1945)
James, Wm. A. Chief Constrn. Engr., Imperial Tobacco Co. of Canada, Montreal. For mail: 3438 Walkley Ave., Montreal. (A.M.1936. M.1940)
James, Wm. Atlee Asst. Chief Engr., Can. Pacific Rly., Lydiatt, Man. (M.1909)
James, W. M. Sunny Brae, Westmorland Co., N.B. (S.1945)
Jamieson, E. A. Surveys Dir., B.C. Power Commission, Vancouver. For mail: 1082 Richmond Ave., Victoria, B.C. (M.1945)
Jamieson, R. E. Prof. Civil Engrg., McGill University, Montreal 2. (A.M.1921. M.1932)
Jamieson, Wm. Field Engr., Powell River Co. Ltd. For mail: Box 414, Powell River, B.C. (M.1925)
Jamieson, Wm. Turnbull Asst. Engr., City of Montreal. For mail: 3821 Hampton Ave., Montreal. (Jr.1912. A.M.1918. M.1940)
Jane, R. S. Vice-Pres. i/c Resch., Shawinigan Chemicals Ltd., Power Bldg., Montreal. (M.1943)
Janelle, W. A. 610 Champagneur Ave., Outremont, Que. (M.1943)
Janigan, Geo. G. 115 Edward St., Halifax, N.S. (S.1943. Jr.1946)
Jankowski, Geo. W. Mech. Engr., Hamilton Bridge Co. Ltd., 231 Bay St. N., Hamilton, Ont. (M.1946)
Jaquays, H. M. Pres., Ontario Steel Products & Vice-Pres., Steel Co. of Canada, Montreal. For mail: 3457 Ontario Ave., Montreal. (S.1898. A.M.1898. M.1909)
Jarand, Wm. H. Sales Engr., Tel. Divn., Northern Electric Co. Ltd., Montreal. For mail: 4442 Harvard Ave., Montreal 28. (A.M.1929. M.1940)
Jardine, E. Ian W. Public Utilities Comm. of B.C., 620 View St., Victoria, B.C. (A.M.1920. M.1940)
Jarmain, Edwin R. Pres., Kelco Engineering Ltd., 13 King St., London, Ont. (M.1944)
Jarman, P. E. Gen. Mgr., City of Westmount, 4633 Sherbrooke St. W., Westmount, Que. (S.1909. Jr.1914. A.M.1917. M.1936)
Jarrell, G. J. Equipt. Engr., Willard Storage Battery Co. of Canada, Toronto. For mail: 269 Campbell Ave., Toronto. (Jr.1937)
Jarrett, Wm. Frederick Plant Engr., Saguenay Power Co. Ltd., Isle Maligne, Que. (S.1936. M.1945)
Jarry, Aurel G. Sales Engr., Jarry & Frère Ltée, Montreal. For mail: 3785 Kent Ave., Montreal 26. (S.1940. Jr.1943)
Jarvis, Gerald W. Chief Engr., McColl-Frontenac Oil Co. Ltd., Royal Bank Bldg., Montreal. (S.1931. Jr.1938. M.1943)
Jarvis, J. G. Demonstrator of Physics, Queen's University, Kingston, Ont. (S.1944)
Jasen, Henry Cons. Engr., 4804 Côte des Neiges, Montreal 26. (M.1940)
Jefferies, J. G. Engr., Aluminum Co. of Canada Ltd., Arvida, Que. (Jr.1945)
Jefferson, W. E. Chief Engr., Maritime Telegraph & Telephone Co. Ltd., Halifax, N.S. For mail: 302 South St. (M.1942)
Jeffery, C. C. Sr. Asst. Engr., Dept. Public Works of Canada, 36 Adelaide St. E. Toronto. (M.1939)
Jeffrey, Alexander Cons. Engr., 215½ North Front, Sarnia, Ont. (Jr.1946)
Jeffrey, D. B. 785 Wilder Ave., Outremont, Que. (S.1946)
Jeffrey, E. W. Illumination Dept. Mgr., Northern Electric Co., 1620 Notre Dame St. W., Montreal. (M.1943)
Jeffreys, Chas. John Chief Engr., Stadler Hurter & Co., Montreal. For mail: 4800 Côte des Neiges. (A.M.1939. M.1940)
Jehu, L. Jr. Res. Devlpt. & Indust. Engrg., Dominion Bridge Co. Ltd., Lachine. For mail: 26 Strathyre Ave., Ville LaSalle, Que. (S.1928. A.M.1937. M.1940)
Jelly, E. M. Divn. Engr., Can. Pacific Railway Co., Brownville Junction, Me., U.S.A. (M.1942)
Jelly, Keith B. Cost Engr., Aluminum Co. of Canada, Arvida. For mail: 105 Castner St. (Jr.1946)
Jemmett, Douglas M. Prof. Elec. Engrg., Queen's University, Kingston, Ont. (A.M.1921. M.1940)
Jenkins, George A. Res. Engr. & Asphalt Tech., Warren Bros. Co., 38 Memorial Drive, Cambridge Mass., U.S.A. (S.1908. Jr.1911. A.M.1922. M.1940)
Jenkins, Thos. H. Design. Engr., Grand Trunk Western Railroad Co., Detroit, Mich. For mail: 472 Rosedale Blvd., Windsor, Ont. (S.1922. Jr.1927. A.M.1932. M.1940)
Jenkins, Wm. Ernest Pres. & Gen. Mgr., Columbia Bitulithic Ltd., Granville Island, Vancouver, B.C. (S.1907. A.M.1917. M.1940)
Jennings, M. W. Supt of Constrn., Alberta Wheat Pool, Lougheed Bldg., Calgary, Alta. (A.M.1922. M.1940)
Jennings, P. J. Supt. Banff National Park, Banff, Alta. (A.M.1911. M.1920)
Jennings, R. B. Property Engr., War Assets Corp., Montreal. For mail: 3432 Peel St. (A.M.1921. M.1926)
Jennings, R. E. 135 Duke St., West Saint John, N.B. (S.1946)
Jeussen, L. N. (A.M.1904. M.1911)
Jepsen, Viggo, Divn. Engr., Consolidated Paper Corp. Ltd., Grand'Mère, Que. (Jr.1932. A.M.1938. M.1940)
Jeske, Robt. A. 255 Garfield St., Winnipeg, Man. (S.1942. Jr.1946)
Jess, Robt. Edmond 1627 Lincoln Ave., Montreal. (S.1938)
Jetté, Arthur Supt. Engr., City of Montreal. For mail: 5601 Phillips Ave., Montreal. (A.M.1920. M.1925)
Jetté, Jos. Chas. Hervé, Divn. Engr., Consolidated Paper Corp. Ltd., Port Alfred, Que. (S.1911. Jr.1917. A.M.1918. M.1940)
Jewett, A. Earle, 101 Aberdeen St., Fredericton, N.B. (S.1942. Jr.1946)
Jewett, F. Coburn Airport Constrn., Dept. of Transport, Ottawa. For mail: Roxborough Apts., Ottawa. (S.1902. A.M.1910. M.1940)
Jewett, W. D. Export Mgr., Dominion Bridge Co. Ltd. P.O. Box 280, Montreal. (M.1945)
Jex, Wm. D. Sr. Dftsmn., Trans-Canada Airlines, Winnipeg, Man. For mail: 134 Scotia St., Winnipeg. (S.1946)
Jickling, R. W. Operating Supt., Sask. Power Commis., Regina. For mail: 2124 Argyle St., Regina, Sask. (S.1919. Jr.1922. A.M.1931. M.1940)
Job, Stanley R. Strl. Dftsmn., Hamilton Bridge Co. For mail: 129 Markland St., Hamilton, Ont. (Jr.1922. A.M.1928. M.1940)
Johannson, Edgar F. Jr. Engr., Canadian Blower & Forge Co. Ltd., Kitchener, Ont. (S.1945)
Johns, C. F. Chief Engr., Res. & Devlpt., Enterprise Foundry Co. Ltd., Sackville, N.B. For mail: Rectory Lane, Sackville, N.B. (S.1924. Jr.1930. A.M.1939. M.1940)
Johnson, Claude V. Tech. Writer & Translator, Dept. Roads of Quebec. For mail: 305 Grand Allée, Quebec. (S.1907. A.M.1910. M.1918)
Johnson, E. L. Factory Mgr., Continental Can Co. of Canada, St. Laurent. For mail: 4044 Grey Ave., Montreal 28. (M.1941)
Johnson, Frank H. Plant Supt., Truro Electric Commission. For mail: 66 Queen St., Truro, N.S. (M.1940)
Johnson, F. Paul Overseas. (S.1938. Jr.1946)
Johnson, G. Alan Vice-Pres. & Tech. Exec., Robert Mitchell Co. Ltd., 750 Belair Ave., Montreal (M.1945)
Johnson, G. O. Air Vice-Marshal, R.C.A.F. Headquarters, Ottawa, Ont. (A.M.1924. M.1940)
Johnson, Howard Mng. Dir., Hall Russell & Co. Ltd., Shipbuilders & Engrs., Aberdeen, Scotland. (M.1942)
Johnson, I. C. 125 Fourth Ave., Cochrane, Ont. (S.1943)
Johnson, J. D. Pres., Canada Cement Co. Ltd., Phillips Square, Montreal. (Affil.1925)
Johnson, James H. Divn. Engr., Borden Co Ltd., Tillsonburg, Ont. For mail: Lisgar Ave., Tillsonburg, Ont. (M.1937)
Johnson, James R. Lt. Col., Tech. Staff Officer, Directorate of Vehicle Devlpt., N.D. H.Q., New Army Bldg., Ottawa. (S.1933. Jr.1938 M.1945)
Johnson, Leonard C. Strl. & Design. Engr., Dept. Public Works of B.C., Victoria, B.C. For mail: 1066 Oliver St., Victoria, B.C. (S.1945)
Johnson, R. E. L. Gen. Mgr., Toronto Divn., Westeel Products Ltd., 28 Atlantic Ave., Toronto 1. (M.1943)
Johnson, Roy W. Mackenzie, Demerara, British Guiana, S.A. (Jr.1938. A.M.1939. M.1940)
Johnson, Stanley Gen. Supt of Mfg., Johnson Wire Works Ltd., Montreal. For mail: 4760 Dagenais St., St. Henri, Montreal. (Affil.1942)
Johnson, Wm. J. Mgr., Johnson Co., Thetford Mines, Que. (S.1921. A.M.1930. M 1940)
Johnston, A. C. Mgr. Power Generation, Aluminum Co. of Canada, Shipshaw. For mail: The Saguenay Inn, Arvida, Que. (A.M.1935. M.1940)
Johnston, Alan H. Project Design, Aluminum Co. of Canada, Arvida. For mail: 846-7th St., Arvida, Que. (M.1945)
Johnston, Bruce F. 3520 McTavish St., Montreal 2. (S.1941)
Johnston, Bruce H. Dist. Mgr., Moloney Electric Co. of Canada, Montreal. For mail: 3520 McTavish St., Montreal. (M.1941)
Johnston, C. M. Vice-Pres., Welch-Johnston Ltd., 474 Bank St., Ottawa. (S.1920. Jr.1923. A.M.1930. M.1940)
Johnston, E. M. Jr. Engr., E. G. M. Cape & Co., Montreal. For mail: 7187 Chambord St., Montreal 35. (S.1936)
Johnston, G. W. F. Chief, Ships Components Divn., War Assets Corp., Montreal. For mail: 4608 Royal Ave., Montreal 28. (S.1914. Jr.1919. A.M.1922. M.1940)
Johnston, H. C. Pres., H. C. Johnston & Co. Ltd., 1502 St. Catherine St. W., Montreal. (A.M.1920. M.1940)
Johnston, H. Lloyd Works Mgr., Can. Industries Ltd., Windsor, Ont. (Jr.1926. A.M.1930. M.1940)
Johnston, H. Wyatt Engr., Sutherland Refiner Ltd., Montreal. For mail: 4048 Gage Road, Montreal 6. (S.1914. A.M 1925. M.1940)
Johnston, J. H. Dist. Engr., Dept. Public Works of Alta., Peace River, Alta. (A.M.1932. M.1940)
Johnston, J. Stuart Serv. Engr., Dominion Oxygen Co. Ltd., Montreal. For mail: 211 Dufferin Road, Montreal. (Jr.1944)
Johnston, J. S. 2 Bay St., Smiths Falls, Ont. (S.1941)
Johnston, O. E. Asst. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 22-36th St., Long Branch, Toronto. (Jr.1936. M.1943)
Johnston, W. D. Dominion Bridge Co. Ltd., Toronto. For mail: 25 Indian Trail, Toronto. (S.1935. Jr.1942)
Johnston, W. J. 5 Prospect Place, Tudor City, New York, U.S.A. (A.M.1938. M.1940)
Johnston, Wm. J. A/Dist. Engr., Dept. Public Works of Canada, 10138-100A St., Edmonton, Alta. (A.M.1920. M.1940)
Johnstone, R. G. Mgr. of Mfg., E. B. Eddy Co., Hull, Que. (Jr.1925. A.M.1930. M.1940)
Johnstone, Robt. W. Asst. Mgr., Anglin-Norcross Ontario Ltd., 57 Bloor St. W., Toronto. (M.1940)
Johre, S. G. Elec. Dftsmn., O. Roy Moore & Co., London, Ont. For mail: 20 McKinnon Place, London, Ont. (A.M.1934. M.1940)
Jolly, John W. Gen. Mgr., Timken Roller Bearing Co., St. Thomas, Ont. (M.1945)
Jomini, Harry Aluminum Co. of Canada Ltd., Wakefield, Que. (M.1942)
Jomini, John L. Shawinigan Water & Power Co. For mail: 46-E Cedar Ave., Shawinigan Falls, Que. (Jr.1937)
Joncas, J. P. Paul Prof. Laval University, Quebec, and Cons. Engr., Joncas & Massé, Quebec Power Bldg., Quebec. (A.M.1913. M.1940)
Joncas, J. Robert Sr. Asst. Engr., Dept, Public Works of Canada, 2 St. Paul St., Rimouski, Que. (M.1945)

Joncas, Louis Joncas & Massé, Quebec Power Bldg., Quebec. (S.1938. M.1945)
Jones, A. R. Asst. to Induction Motor Engr., Can. General Electric Co., Peterborough, Ont. For mail: 5 Anne St. (Jr.1930. M.1943)
Jones, C. H. L. Pres. & Mng. Dir., Price Bros. & Co. Ltd., Quebec, and Mersey Paper Co. Ltd., Box 485, Liverpool, N.S. (M.1926)
Jones, Douglas Secy.-Engr., Canadian Pulp & Paper Assn., 3430 University St., Montreal. (Affil.1941)
Jones, David Carlton Natural Gas Engrg., Canadian Western Natural Gas Light, Heat & Power Co., Calgary, Alta. For mail: 1607-9th St. N.W., Calgary, Alta. (S.1937. Jr.1943)
Jones, Donald S. Overseas. (S.1944)
Jones, E. Donald 1447 Foch Ave., Verdun, Que. (S.1940)
Jones, Ernest H. Asst. Engr., Ont. Dept. of Highways, 30 Sprucehill Road, Toronto 8. (A.M.1939. M.1940)
Jones, Edward L. 1716-25A St. W., Calgary, Alta. (S.1939. Jr.1946)
Jones, Evan S. Dept. Public Works, New Westminster, B.C. (A.M.1939. M.1940)
Jones, F. S. Chief Engr., River St. Lawrence Ship Channel, Dept. of Transport, 400 Youville Sq., Montreal. (A.M.1919. M.1940)
Jones, Geo. H., B'cast Transmitter Engr., Dept., Northern Electric Co., 1261 Shearer St., Montreal. (M.1946)
Jones, Harry A. Overseas. (S.1927. A.M.1930. M.1940)
Jones, H. C. 66 Harshaw Ave., Toronto. (S.1926. Jr.1928)
Jones, Harry Edwin Jr. Engr.-in-Trng., Hydro Electric Power Comm. of Ont., Toronto. For mail: 69 Durban Road, Toronto 9. (S.1946)
Jones, J. Allan Engr., Central Mortgage & Housing Corp., Vancouver, B.C. For mail: 3792 West 34th Ave. (A.M.1938. M.1940)
Jones, J. H. Mowbray Mill Mgr. & Chief Engr., Mersey Paper Co. Ltd., Liverpool, N.S. (S.1925. Jr.1930. A.M.1932. M.1940)
Jones, Kenneth Gordon 234 Oak St., New Glasgow, N.S. (S.1946)
Jones, L. E. Vice-Pres., Armco Drainage & Metal Products of Canada Ltd., 41 George St., Guelph, Ont. (M.1922)
Jones, L. M. Dir., Warren Bituminous Paving Co. Ltd., Toronto. For mail: 57 Burnhamthorpe Blvd., Islington, Ont. (A.M.1908. M.1918)
Jones, Morris H. Chief Engr., Ontario Paper Co. Ltd., Thorold. For mail: 48 Monck St., St. Catharines, Ont. (A.M.1924. M.1940)
Jones, Owen J. Coleman, Alta. (S.1945)
Jones, R. B. Asst. Chief Engr., Can. Pacific Railway, Windsor Station, Montreal. (A.M.1928. M.1940)
Jones, Reginald E. Elec. Engr., Hydro Elec. Power Comm. of Ont., Toronto. For mail: Box 58, Clarkson, Ont. (M.1938)
Jones, Ralph Hamilton Engr., Bell Telephone Co., Ottawa. For mail: 164 Sherburn St., Winnipeg, Man. (S.1946)
Jones, Robt. J. Investigator, Dept. Mines & Resources, 40 Lydia St., Ottawa. (Jr.1945)
Jones, V. C. Commns. Engr., Can. Pacific Rlwy, 368 Main St., Winnipeg, Man. (S.1922. A.M.1926. M.1940)
Jones, West Gordon 28 Dalewood Cres., Hamilton, Ont. (S.1946)
Jones, W. S. R.R. No. 1, Box 7, South Edmonton, Alta. (S.1946)
Jonsson, Junius City Engr., Prince Albert, Sask. (M.1938)
Jopp, James Melville Design Engr. Brown Corp., La Tuque, Que. (M.1945)
Jordan, Jack McLean County Engr. & Road Supt., United Counties of Northumberland & Durham, Cobourg, Ont. (S.1934. Jr.1938)
Josephson, G. M. 1951 Cedar Crescent, Vancouver, B.C. (S.1946)
Josephson, J. Engr., Singer Mfg. Co., Thurso, Que. For mail: 661 Querbes Ave., Outremont, Que. (S.1941. Jr.1946)
Josslin, J. A. Asst. Chief Dftsmn., Ontario Divn., Dominion Bridge Co. Ltd., Toronto. For mail: 915 St. Clair Ave. W., Toronto. (Affil.1942)
Jost, Edward B. Gen. Supt. of Canals, Dept. of Transport, West Block, Ottawa. (S.1902. A.M.1913. M.1940)
Jost, L. G. Strl. Engr., Quinton Engineers, Lt., Los Angeles. For mail: 8342 Kirkwood Drive, Los Angeles 40, Calif., U.S.A. (S.1909. A.M.1913. M.1940)
Jost, Roland M. Hillsborough, N.B. (S.1945)
Joubert, Max Nowlen 607 Merton Ave., St. Lambert, Que. (S.1941. Jr.1946)
Joy, Richard J. D-30, McCulloch Hall, Soldiers Field, Harvard Business School, Boston 63, Mass. (S.1941)
Joyal, Jules Woodlands Engr., Consolidated Paper Corp., 121—3rd Ave., Grand'Mere, Que. (Jr.1923. A.M.1925. M.1936)
Joyce, W. A. Rep., Resch. & Devlpt. Br., Dept. Reconstruction & Supply, Electric Railway Chambers, Winnipeg, Man. (S.1937. Jr.1946)
Jubien, Ernest B. Dominion Textile Co., Montreal. For mail: 150 Vivian Ave., Town of Mount Royal, Que. (S.1922. A.M.1935. M.1940)
Judge, J. W. 11009—90th Ave., Edmonton, Alta. (M.1941)
Julian, Fennell T. Supt., J. A. Vance, Gen. Cont., Woodstock, Ont. For mail: 591 King St., Woodstock, Ont. (Jr.1921. A.M.1930. M.1940)
Julien, Roger Asst. Dist. Engr., Public Works Dept., Montreal. For mail: 1396 Sherbrooke St. E., Montreal 24. (S.1941. Jr.1946)
Jull, Thos. A. Mech. Engr., John Inglis Co. Ltd., Toronto. For mail: 55 Divadale Drive, Leaside, Ont. (Jr.1943)
Julson, Oliver Melvin Provincial Institute of Technology & Art, Calgary, Alta. (S.1945. Jr.1946)
Juneau, Octave A. Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)
Junkin, Bruce F. Y.M.C.A., Drummond St., Montreal. (Jr.1945)
Jupp, Ernest H. Dist. Constrn. Supvr., Soldiers Settlement & Veterans' Land Act, Eburne. For mail: 2015 Inglewood Ave., Holyburn, B.C. (M.1943)
Justice, Claude W. Elec. Engr., Noranda Mines Ltd. For mail: 121—3rd St., Noranda, Que. (S.1925. Jr.1929. A.M.1935. M.1940)
Jutras, Gaston Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)

K

Kahn, F. L. 128 Clifton Road, Toronto. (S.1946)
Kallio, W. Lucky Lake, Sask. (S.1943. Jr.1946)
Kane, C. S. Sales Mgr., East. Divn., Dominion Bridge Co. Ltd., Lachine. For mail: 4839 Westmount Ave., Montreal 6. (Jr.1920. A.M.1923. M.1940)
Kane, John J. Jr. Engr., John Inglis Co., Toronto. For mail: 322 Pacific Ave., New Toronto. (S.1946)
Kane, R. J. 4839 Westmount Ave., Montreal 6. (S.1940. Jr.1945)
Karlinsky, J. 324 Dufferin Ave., Winnipeg, Man. (S.1945)
Karn, Herbert C. Power Supvr., Can. Industries Ltd., P.O. Box 10, Montreal. (A.M.1928. M.1940)
Karn, Wm. Matheson, Sales Engr., Chem. Sales & Service, Electric Reduction Sales Co. Ltd., Buckingham, Que. (Jr.1943)
Kasten, H. L. Strl. Engr., Rule, Wynn & Rule, Archs., Edmonton, Alta. For mail: 10820—83rd Ave. (S.1945)
Kato, Y. Robt. A. Rankin & Co., Montreal. For mail: 429 Victoria Ave., Cornwall, Ont. (S.1945)
Katz, Morris Chemist, National Research Council, Ottawa. (S.1924. A.M.1930. M.1940)
Kauth, C. G. Plant Supt., Dominion Oxygen Co. Ltd., Toronto. For mail: 9 Chudleigh Ave. (S.1934. Jr.1937)
Kay, Bruce E. A. Kay Manufacturing Co. Ltd., Montreal. For mail: 5532 Trans-Island Ave. (S.1938. Jr.1946)
Kay, Wm. Mech. Supt., Spruce Falls Power & Paper Co. Ltd., Kapuskasing, Ont. For mail: P.O. Box 577. (A.M.1939. M.1940)
Kaye, John R. Partner, Engineering Service Co., 14 Prince St., Halifax, N.S. (S.1924. A.M.1932. M.1940)
Kazakoff, J. Asst. to Supvr. of South. Properties, Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (S.1935. Jr.1940)
Kean, D. J. County Engr., County of Ontario, 416 Centre St., Whitby, Ont. (A.M.1920. M.1937)
Kean, Ernest Asst. to Engr., Fraser-Brace Ltd., 164 Barrie St., Kingston, Ont. (S.1946)
Kean, John David Asst. County Engr., County of Ontario. For mail: 127 Brock St. S., Whitby, Ont. (S.1939)
Keane, E. J. Dir., Sec. Treas. & Chief Engr., Paul Curran Ltd. (Canada), Canada Cement Bldg., Montreal. (Affil.1943)
Kearney, Graham Dist. Mgr., English Electric Co. of Canada, 1243 University St., Montreal. (M.1927)
Kearney, Thomas 5652 Marc Sauvalle St., Montreal 20. (S.1944)
Kearns, Jas. A. Cons. Engr., 1414 Drummond St., Montreal. (S.1912. A.M.1925. M.1940)
Keay, H. O. Mgr., Resch. Lab., Consolidated Paper Corp. Ltd., Three Rivers, Que. (M.1909)
Keay, John A. D. Gen. Supt., Northern Constrn. Co. & W. W. Stewart Ltd., 724 Vancouver Block, Vancouver, B.C. (M.1945)
Keay, Wm. Logan Instrmn., Can. National Rlys., Winnipeg, Man. For mail: 101 Noble Ave., Winnipeg, Man. (S.1941. Jr.1946)
Keays, Bryce F. c/o Divn. Engr's. Office, Campbellton, N.B. (S.1942. Jr.1946)
Keddy, H. M. Marine Sales Engr., Schooner Outfitting Co. Ltd., 119 Lower Water St., Halifax, N.S. (M.1946)
Keeler, R. B. 395 Garlies St., Winnipeg, Man. (S.1941. M.1946)
Keeley, Henry Sales & Appln. Engr., Can. Gen. Elec. Co., 212 King St. W., Toronto. (S.1945. Jr.1946)
Keenan, John S. Mgr., Supply Dept., Can. Gen. Elec. Co., 212 King St. W., Toronto. (M.1940)
Keil, Hugh Douglas Elec. Engr., Candn. Industries Ltd., Windsor, Ont. (Jr.1943)
Keirstead, Hazen M. Box 242, Sussex, N.B. (S.1945)
Keith, Fraser Sanderson Vice-Pres., Canadian Forestry Assn., Montreal. For mail: Box 268, Ste. Anne de Bellevue, Que. (S.1902. A.M.1909. M.1921)
Keith, Homer P. Dist. Airway Engr., Dept. of Transport, Tegler Bldg., Edmonton, Alta. (A.M.1922. M.1940)
Keith, Jas. Asst. Engr., Candn. Domestic Engrg. Co. Ltd., Montreal. For mail: 4935 Cianranald Ave. (S.1946)
Keith, J. Clark Gen. Mgr., Windsor Utilities Comm., Canada Bldg., Windsor, Ont. (A.M.1917. M.1940)
Keith, Leslie Sr. Asst. Airway Engr., Dept. of Transport, Civil Aviation Divn., Box 326, Whitehorse, Yukon Territory. (M.1945)
Keith, R. R., Asst. Supt., Sask. Power Comm., North Battleford, Sask. (M.1946)
Keith, W. H. County Engr., County of Wellington, Court House, Guelph, Ont. (S.1921. Jr.1927. A.M.1928. M.1940)
Kelimbet, Bohdan Canadian Celanese Ltd., Drummondville, Que. For mail: 196 Brock St. (M.1945)
Kellam, G. D. Asst. Engr., Candn. Western Natural Gas, Light, Heat & Power Co., Calgary, Alta. For mail: 819-12th Ave. W. (S.1933. Jr.1937. M.1946)
Kelland, W. W. Alberta Hotel, Edmonton, Alta. (M.1941)
Kellett, J. E. Dept. Public Works of Canada, 10138-100-A St., Edmonton, Alta. (M.1945)
Kellett, W. Melvin Indust. Engr., Can. Industries Ltd., Montreal. For mail: 4940 Coronet Ave. (M.1943)
Kellogg, Paul Pres., Stevenson & Kellogg Ltd., Sun Life Bldg., Montreal 2. (M.1940)
Kelly, Edward A. Divn. Engr., Dept. Highways of Ont., Kenora, Ont. For mail: 707-1st St. S. (A.M.1924. M.1926)
Kelly, Ernest A. Mgr., Sault Structural Steel Co. Ltd., Wylde Ave., Sault Ste. Marie, Ont. (Affil. 1945)
Kelly, Frank L. Mount Allison University, Sackville, N.B. (S.1944)
Kelly, James Frederick, Asst. Engr., Dept. Public Works of Canada, Federal Bldg., Halifax, N.S. (M.1944)
Kelly, Joseph J. Mgr., Hamilton Dist., Lincoln Electric Co. of Canada Ltd. For mail: 35 Melrose Ave. S., Hamilton, Ont. (M.1940)
Kelly, James O. Lieut., R.C.E.M.E., Base W/S, No. 10 Coy., R.C.E.M.E., Longue Pointe Ordnance Depot, Montreal. (S.1940. Jr.1943)
Kelly, Oliver G., Airway Engr., Civil Aviation, Dept. of Transport, Edmonton, Alta. (M.1946)
Kelly, S. F. Asst. Chief Dftsmn., Hamilton Bridge Co., Hamilton. For mail: Box 89, Port Nelson, Ont. (Affil.1929)
Kelly, W. H. Contracting Engr., 1434 St. Catherine St. W., Montreal 2. (A.M. 1937. M.1940)
Kelly, Wm. N. Cons. Mech. Engr., 837 W. Hastings St., Vancouver, B.C. (M.1936)
Kelsey, Ernest S., Electronics Resch. Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1919. Jr.1925. A.M.1931. M.1940)
Kemp, C. G. Asst. Works Mgr., Consumers Glass Co. Ltd., Ville St. Pierre For mail: 4402 King Edward Ave., Montreal 28. (A.M.1935. M.1940)
Kemp, J. Colin, Mng. Dir., Geo. S. Armstrong (Canada) Ltd., 360 St. James St., Montreal 1. (S.1907. A.M.1912. M.1940)
Kemp, Oliver, Designer, Dominion Structural Steel Ltd., Montreal. For mail: 455 Beaconsfield Blvd., Beaurepaire, Que. (M.1940)
Kempton, D. R. Jr. Testing Engr., Hydro Electric Power Comm. of Ont., Toronto. For mail: 317 Lee Ave. (S.1940. Jr.1946)
Kemsley, Sydney H. Surveyor Dept. Public Works, Colonial Govt., Hamilton, Bermuda. For mail: "Overland", Devonshire, Bermuda. (A.M.1939. M.1940)
Kendall, H. C. Bldg. & Mech. Supt., Toronto Terminals Railway Co., Union Station, Toronto. (A.M.1921. M.1940)
Kendall, Ralph Cons Engr. & Land Surveyor, Queen Bldg., Halifax, N.S. (M.1940)
Kendler, Emil 205 Dufferin Road, Hampstead, Que. (S.1945)
Kennedy, Duncan 16 Queens Road, Beckenham, Kent, England. (A.M.1926. M.1940)
Kennedy, Dorwin E. Forest Products Engr., Dept. Mines & Resources, Ottawa. (S.1940. Jr.1942)
Kennedy, Gerald Wilfred Asst. Prod. Mgr., Montreal Daily Star. For mail: 4166 St. Catherine St. W., Montreal 6. (S.1945)
Kennedy, Howard Commr., Ontario Royal Commission on Forestry, Toronto. For mail: 8 Ellerdale Rd., Hampstead, Que. (A.M.1921. M.1928)
Kennedy, H. C. Montreal Mgr., Wm. Kennedy & Sons Ltd., Canada Cement Bldg., Montreal. (S.1904. A.M.1910. M.1940)
Kennedy, Harold E. Strl. Designer & Dftsmn., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 9 Castle Frank Cres. (S.1937. Jr.1942)
Kennedy, J. E. 226 Cedric Ave., Toronto. (S.1946)
Kennedy, John F. Strl. Engr., Shawinigan Engineering Ltd., 107 Craig St. W., Montreal. (S.1941. Jr.1944)
Kennedy, Keith Overseas. (S.1940. Jr.1946)

Kennedy, Russell J. Lecturer, Dept. Civil Engrg., Queen's University, Kingston, Ont. For mail: 191 Collingwood St. (S.1940. Jr. 1946)
Kennedy, Robt. Wm. Overseas. (S.1942. Jr.1946)
Kennedy, S. M. Can. Industries Ltd., Hamilton, Ont. For mail: 51 Blake St. (Jr.1941)
Kennedy, T. Dowsley Pres. & Gen. Mgr., Wm. Kennedy & Sons Ltd., Owen Sound, Ont. (A.M.1911. M.1940)
Kennedy, T. F. S/L, R.C.A.F., Chief Ground Instructor, Pennfield Ridge, N.B. For mail: Saint Andrews, N.B. (Jr.1945)
Kennedy, Taylor J. Supt., Canada Cement Co. Ltd., Montreal East. For mail: 371 Lansdowne Ave., Westmount, Que. (M.1944)
Kennedy, T. V. (S.1942)
Kennett, D. A. Jr. Engr., P.F.R.A., Dom. Dept. of Agriculture, Erskine, Alta. (S.1943. Jr. 1946)
Kenney, B. D. 123 St. George St., Toronto 5. (S.1943)
Kenney, C. L. A/Divn Engr., Dept. Highways & Public Works of N.S., Box 160, Sydney, N.S. (M.1940)
Kenny, W. E. Student Trng. Course, B.C. Power Comm. P.O. Box 606, Victoria, B.C. (S.1946)
Kenrick, Robt. R. 3525 Vendome Ave., Montreal. (A.M.1888. M 1898)
Kensit, H. E. M. 101 Fourth Ave., Ottawa. (M.1914)
Kenst, Richard J. Owner Strathcona Garage, Vancouver, B.C. For mail: 2110 W. 43rd Ave. (S.1939. Jr 1946)
Kent, A. Douglas Asst. Resch. Engr., Divn. of Physics, National Research Council, Ottawa. For mail: 104 Research Road, Quarries P.O. (S.1935. Jr.1942)
Kent, Cecil C. Patent Attorney, Fetherstonhaugh & Kent, C.P.R. Bldg., Winnipeg, Man. (Affil.1938)
Kent, Edward S. Chief Engr., Cowin & Co. Ltd., 1137 Pacific Ave., Winnipeg, Man (A.M.1918. M.1940)
Kent, Geo. E. Asst. Refinery Supt., Imperial Oil Ltd., Regina, Sask. For mail: 2336 St. John St. (S.1926. A.M.1934. M.1940)
Kent, G. N. Clare Shipbuilding Co. Ltd., Meteghan, N S. (M.1944)
Kent, H. F. 82 Cedar St., Halifax, N.S. (M.1942)
Kent, J. C. 4727 Wallace St., Vancouver, B.C. (S.1943)
Kent, Norman S. Tel. Equipt. Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1946)
Kent, Stanley R. Instr. in Arch., Ajax Divn., University of Toronto, Ajax, Ont. (S.1944. Jr.1946)
Kent, Wm. L. Supt., Northern Construction Co & J. W. Stewart Ltd., 736 Granville St., Vancouver, B.C. (S.1929. Jr.1937. M.1941)
Kenyon, Lot Amos 4926 Mira Road, Montreal 6. (S.1908. A.M.1914. M.1940)
Keppy, John C. Dist. Plant Engr., Bell Telephone Co., London, Ont. For mail: 331 Ridout St. S. (M.1945)
Ker, Frederick Innes Mng. Dir. & Editor, Hamilton Spectator, Hamilton, Ont. (A.M.1918. M.1929)
Ker, M. F. Chief Engr., Township of Stamford, Niagara Falls, Ont For mail: 2057 Drummond Road. (Jr.1920. A.M.1927. M.1940)
Ker, Walter Allan Asst. Engr., Water Rights Branch, Parliament Bldgs., Victoria, B.C. (S.1944. Jr.1946)
Kerfoot, John G. P. H. Odd Centreless Grinding Ltd, Kitchener. For mail: R.R. No. 4, Kitchener, Ont. (S.1936. Jr.1942)
Kerfoot, J. T. W. E. Dillon Co. Ltd., Leaside, Ont. For mail: 60A Lowther Ave., Toronto. (S.1946)
Kernahan, G. M. 1841 Assiniboine Ave., Winnipeg, Man. (S 1946)
Kerr, A. T. 3141 W. 36th Ave., Vancouver, B.C. (A.M.1901. M.1922)
Kerr, J. J. Dftsmn., Dominion Engrg. Works Ltd., Lachine, Que. (S.1946)
Kerr, James W. Central Station Sales Divn., Canadian Westinghouse Co. Ltd., Hamilton, Ont. (Jr.1938)
Kerr, Robt. A. Mech. Engr., Cable Divn., Northern Electric Co. Ltd., Montreal. For mail: 5675 Sherbrooke St. W. (S.1932. Jr.1940. M 1945)
Kerr, Robt. G. 6312 Angus Drive, Vancouver, B.C. (S.1946)
Kerr, S. Logan Cons. Engr. & Pres., S. Logan Kerr & Co. Ltd., Philadelphia, Pa., U.S.A. For mail: 31 Westview St (M.1935)
Kerry, Armine John Rehabilitation & Employment Officer, The Engineering Institute of Canada, 2050 Mansfield St., Montreal 2. (Jr.1931. A.M.1934. M.1940)
Kerry, Colin W. 465 Côte St. Antoine Road, Montreal. (S.1942)
Kerry, Frank George Mgr., Devlpt. & Engrg. Dept., Canadian Liquid Air Ltd., 1111 Beaver Hall Hill, Montreal. (Jr 1937. M.1944)
Kerry, John G. G. P.O. Box 340, Port Hope, Ont. (S.1888. A.M.1894. M.1904)
Kershaw, Norman W. Plant Engr., Eagle Pencil Co., New York. For mail: 72 Dale Ave., Allendale, N.J., U.S.A. (S.1935. Jr.1937)
Kerson, M. W. Gen. Engrg., Aluminum Co of Canada, Montreal. For mail: 4593 Harvard Ave. (A.M.1931. M.1940)
Kert, Monroe Harold Jr. Engr., Candn. Domestic Engrg. Co. Ltd., 1440 St. Catherine St. W., Montreal. (S.1946)
Ketchen, Wm. Arthur Chief Chemist, Fraser Companies Ltd., Edmundston, N.B. (S.1924. Jr.1928. A.M 1933. M.1940)
Ketchum, Verne Chief Engr., Timber Structures, Inc., 5035 First Ave. S., Seattle 4, Wash., U.S.A. (M.1944)
Ketterson, A. R. 2 Ellerdale Road, Hampstead, Que. (A.M.1908. M.1938)
Keyfitz, Irving M. Design Engr., A. V. Roe Canada Ltd., Box 430, Terminal "A", Toronto. (S.1940. Jr.1944)
Key-Jones, Gilbert Owner, Key Agencies, 215—10th Ave., Calgary, Alta. (Affil.1942)
Keyser, Graham M. Demonstrator, Physics Dept., Queen's University, Kingston, Ont. For mail: 25 College St. (S.1946)
Keyt, Warren E. Sr. Asst., Public Works of Canada, P.O. Bldg., Columbia St., New Westminster, B.C. (A.M.1920. M.1940)
Kidd, W. S. Vice-Pres. & Gen. Mgr., E. B. Eddy Co., Hull. For mail: 856 Echo Drive, Ottawa. (Jr.1921. A.M.1928. M.1940)
Kielland, J. L. Designing Engr., Shawinigan Engineering Co., 107 Craig St. W., Montreal. (M.1945)
Kierans, M. D. 3502 Northcliffe Ave., Montreal 28. (S.1945)
Kilborn, R. K. Mech. Supt., McIntyre Porcupine Mines Ltd., Schumacher, Ont. (M.1945)
Kilbourn, F. B. Vice-Pres. & Gen. Mgr., Canada Cement Co. Ltd., Philips Square, Montreal. (A.M.1924. M.1927)
Kilburn, Daniel G. Chief Engr., Board of Transport Commissioners for Canada, Ottawa. For mail: P.O. Box 162. (S.1907. A.M.1913. M.1936)
Killaly, A. Laurence Suptg. Engr., Trent Canal, Dept. of Transport, Peterborough, Ont. For mail: 502 Weller St. (S.1900. A.M.1910. M.1940)
Killam, D. A. Constrn. Supvr., Candn. Industries Ltd., P.O. Box 10, Montreal. (S.1925. Jr.1928. A.M.1935. M.1940)
Killam, F. R. Pres., Industrial Coatings Ltd., Ft. Hornby St., Vancouver, B.C. (S.1937. Jr.1940)
Killam, Robt. B. Asst. Prof. Mech. Engrg., McGill University, Montreal. For mail: 2168 Sherbrooke St. W. (S.1942. M.1945)
Killer, Fred. A. Geologist, Imperial Oil Ltd., 335—7th Ave. W., Calgary, Alta. (M.1945)
Killoran, Jos. L. Chief Engr., Canadian Celanese Ltd., Drummondville, Que. (M.1945)
Kimpton, Geoffrey H. Mngmt. Engr., Stevenson & Kellogg Ltd., Sun Life Bldg., Montreal. (S.1934. M.1940)
Kindersley, Robt. Overseas. (A.M.1940. M.1940)
King, B. Wensley Exec. Engr., Canadair Ltd., Cartierville. For mail: 114 Morrison Ave., Town of Mount Royal, Que. (M.1945)
King, C. N. Engrg. Dept. Can. Pacific Rly., Montreal. For mail: 4555 Hampton Ave. (Jr.1940)
King, Eric Chas. Major, R.C.E.M.E. Workshops, 6565 Notre Dame St. E., Longue Pointe, Montreal 5. (Jr.1935. A.M.1937. M.1940)
King, Hector I. Design Engr., Truscon Steel Co. of Canada Ltd., Montreal. For mail: 5131 Earnscliffe Ave. (S.1938. Jr.1939)
King, Herbert L. M. Lieut., R.C.E.M.E. Regina, Sask. For mail: 3217 Dewdney Ave. (S.1940. Jr.1941)
King, J. D. Mgr., Detroit Stoker Co. of Canada, New Birks Bldg., Montreal. (Affil.1935)
King, J. M. Metalgst., Can. General Electric, Peterborough, Ont. For mail: 277 Monaghan Road. (Jr.1945)
King, J. S. L. (S.1940)
King, Peter C. Lt.-Col., R.C.E.M.E., Dir. Vehicle Devlpt., N.D.H.Q., Ottawa. For mail: 20 Bower Ave. (S.1928. A.M.1937. M.1940)
King, W. A. 1711—29th St. S.W., Sub. P.O. 13, Calgary, Alta. (S.1939. Jr.1946)
Kinghorn, Andrew A. Pres. & Mgr., Kinghorn Construction Co. Ltd., Excelsior Life Bldg., Toronto. (M.1933)
Kinghorn, Wm. W. 206 Smythe St., Fredericton, N.B. (S.1941. Jr.1943)
Kingsland, E. N. F/O, R.C.A.F., No. 23 E.F.T.S., Davidson, Sask. For mail: 544 Lansdowne Ave., Westmount, Que. (S.1937. M.1945)
Kingsmill, C. G. Gen. Supt., Beauharnois Light, Heat & Power Co., P.O. Box 100, Beauharnois, Que. (Jr.1927. A.M.1931. M.1940)
Kingston, Laurence B. 131 Brown Ave, Quebec. (S.1905. A.M.1912. M.1934)
Kingston, T. M. S. City Mgr. & Engr., City Hall, Chatham, Ont. (S.1921. Jr.1927. A.M.1931. M.1938)
Kinnear, Clifford R. Asst. Engr. of Way, Toronto Transportation Comm. For mail: 209 Strathallan Blvd., Toronto. (A.M.1921. M.1936)
Kippan, J. A. Can. Comstock Ltd., Saint John, N B. (S.1941. Jr.1946)
Kirby, E. G. Asst. Office Mgr., Price & Pierce Ltd., Sun Life Bldg., Montreal 2. (M.1944)
Kirby, Guy H. Plant Engr., St. Jerome Plant, Rolland Paper Co. For mail: 312 Globensky St., St. Jerome, Que. (S.1919. A.M 1923. M.1940)
Kirby, Thos. H. Vice-Pres., Filer-Smith Machinery Co. Ltd., Winnipeg, Man. For mail: 250 Waverley St. (A.M.1919. M.1940)
Kirk, J. W. Field Engr., International Water Supply Ltd., 12 Maitland St., London, Ont. (S.1943. Jr.1944)
Kirk, W. D. Supt., E. G. M. Cape & Co., Montreal. For mail: 5551 Queen Mary Road. (S.1927. A.M 1937. M.1940)
Kirkland, Wm. D. Elec. Engr., City Power Plant, Edmonton, Alta. (S.1937. M.1946)
Kirkpatrick, Everett C. Works Mgr., Steel Co. of Canada, 525 Dominion St., Montreal. (S.1906. A M.1913. M.1926)
Kirkpatrick, P. C. Res. Engr., H. G. Acres & Co., Niagara Falls. For mail: 29 Grosvenor Ave., Ottawa. (S.1915. A.M.1919. M.1940)
Kirkpatrick, P. E. Calgary Power Co., Lethbridge, Alta. (A.M.1938. M.1940)
Kirkpatrick, Robt. E. Mech. Engr., Consolidated Paper Corp., Grand'Mere, Que. (S.1937. Jr.1942)
Kirkwood, J. Gordon Jr. Engr., Canadian Bridge Co. Ltd, Walkerville, Ont. (S.1939. Jr.1945)
Kirsh, Leonard B. 3527 Lorne Ave., Montreal. (S.1944)
Kittlitz, Raymond Stanley Student Operator, Exploration Dept., Imperial Oil Ltd., Calgary. For mail: Box A, Bruderheim, Alta. (S.1946)
Kitto, Frank Surveyor, Dept. Lands & Forests, Toronto. For mail: 2522 Yonge St. (S.1905. A.M.1912. M.1921)
Klassen, Harold C. 165 Cathedral Ave., Winnipeg, Man. (S.1945)
Klassen, H. W. 1262 Fredrick St., North Battleford, Sask. (S.1945)
Klawe, C. H. 29 Classic Ave., Toronto 5. (M.1946)
Klein, Edward Treas., Candn. Laco Lamps Ltd., Montreal. For mail: 25 Barat Road, Westmount, Que. (A.M.1920. M.1940)
Klein, Max 362 Fairmount Ave. W., Montreal. (S.1942. Jr.1946)
Klein, Samuel Harold Mech. Engr., Air Conditioning Engineering Ltd., Montreal. For mail: 362 Fairmount St. W. (S.1946)
Klempner, Harold Sr. Civil Engr., Directorate Civil Engrg. & Mtce., Naval Service H.Q., Ottawa. For mail: 473 Parkdale Ave. (M.1944)
Kline, Donald R. Explosion Damage Appraiser, Halifax Explosion Claims Comm., Halifax, N.S. For mail: 11 Jennings St. (M.1946)
Kline, J. Douglas Design Engr., Public Service Comm. of Halifax, 601 Barrington St., Halifax, N.S. (Jr.1941. M.1944)
Klodniski, N. Engrg. Dftsmn., Can. National Rlys., Montreal. For mail: 2168 Sherbrooke St. W. (S.1937. Jr.1943)
Klotz, C. O. P. Devlpt. Divn., Sales Dept., Aluminum Co. of Canada, Sun Life Bldg., Montreal. (S.1933. M.1940)
Knapp, E. W. Supt., Engrg. Divn., Shawinigan Water & Power Co., Craig St. W., Montreal. (Jr.1923. A.M.1930. M.1940)
Knecht, J. E. 115 Wicksteed Ave., Town of Mt. Royal, Que. (S.1945)
Knight, C. A. Asst. Roads Engr., Dept. Public Works of Newfoundland. For mail: 18 Henry St., St. John's, Nfld. (Jr.1936)
Knight, Curtis L. E. Asst. Engr., Dept. Public Works, Grenada, B.W.I. For mail: St. Georges, Grenada, B.W.I. (S.1943)
Knight, F. G. Works Engr., Consumers Gas Co. of Toronto, 269 Front St. E., Toronto 2. (M.1944)
Knights, K. R. Equipt. Engr., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 312 Roehampton, St. (S.1941. Jr.1946)
Knutsen, George Airway Engr., & Airport Mgr., Civil Aviation Divn., Dept. of Transport, Fort Simpson, N.W.T. (M.1941)
Kobayashi, George J. 5868 Bannantyne Ave., Verdun, Que. (S.1945)
Koblynyk, Demetrius F. Elec. Engr., Calgary Power Co. Ltd., Calgary, Alta. For mail: 220-12th Ave. N.E. (S.1938. Jr.1943)
Koch, Donald E. 690 Victoria Ave., Montreal 6. (S.1945)
Kohl, Geo. H. R.R. No. 6, Guelph, Ont. (Jr.1913. A.M.1919. M.1927)
Kolbeins, Henry Dftsmn. & Jr. Engr., Arthur Pearson, Cons. Engr., Vancouver, B.C. For mail: 557-West 22nd Ave. (S.1944)
Korcheski, Wm. B. Designing Dftsmn. & Engr., Brompton Pulp & Paper Co. Ltd., Red Rock, Ont. (S.1937. A.M.1940. M.1940)
Korcz, John 5677 Fifth Ave., Rosemount, Montreal 36. (S.1945)
Koreen, O. J. Chief Dftsmn., Port Arthur Shipbuilding Co. Ltd. For mail: 315 Wolseley St., Port Arthur, Ont. (A.M.1939. M.1940)
Koropatnick, Peter Dept. Public Works of B.C., Port Crawford, B.C. (S.1940. Jr.1946)
Korwin-Gosiewski, J. S. Mech. & Elec. Engr., & Partner, Korward Wood Products Co., 1070 Osborne St., Montreal. (M.1945)
Kosnar, V. G. Elec. Engr., Dept. Mines & Resources, Cartier Bldg., Ottawa. (S.1937. Jr.1946)

Koulomzine, Theodore Cons. Engr., Sr. Partner. Koulomzine, Geoffrey, Brossard & Co., P.O. Box 870, Val d'Or, Que. (M.1945)
Kozak, Stephen Transm. Engrg., Bell Telephone Co. of Canada, Toronto. For mail: 210 Ashworth Ave. (S.1946)
Kraft, Ferdinand Tech. Dir., Marathon Paper Mills of Canada, Marathon, Ont. (M.1945)
Kraft, Robt. W. Project Engrg., Aluminum Co. of Canada, Arvida, Que. For mail: 105 Castner St. (S.1941. Jr.1945)
Krassov, Chas. Engr., Ford Motor Co. of Canada, Windsor, Ont. For mail: 220 McEwan Ave. (M.1944)
Krebser, Edward M. Plant Supt., Candn. Bridge Co. Ltd., 1219 Walker Road, Walkerville, Ont. (A.M.1930. M.1940)
Krebser, Louis F. Heating & Ventilg. Engr., Canadian Industries Ltd., Beaver Hall Square, Montreal. (A.M.1932. M.1940)
Kuhring, Paul L. Asst. Chief Engr., River St. Lawrence Ship Channel, Dept. of Transport, Montreal. For mail: 16 Dobie Ave., Town of Mt. Royal, Que. (Jr.1922. A.M.1925. M.1940)
Kummen, Harold T. Engrg. Supt. Kummen-Shipman Electric, Ltd., 317 Fort St., Winnipeg, Man. (S.1941. Jr.1946)
Kurtz, Harold J. Mount Albert, Que. (S.1925. Jr.1928. A.M.1934. M.1940)
Kuster, Norman W. Design Drftsmn., Automotive Divn., Can. Car & Foundry, Fort William, Ont. For mail: 236 Pruden St. S.1943)
Kuzyk, Fred T. Poplar Point, Man. (S.1945)
Kuzyk, Wm. J. (S.1943)
Kydd, George Res. Engr., Hudson Bay Terminals, Dept. of Transport, Churchill, Man. For mail: 143 First Ave., Ottawa. (S.1902. Jr.1911. A.M.1914. M.1940)
Kyle, Willard Hugh (S.1926. A.M.1931. M.1940)
Kyles, James Stirling, Engr., Bell Telephone Co., London, Ont. For mail: 512 Waterloo St. (S.1946)

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Laari, Wm. Spec. Lecturer, Hydraul., University of Toronto. For mail: 27 Greenlaw Ave., Toronto 10. (Jr.1942)
Laberge, Chas. R., Asst. Chief Engr., Dept. Public Works of Quebec, 515 St. Gabriel St., Montreal. (M.1945)
Laberge, Jacques 4344 Decarie Blvd., Montreal 28. (S.1944)
Laberge, Jérôme G. 525 Prince Arthur St. W., Montreal. (S.1946)
Laberge, Paul X. Plant Engr., Pulp & Paper Mill, Donohue Bros. Ltd., La Malbaie, Que. (S.1940. Jr.1944)
Labossière, G. R. 585-4th Ave., Lachine, Que. (S.1946)
Labrèche, J. Robert Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)
Labrecque, Henri Prof., Ecole Polytechnique & Ecole des Beaux-Arts, and Cons. Engr., Labrecque, Leblanc & Labrecque, 10 St. James W., Montreal. (M.1943)
LaBrish, Gordon Aluminum Co. of Can., Montreal. For mail: 4462 Wilson Ave. (S.1939)
Labrosse, Fernand J. Estimator Engr., Clairval Construction Co., Montreal. For mail: 3668 St. Hubert St. (S.1941. M.1946)
Lacasse, Gérard Engr., D. Lamothe, Gen. Contr., Noranda, Que. For mail: P.O. Box 386. (M.1946)
Lace, George S. Supvg. Inspr., Civil Aviation Branch, Dept. of Transport, Montreal. For mail: 1649 Lincoln Ave. (M.1943)
Lachance, Keith E. 138 Faraday St., Ottawa. (S.1946)
Lackman, Gerald Leonard Indust. Designer, Design Services Regd., 1189 Crescent St., Montreal. (S.1942)
Lacombe, Jean L. Plant Engr., Barrett Co. Ltd., Joliette, Que. (S.1937. M.1942)
Lacroix, Emile City Engr. & Mgr., City Hall, Outremont, Que. (A.M.1921. M.1940)
Laferme, L. 5540 Queen Mary Road, Montreal. (Jr.1920. A.M.1921. M.1940)
Laferrière, R. A. Dept. Public Works of Canada, Hunter Bldg., Ottawa. (A.M.1939. M.1940)
Laflèche, Jean Jacques 2158 Ontario St. E., Montreal 24. (S.1944)
Laffoley, Laurence H. Engr. of Bldgs., Can. Pacific Rly., Windsor Station, Montreal. (S.1914. A.M.1921. M.1940)
Lafleur, Armand E. Res. Engr., Que. Roads Dept., Notre Dame du Bon Conseil, Co. Drummond, Que. (M.1945)
Lafond, R. O. Capt., R.C.E., St. Louis Barracks, Quebec. (S.1940)
Lafontaine, Charles 1292 Beaubien St. E. Montreal 35. (S.1945)
LaFontaine, D. J. Chief Engr., Electric Tamper & Equipment Co. of Canada, 1440 St. Catherine St. W., Montreal 25. (S.1931. M.1940)
LaFontaine Fernand J. Engr., Quebec Govt. For mail: 4582 Lafontaine St., Montreal 4. (S.1944)
Lafontaine, Laurent 83 De Castelneau St., Montreal 14. (S.1945)
LaForest, J. M. M. Montreal Harbour, National Harbours Board. For mail: 1433 Lajoie Ave., Outremont, Que. (A.M.1916. M.1940)
Laframboise, Adhémar Chief Engr., Eastern Canada Steel & Iron Works Ltd., Lesage Ave., Quebec. (S.1911. A.M.1916. M.1940)
Lafrance, Paul-Emile 215 Fourth St., Shawinigan Falls, Que. (S.1945)
Lafrenière, Théo. J. Chief Engr., Quebec Ministry of Health, 1570 St. Hubert St., Montreal 24. (M.1920)
Laganière, Fernand 97 Côte d'Abraham, Quebec. (S.1944)
Laganière, Gabriel 4702 Lafontaine St., Montreal. (S.1944)
Laganière, René 4702 Lafontaine St., Montreal. (S.1942)
La Haye, J. C. 1908 Gauthier St., Montreal. (S.1944)
Lahey, J. Walter Town Engr., Dartmouth, N.S. (M.1946)
Laidlaw, Douglas S. Cons. Engr., Laidlaw & Co., Bank of Montreal Bldg., Port Arthur, Ont. (Jr.1930. A.M.1935. M.1940)
Laidrich, Edward Devlpt. Engr., Voit Rubber Co. Ltd., Los Angeles. For mail: 605 So. Flower St., Los Angeles 14, Calif., U.S.A. (M.1944)
Laing, A. K. Civil Engr., Dept. of Transport, Ottawa. (S.1926. A.M.1934. M.1940)
Laing, David A. S. Planning Engr., Phillips Electrical Works Ltd., Brockville, Ont. For mail: 4 Lancaster Ave. (S.1930. A.M 1937. M.1940)
Laing, Wm. L. Asst. Engr., Mech. Engrg., Dominion Bridge Ltd., Lachine. For mail: 3562 Belmore Ave., Montreal. (A.M.1939. M 1940)
Laird, David W. Designing Engr., C. D. Howe Co. Ltd., Public Utilities Bldg., Port Arthur, Ont. (S.1939. Jr.1940. M.1942)
Laird, Robt. G. Engr., Valley Pipe Line Co. Ltd, Turner Valley, Alta. (A.M.1940. M.1940)
Laird, W. D. Dept. of Reconstruction, Montreal. For mail: 3193 The Boulevard, Westmount, Que. (M.1946)
Lajoic, Gérard Dept. Public Works of Canada, Post Office, Upper-Town, Quebec. (M.1941)
Lajoie, Maurice 9 Hinton St., Montreal East 5. (S.1945)
Lake, Addison A. 3821 Harvard Ave., Montreal 28. (S.1946)
Lake, Henry M. Chief Dftsmn., Algoma Steel Corp. Ltd., Sault Ste. Marie, Ont. For mail: 35 Forest Ave. (M.1944)
Lakin, John T. Section Engr., Candn. Celanese Ltd., Drummondville, Que. For mail: 28 Bérard St. (A.M.1932. M.1940)
Lalande, J. B. Elec. Engr., Can. Westinghouse Co. Ltd., Hamilton, Ont. For mail: 156 Burriss St. (S.1941. Jr.1946)
Lalande, Jean-Marie 10817 St. Denis St., Montreal 12. (S.1944)
Lalande, Jean Paul Gentilly Road, Longueuil, Que. (S.1944)
Laliberté, Paul E. Box 16, Montebello, Que. (S.1945)
Lalonde, J. Antonio Cons. Engr., J. A. Lalonde & Co. Ltd., 958 Dunlop Ave., Outremont, Que. (S.1910. Jr.1915. A.M.1920. M.1940)
Lalonde, Jean-Paul Cons. Engr., Lalonde & Valois, Montreal. For mail: 3785 Marlowe Ave. (S 1925. A.M.1935. M.1940)
Lalonde, Jean-Paul Divn. Engr., Quebec Dept. of Roads, Victoriaville, Que. (M.1946)
Lalonde, Marcel 4-13th Ave., Lachine, Que. (S.1944)
Lamarche, J. J. Emile Dftg., Candn. Car & Foundry Co., Longue Pointe Divn., Montreal. For mail: 4459 Garnier St. (M.1945)
Lamarche, Marcel 1891 Sherbrooke St. E., Montreal 24. (S.1937. Jr.1944)
Lamarche, Patrice Luc, P.O. Box 103, Mont Laurier, Que. (S.1944)
Lamarre, Emile Cons. Engr., 90 St. Dominique St., Jonquiere, Que. (M 1945)
Lamb, Hugh Chief Bldg. Inspr. & Office Engr., Veterans Land Act, Montreal. For mail: 1061 Richard Ave., Verdun, Que. (S.1936. M.1945)
Lamb, John A. Town Planning Engr., City Hall, Calgary, Alta. (Jr.1938)
Lamb, Henry John Res. Tech. Officer, Anaconda American Brass Ltd., Toronto. For mail: 37 Rosedale Road. (A.M.1899. M.1905)
Lamb, J. M. M. Agent, Dept. of Transport, Saint John, N.B. (M.1942)
Lamb, Thomas Asst. Bridge Engr., Manitoba Dept. of Public Works, Winnipeg. For mail: 184 Maplewood Ave. (S.1940. Jr.1946)
Lambert, Arthur A. Asst. to Chief Engr., West Kootenay Power & Light Co. Ltd., South Slocan, B.C. (M.1946)
Lambert, J. B. Dept. Public Works of Canada, P.O. Box 40, New Westminster, B.C. (A.M.1920. M.1940)
Lambert, Jean Louis. (S.1945)
Lambert, Lorne C. Aluminum Co. of Canada, P.O. Box 115, Long Branch, Ont. (M.1945)
Lambert, Noel D. Pres., Northern Construction & J. W. Stewart Ltd., 724 Vancouver Block, Vancouver, B.C. (M.1942)
Lamont, D. A. Sales Engrg., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 527 King St. (S.1944)
LaMothe, Georges E. Chief Logging Engr., Price Bros. & Co. Ltd., 65 Ste. Anne St., Quebec. (S.1910. Jr.1916. A.M.1920. M.1940)
LaMountain, George W. Supt. of Properties, Aluminum Co. of Canada, Arvida, Que. (M.1944)
Lamoureux, Georges Asst. Engr., Dept. Public Works of Canada, 1254 Bishop, Montreal (M.1944)
Lamoureux, Lucien 5115-7th Ave., Rosemount, Montreal. (S.1944)
Lamoureux, Marcel Asst. Engr., Dept. Public Works of Canada, Montreal. For mail: 6305 Louis-Hémon St. (Jr.1934. M.1941)
Lancaster, Gerald N. Sales Mgr., Vancouver Iron Works Ltd., 1155 Sixth Ave. W., Vancouver, B.C. (Affil.1940)
Lancefield, H. A. Mathews Conveyor Co., Port Hope, Ont. (S.1939. Jr.1943)
Lanctot, R. Gen. Master Mech., Can. Car & Foundry Ltd., 621 Craig St. W., Montreal. (S.1922. Jr.1926. A.M.1936. M.1940)
Lanctot, Théo Cons. Engr., Ste. Marie & Lanctot, 63 Main St., Hull, Que. (M.1946)
Landauer, Fred J. Mech. Engr., Canadian Vickers Ltd., Montreal. For mail: 376 Redfern Ave. (S.1945)
Landry, Claude C. 5755 Cote des Neiges Road, Montreal 26. (S.1945)
Landry, Wm. Alexander Engrg. Staff, Fraser-Brace Engineering Co. Ltd., Royal Bank Bldg., Montreal. (S.1945)
Lane, P. M. Avon River Power Co., Windsor, N.S. (M.1940)
Lane, R. C. (Jr.1940)
Lang, E. C. Engr., Laramore & Douglass Inc., 327 S. LaSalle St., Chicago, Ill., U.S.A. (M.1931)
Lang, John L. Lang & Ross, Sault Ste. Marie, Ont. For mail: 1085 Queen St. E. (M.1921)
Lang, J. T. Mgr., Construction Equipment Co. Ltd., 135 Lower Water St., Halifax, N.S. (S.1930. Jr.1931. M.1941)
Langenek, Frederick 1176 W. 11th Ave., Vancouver, B.C. (S.1944. Jr.1946)
Langelier, J.-Nap. Engr., Montreal Metropolitan Comm., 10 St. James St. W., Montreal. (M.1943)
Langevin, Jean H. Stress Analyst, Canadair Ltd., Montreal. For mail: 1216 Sanguinet St. (S.1944. M.1945)
Langevin, J. M. 103 rue Ste. Anne, Quebec. (S.1946)
Langevin, L. E. Cons. Engr., 513 Rachel St. E., Montreal. (M.1942)
Langille, L. L. Mech. Dftsmn., Chief Arch.'s Office, Can. National Rlys., Montreal. For mail: 35 Edison Ave., St. Lambert, Que. (S.1943. Jr.1946)
L'Anglais, Francois 3493 Delorimier Ave., Montreal. (S.1942)
Langley, Gordon Russell Chief Engr., Peterborough Works, Can. Gen. Elec. Co. For mail: 239 Burnham St., Peterborough, Ont. (M.1919)
Langley, John G. Market Resch., Can. Gen Elec. Co., Toronto. For mail: 241 Wychwood Ave. (S.1939. Jr.1946)
Langlois, Charles Engr. & Sec. Treas., Town of Sillery, 3 Maguire Ave., Sillery, Que. (M.1944)
Langlois, Maurice Chief Engr., Pagé Equipment & Construction Co. Ltd., P.O. Box 299, Three Rivers, Que. (M.1946)
Langlois, Raoul Asst. Chief Engr. Montreal Tramways Comm., 159 Craig St. W., Montreal. (A.M.1928. M.1940)
Langlois, R. Ernest 835 Viger Ave., Montreal 24 (S.1944)
Langlois, Roger P. Engr., B.G.L. Engineers & Builders Ltd., Outremont. For mail: 1908 Van Horne Ave., Montreal. (S.1944)
Langlois, W. Lawrence 287 Foster Ave., Belleville, Ont. (S.1923. Jr.1925. A.M.1935. M.1940)
Langman, John N. Constrn. Mgr., King Paving Co. Ltd., Oakville, Ont. A.M.1939. M.1940)
Langsner, Lawrence L. 1560 Van Horne Ave., Outremont, Que. (S.1945)
Langston, A. Edgar 30 Union St. W., Kingston, Ont. (S.1946)
Langston, John Francis Mng. Dir., Denton-Spencer Co. Ltd., Cons. Engrs., Calgary, Alta. For mail: 1811-7th St. W. (S.1937. Jr.1938. M.1945)
Langstroth, C. C. Asst. Mgr. & Chief Engr., Dominion Hoist & Shovel Co. Ltd., P.O. Box 220, Montreal. (S.1921. A.M.1927. M.1940)
Laniel, J. Albert, Dist Engr., Dept. Public Works of Canada, P.O. Box 460, Rimouski, Que. (M.1945)
Lantz, Gerald G. Test Course, Can. Gen. Elec. Co. For mail: 196 Reid St., Peterborough, Ont. (S.1945)
Lapeyre, Jean (M.1942)
Lapierre, Gaetan 12335 Dion St. Cartierville, Que. (S.1944)
Lapierre, Maurille 534 Therrien St., Montreal 30. (S.1940. Jr.1946)
Lapierre, Marcel L. 12335 Dion St., Cartierville, Que. (S.1945)
LaPlant, Jno. F. 330 College Ave., Simcoe, Ont. (A.M.1932. M.1940)
Laplante, J. H. Arthur Engr. & Vice-Pres. Union Quarries & Paving Ltd., Quebec. For mail: 174 St. Louis Road. (S.1934. A.M.1936. M.1940)
Laplante, René Engr., Provincial Electricity Board, 132 St. James St. W., Montreal. (A.M.1935. M.1940)

Lapointe, Gérard A. Civil Engr., Dept. Public Works of Canada, and Engr., Key Engineers Regd., Ottawa. For mail: 3873 Van Horne, Montreal. (S.1936. Jr.1940)
Laporte, Philip Engr., Machine Design, Northern Electric Ltd., Montreal. For mail: 1444 St. Elizabeth St. (S.1944)
Lappi, D. M. Elec. Engr., Northern Electric Co., Montreal. For mail: 112 Union Blvd., St. Lambert, Que. (S.1943. Jr.1946)
Laquerre, Maurice L., Cons. Engr., Lavoie, Delisle & Laquerre, Chicoutimi. For mail: 567 Hunt St., Arvida, Que. (S.1942. Jr.1942. M.1945)
Lareau, Fernand Strl. Engr., T. Pringle & Son., Montreal. For mail: 731 6th Ave., Verdun, Que. (S.1944. Jr.1946)
Larivière, Alex. Vice-Pres., Provincial Transportation & Communication Board, Court House, Quebec. (S.1910. Jr.1914. A.M.1917. M.1932)
LaRivière, Marcel G. Jr. Engr., Dept. Public Works of Canada, Ottawa. For mail: 17 Westmount Ave. (S.1935. Jr.1943)
Larmour, D. A. Res. Engr., Sask. Dept. of Highways, Regina. For mail: Lanigan, Sask. (S.1943. Jr.1946)
Larnder, I. T. Chesson Strl. Designer, Fraser-Brace Engineering Co. Ltd., Royal Bank Bldg., Montreal (M.1945)
Laroche, Jean L. Marine Industries Ltd., Sorel, Que. (S.1941. M.1945)
Larochelle, Josephat 1810 Aird Ave., Montreal 4. (S.1945)
Larochelle, Joseph E. 316 Daly Ave., Ottawa. (A.M.1903. M.1940)
Larose, Claude Divn. Engr., Roads Dept. of Quebec, Napierville, Que. (M.1945)
Larose, Gérard Mun. Engr., City of Montreal. For mail: 5112 Parthenais St. (S.1939. Jr.1942)
Larose, J. P. 218 Labonte St., Longueuil, Que. (S.1944)
Lash, A. W. Hydr. Engr., Ontario Paper Co. Ltd., Thorold. For mail: R.R. No. 1, Fonthill, Ont. (A.M.1936, M.1940)
Lash, Stanley D. Assoc. Prof. Civil Engrg. Queen's University, Kingston, Ont. (A.M.1938. M.1940)
Lassman, Salomon H. Designer, Canadair Ltd., Cartierville. For mail: 382 Querbes Ave., Montreal. (S.1945)
Latimer, Frank Herbert Priv. Prac., 102 Eckhardt Ave. W., Penticton, B.C. (M.1917)
Latimer, Norman H. Jr. Engr., B.C. Power Comm., Victoria. For mail: Penticton, B.C. (S.1946)
Latouche, Marcel Elec. Engr., Saguenay Electric Co., Bldv. St. Joseph, Roberval, Que. (S.1945)
Latreille, André Engr. & Estimator, Atlas Construction Co. Ltd., Montreal. For mail: 3841 St. Hubert St. (S.1939. Jr.1945)
Latreille, Raymond Commr. & Sec., Quebec Hydro-Electric Comm., 107 Craig St. W., Montreal. (M.1944)
Lau, Neil A. 3653 University St., Montreal. (S.1944)
Lauchland, L. Stuart Asst. Prof., Elec. Engrg., University of Toronto, Toronto 5. (S.1939. M.1945)
Laughlan, S. C. 4995 Chester St., Vancouver, B.C. (Jr.1941)
Laughlin, H. S. Priv. Prac., P.O. Box 44, Milltown, N.B. (M.1945)
Laughlin, Wm. Howard Mountjoy Cons. Engr., Proctor, Redfern & Laughlin, Toronto. For mail: 20 King's Garden Rd., Kingsway Park. (A.M.1929. M.1940)
Laughton, J. A. Dominion Rubber Co. Ltd., Montreal. For mail: 3510 Cote St. Catherine Rd. (M.1940)
Lauren, Olli K. Elec. Engr., Shawinigan Water & Power, Montreal. For mail: 76 York Ave., Westmount, Que. (S.1945)
Laurence, Emile Asst. Joint Chief Engr., Montreal Region, Dept. Public Works of Quebec. For mail: 3520 McTavish, Montreal 2. (Jr.1930. A.M.1934. M.1940)
Laurence, Harold F. Inspn. Engr., Dept. Highways of N.S., Halifax. (A.M.1906. M.1910)
Laurence, Jacques Assoc. Prof. Elec. Engrg., Ecole Polytechnique, Montreal. For mail: 1820 St. Joseph Blvd. E. (S.1936. Jr.1940. M.1945)
Laurendeau, Camille 660 St. Catherine St. W., Montreal. (M.1946)
Lauriault, W. E., Cons. Engr. & Que. Land Surveyor, 861 Couvent St., Montreal. (M 1942)
Laurie, Albert Laurie & Lamb, 132 St. James St. W., Montreal. (M.1921)
Laurie, E. Stuart Engr., Laurie & Lamb, 132 St. James St. W., Montreal. (M.1945)
Laurie, W. L. Overseas (Jr.1924. A.M.1931. M.1940)
Laurier, Armand 1735 Dufresne St., Montreal. (S.1944)
Laurin, Léopold 2710 Reading St., Montreal. (S.1944. Jr.1946)
Laurin, Wilfrid, Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S 1944)
Lauzon, Jean-L. 500 Jarry St., Montreal 10. (S.1944)
Lavallée, Jean Charles 518-3rd Ave., Limoilou, Que. (S.1941. Jr.1946)
Lavallée, Paul 2nd Elec. Engr., Aluminum Co. of Can., Shawinigan Falls, Que. For mail: 208-5th St. (S.1944)
Lavallée, Paul-Henri Traffic Engr., Bell Telephone Co., Montreal. For mail: Ste. Claire, Co. Dorchester, Que. (S.1945)
Laverdure, Conrad Engr., Gas Distbn. Dept., Quebec Hydro-Elec Comm., 107 Craig St. W., Montreal. (S.1941. M.1945)
Lavergne, Emile D. Gen. Contractor, 48 Fifth St., Shawinigan Falls, Que. (S.1937. Jr.1940. M.1943)
Laverty, Clarence A. Asst. Chief Inspr., Boiler Inspection & Insurance Co., Bank of Nova Scotia Bldg., Montreal. (A.M.1937. M.1940)
Lavigne, Ernest Prov. Fire Commr., Dept. Public Works of Quebec. (S.1913. Jr.1917. A.M.1918. M 1940)
Lavigueur, J. Bernard Chief Engr. & Prod. Mgr., Sicard Ltd., 2055 Bennett St., Montreal. (S.1938. Jr.1944)
Laviolette, J. P. 126 Arundel Ave., Toronto 6. (S 1941)
Lavoie, Edouard, Lavoie & Delisle, P.O. Box 178, Chicoutimi Centre, Que. (M.1923)
Law, Ernest G. Lt. Cdr., R.C.N.V.R., Naval Service H.Q., Ottawa. For mail: 200 Stewart St. (S.1938 Jr.1946)
Lawrence, Alfred John Northern Electric Co., Montreal. For mail: 662 Davaar Ave. (S.1915. Jr.1916. A.M.1917. M.1940)
Lawrence, E. A. Asst. to City Engr., City Hall, Lethbridge, Alta. (S.1932)
Lawrence, F. S. Cdn. National Rlys. For mail: 2082 Tupper St., Montreal. (A.M.1939. M.1940)
Lawrence, Keith A. Asst. Town Engr., Town Hall, San Fernando, Trinidad, B.W.I. (S.1946)
Lawrence, Norman A. Dftsmn. & Designer, City Power House, Edmonton, Alta. For mail: 11635-87th St. (S.1941. Jr.1945)
Lawrence, Robt. S. Supt., Northern Divn. Oper. & Mtce., St. Mary & Milk Rivers Devlpt., C.P.R., 207-7th St. S. Lethbridge, Alta. (A.M.1920. M.1940)
Lawrence, W. S. Rockingham, Halifax Co., N.S. (Jr.1914. A.M.1925. M.1940)
Lawson, George W. Prodn. Supvr., Johnson & Johnson Ltd., Montreal. For mail: 76 Greenfield Ave., Greenfield Park, Montreal 23. (S.1935. Jr.1938. M.1943)
Lawson, Glenn Wm. Salesman, F. H. Lawson & Sons Ltd., Brandon, Man. For mail: 750-14th St. (S.1941. Jr.1946)
Lawson, Horace H. 142 Lower Albert St., Kingston, Ont. (A.M.1932. M.1937)
Lawson, Wm. J. Asst. Chief Highway Engr., Dept. Public Works of N.B., Fredericton, N.B. (Jr.1921. A.M.1927. M.1940)
Lawson, Wilfrid S. Chief Engr., Penitentiaries, Dept. of Justice, Ottawa. (A.M.1907. M.1916)
Lawton, Frederic Lewis Asst. Chief Engr., Aluminum Co. of Canada, Sun Life Bldg., Montreal. (S.1920. A.M.1928. M.1936)
Lawton, Herbert C. Elec. Contr., 68 Thorne Ave., Saint John, N.B. (Affil.1943)
Layne, Geoffrey F. Chief Engr. & Vice-Pres. i/c Mfg., Price Bros. & Co. Ltd., 65 St. Anne St., Quebec. (S.1914. Jr.1919. A.M.1920. M.1940)
Layton, Michael S. Asst. to Vice-Pres., Steel Co. of Canada Ltd., 525 Dominion St., Montreal. (Jr.1938)
Lazenby, T. W. Mech. Dftsmn., Consolidated Mining & Smelting Co., Tadanac. For mail: 1090 Farwell St., Trail, B.C. (Jr.1928. A.M.1934. M.1940)
Lazier, Francis S. 49 St. Clair Ave. W., Toronto. (S.1906. A.M.1911. M.1920)
Lazier, Morley J. C. Cons. Engr., 170 Bay St., Toronto. (M.1944)
Lazorka, Dick Aluminum Co. of Canada, Montreal. For mail: 114 Monkland Blvd., Ville St. Laurent, Que. (S.1931. Jr.1937)
Lea, Edgar R. Jr. Mech. Engr., Can. International Paper Co., Gatineau, Que. For mail: 136 Gloucester St., Ottawa. (S.1944)
Lea, H. W. Coordinator Public Projects, Dept. Reconstruction & Supply, Ottawa. For mail: 18 Rideau St. (Jr.1924. A.M.1935. M.1940)
Lea, Wm. Schurman Cons. Engr., 1226 University St., Montreal. (A.M.1909. M.1913)
Leach, J. Gordon Petrolm. Techn., Shell Oil Co. of Canada, Montreal East. For mail: 358 Redfern Ave., Westmount, Que. (S.1944. Jr.1946)
Leach, T. A. J. Res. Engr., Sask. Dept. of Highways, Regina. For mail: 607 Albert Ave., Saskatoon. (Jr.1940)
Leadlay, F. R. Engrg. Dept., Toronto, Hamilton & Buffalo Railway, Hamilton. For mail: Waterdown, Ont. (S.1925. A.M.1929. M.1940)
Leahey, James C. Sales Engr., Ahlberg Bearings Canada Ltd., 4000 Namur St., Montreal. (S.1935. Jr.1940)
Leary, Clarence H. Mount Allison University, Sackville, N.B. (S.1946)
Leavens, J. W. (S.1928)
Leaver, Gerald Joseph 472 Gladstone Ave., Ottawa. (S.1946)
LeBel, Harry W. S. Plant Engrg., Electro Metallurgical Co. of Canada, Welland, Ont. For mail: 32 Margaret St. (S.1937. Jr.1942)
LeBel, Marcel Dist. Engr., Roads & Bridges, Dept. of Colonization of Que., Rouyn, Que. For mail: 103 Perreault St. W. (S.1940. Jr.1945)
LeBel, Paul LeBel Constrn. Ltd., 5571 Canterbury Ave., Montreal. (M.1941)
LeBel, Raymond Strl. Engr., J. M. Eug. Guay, Cons. Engr., Montreal. For mail: 5043 St. Catherine East. (S.1938. Jr.1940)
LeBlanc, A. René Constrn. & Mtce., National Breweries Ltd., Montreal. For mail: 194-a Querbes Ave. (S.1942)
LeBlanc, C. Jos. Engr., Office of Director of Public Works of Montreal. For mail: 169 Jarry St. (A.M.1920. M.1940)
Leblanc, Fernand, Prof. i/c Elec. Lab., Ecole Polytechnique and Cons. Engr., Pitt Leblanc & Montpetit, 513 Rachel St. E., Montreal 34. (M.1945)
Leblanc, Jules Chief Engr., Rural Electrification Bureau of Que., Parliament Bldg., Quebec. (S.1928. Jr.1932. A.M.1938. M.1940)
LeBlanc, J. Roger 3724 St. Hubert St., Montreal 24. (S.1945)
Leblanc, Maurice 8743-a Lajeunesse St., Montreal 12. (S.1945)
Leblanc, Raymond F. Assoc. Prof. of Mining & Metallurgy, Ecole Polytechnique, 1430 St. Denis St., Montreal. (M.1944)
LeBourdais, Raymond 6595 Briand St., Montreal 20. (S.1945)
LeBourveau, Homer B. Transm. & Distbn. Engr., Calgary Power Co. Ltd, 313-8th Ave. W., Calgary, Alta. (A.M.1930. M.1940)
Le Boutillier, W. P. C. Wood Room Supt., Price Bros. & Co. Ltd., Kenogami, Que. For mail: 2 Maple St. (Jr.1929. A.M.1938. M.1940)
LeBrun, Hubert Sales Engr., Can. Gen. Elec. Co., 1000 Beaver Hall Hill, Montreal. (S.1941. Jr.1946)
LeCapelain, Chas. King Inspr., National Parks, Dept. Mines & Resources, Ottawa. For mail: 577 Melbourne Ave. (A.M 1933. M.1940)
Lecavalier, Gabriel Que. Dept. of Roads, Napierville, Que. (S.1939. Jr.1946)
Lecavalier, J. F. Aeron. Engr., Air France, New York. For mail: 110 East 25th. St., Wilmington, Del., U.S.A. (S.1937. Jr.1944. M.1945)
Lecavalier, Jean-Paul Priv. Prac., 5582 Dunmore Ave., Montreal 26. (S.1936. M.1941)
Lecavalier, Robt. 6280 St. Denis St., Montreal. (S.1941)
LeClair, Wm. Jas. Sec. Mgr., Canadian Lumbermen's Assn., Victoria Bldg., Ottawa. (S.1914. Jr.1919. A.M.1928. M.1938)
Leclaire, J. P. Chief Engr., Port of Montreal, National Harbours Board. For mail: 5725 Cote des Neiges, Montreal 29. (M 1925)
Leclerc, André Asst. Hyd. Engrg. Dept., Ecole Polytechnique, Montreal. For mail: 8914 Basile-Routhier St. (S.1941. M.1945)
Leclerc, J. Edouard Engr., Bridges & Structures Br., Dept. Highways of Quebec. For mail: 26 Belmont Ave., Quebec. (M.1945)
LeCointe, P. P. Chief Engr., Jean Bonnell Societies, 4450 St. Denis St., Montreal. (M.1938)
L'Ecuyer, J. M. Fernand Dominion Rubber Co., Montreal. For mail: 1880 Galt St. (S.1944)
Ledoux, J. A. Rolland Mgr., Royalmount Constrn. Ltd.., Montreal. For mail: 5670 Decelles Ave. (M 1946)
Leduc, Albert i/c Modernization of Street Lighting, City of Montreal. For mail: 3655 Ste. Famille St., Montreal. (M.1945)
Leduc, François J. Cons. Engr., 354 St. Catherine E., Montreal. (M.1938)
Leduc, J. D. René Engr., Machine Shop, Marine Industries Ltd., Sorel, Que. For mail: 5 Goupil St. (Jr.1942)
Lee, Frank Parksville, B.C. (M.1908)
Lee, Frank B. Test Engr., General Electric Co., Schenectady. For mail: Box 420, Y.M.C.A., Schenectady, N.Y., U S.A. (S.1944)
Lee, John Douglas Asst. Prof. Civil Engrg., Queen's University, Kingston. (S.1940. Jr.1943. M.1946)
Lee, J. W. Jr. Engr, Hydro-Elec. Power Comm. of Ont. For mail: 3029 Lundy's Lane, Niagara Falls, Ont. (S.1940. Jr.1946)
Lee, Leonard A. Plan Exam. Engr., Dept. of Bldgs., City Hall, Toronto. (M.1934)
Lee, R. E. 64 Laird Drive S., Leaside, Ont. (M.1944)
Lee, W. S. Jr. Pres., W. S. Lee Engrg. Corp., Power Bldg., Charlotte, N.C., U.S.A. (A.M 1930. M.1940)
Lee, Wm. U. Engr. & Material Expediter, Fraser Brace Ltd., Chalk River, Ont. For mail: 1162 St. Urbain St., Montreal 18. (S.1945)
Leebosh, Ilja Designing Engr., Hydraulic Divn., Quebec Hydro-Electric Comm., 107 Craig St. W., Montreal 1. (A.M 1938. M.1940)
Leeper, R. P. (S.1942. Jr.1946)
Lees, Thomas 3873 W. 22nd Ave., Vancouver, B.C. (A.M.1911. M.1928)
Lefeaux, Stuart S. 1195 Clyde Ave., West Vancouver, B.C. (S.1943)
Lefebvre, Gérard Dufresne, McLagan Associates Regd., Montreal. For mail: 133 Ave. Quinn, Longueuil, Que. (S.1940. Jr.1946)
Lefebvre, Jean Tropical Oil Co., Apartado Nacional 570, Bogota, Colombia, S.A. (S.1934. M.1940)
Lefebvre, Jos A. Principal Engr., Dist. No. 2, Quebec Dept. of Roads, Quebec. (A.M.1915. M.1926)

Lefebvre, J. Jules Fire Protec. Engr., Canadian Underwriters' Assn., Montreal. For mail: 7114 Delanaudière St. (Jr. 1944. M.1945)
Lefebvre, J. L. P. Sr. Engr., Prov. Fire Commr.'s Office, Dept. Public Works, Parliament Bldg., Quebec. (M.1944)
Lefebvre, Marcel Mgr., Laurentide Engrg. Industries Ltd., 7032 Côte des Neiges, Montreal. (S.1941. Jr.1946)
Lefebvre, Paul Emile Chief Engr., Lefebvre Frères Ltd., 970 De Bullion St., Montreal. (S.1944. Jr.1946)
Lefort, Jean Sr. Engr., Stevenson & Kellogg Ltd., Montreal. For mail: 6230 Clanranald Ave. (S.1935. Jr.1942. M.1945)
Lefrançois, J. Germain Cons. Engr., Montreal. For mail: 128 Chambly Road, Longueuil, Que. (Jr.1937. M.1943)
Légaré, Denis 5191-4th Ave., Rosemount, Montreal. (S.1944)
Legendre, Rosaire Engr., Fisheries Research Board of Canada, Grand River. For mail: 26 Couillard St., Quebec. (S.1944. Jr.1946)
Leger, Adrian Ralph Engrg. Dept., Gaspesia Sulphite Co. Ltd., Staff House, Chandler, Que. (S.1946)
Leger, J. A. K., Hill Farm, Orchard Close, Ruislip, Middlesex, England. (S.1937. Jr.1946)
Léger, Jean Marc Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Leger, Oswald E. Engineers' Club of Montreal, 1175 Beaver Hall Sq., Montreal 2. (A.M.1924. M.1936)
Legg, John H. Mgr., Suzorite Co. Ltd., Shawinigan Falls, Que. For mail: 99 Maple Ave. (S.1927. A.M.1935. M.1940)
Legget, Robt. F. Assoc. Prof. Civil Engrg., University of Toronto, Toronto 5. (Jr.1929. A.M.1931. M.1940)
Legris, Chas. E. Supvg. Engr., Reconstruction Finance Corp., P.O. Box 128, New Castle, Pa., U.S.A. (A.M.1923. M.1940)
Legris, J. A. Partner, Ridout & Maybee, Patent Attorneys, Toronto. For mail: 1535 Bathurst St. (S.1943)
Legros, Jean 5527-4th Ave., Rosemount, Montreal 36. (S.1945)
Leheup, Chas S. H. "Weybourne", 36 Elmhurst Drive, South Woodford, London E.18, England. (M.1941)
Leigh, E. D. Sales Engr., Amalgamated Electric Corp. Ltd., Montreal. For mail: 2541 Bélanger St. (Jr.1946)
Leigh-Mallory, G. E. Auto Stamping Inspr., General Motors of Canada, Oshawa, Ont. For mail: "The Madison" (Affil.1940)
Leighton, C. A. Marine Industries Ltd., Montreal. For mail: P.O. Box 321, Station "H". (A.M.1924. M.1940)
Leightner, D. B. Can. Westinghouse Co. Ltd., Hamilton. For mail: 17 Elm St. E., Welland, Ont. (S.1929. Jr.1936)
Leipoldt, E. Van N. Elec. Engr., Shawinigan Engineering Co. Ltd., Power Bldg., Montreal. (M.1941)
Leitch, Hugh J. Strl. Sales Engr., Dominion Bridge Co. Ltd., Lachine. For mail: 3 Northcote Rd., Hampstead, Que. (S.1920. Jr.1927. A.M.1934. M.1940)
Le Maistre, E. B. A. 1387 Athlone Road, Town of Mount Royal, Que. (S.1937)
Leman, Beaudry Pres. Banque Canadienne Nationale, 112 St. James St., Montreal. (S.1901. A.M.1902. M.1940)
Lemay, Romuald 61 Sherbrooke St. E., Montreal 18. (S.1944)
Lembcke, Robt. E. Asst. Engr., Texas & Pacific Railway Depot, Fort Worth, Texas, U.S.A. (A.M.1914. M.1940)
Lemieux, Chas. Mgr., Les Pétroles de Quebec Inc., Quebec. For mail: 74 William North. (A.M.1939. M.1940)
Lemieux, Gilbert Asst. Princ. Engr., Highways, Dept. of Roads, Quebec. For mail: 112 Abraham Hill. (S.1935. Jr.1938. M.1944)
Lemieux, Henri-Julien Assoc., Lamarre & Lemieux, Cons. Engrs. and Plant & Constrn. Engr., National Granite Ltd., 20 Collard St., St. Joseph d'Alma, Que. (S.1938. Jr.1942. M.1945)
Lemieux, J. Philias Civil Engr., Geo. Demers, Cons. Engr., Quebec. For mail: 332 rue St. Joseph, Lauzon, Que. (S.1942)
Lemieux, Jacques R. 250 Vimy St., Sherbrooke, Que. (S.1941. Jr.1946)
Lemieux, Roland A. City Mgr. & Engr., 219-A Davis St., Arvida, Que. (S.1937. M.1940)
Lemmon, Cyril C. Constrn. Supvr., 94 Duffus St., Halifax, N.S. (M.1944)
Lemmon, T. G. 271 Earl St., Kingston, Ont. (S.1946)
Lentz, C. P. 615-8th St. E., Saskatoon, Sask. (S.1941)
Leon, Clifford E. (S.1944)
Leonard, H. A. 3498 Walkley Ave., Montreal 28. (Jr.1944)
Leonard, Ibbotson Pres., E. Leonard & Sons, London, Ont. (S.1903. A.M.1912. M.1922)
Leonards, G. A. Lecturer, Dept. Civil Engrg., McGill University. For mail: 4219 Esplanade Ave, Montreal 18. (S.1943. M.1945)
Le Pan, A. D. Supt., University of Toronto. For mail: 82 Walmer Road, Toronto. (A.M. 1921. M.1940)
Lepine, Jerôme 97 ave. Bégin, Quebec. (S.1946)
Lépine, Marcel 2055 Cartier St., Montreal 24. (S.1944)
Lepp, Henry Consolidated Mining & Smelting Co., Yellowknife, N.W.T. (S.1943. Jr.1946)
Leprohon, Bernard Donat 1831 Desjardins St., Montreal 4. (S.1945)
Leroux, Florian G. Stress Engr., Canadair Ltd., Cartierville. For mail: 2750 Van Horne Ave., Montreal 26. (S.1939. Jr.1946)
Leroux, Fred C. Indust. Engr., J. Leckie Co. Ltd., 220 Cambie St., Vancouver, B.C. (S.1939. Jr.1942)
Leroux, George G. Engr., Foundation Co. of Canada, Montreal. For mail: 94 Dufferin Road. (S.1939. Jr.1942)
Leroux, Jean-Jacques, Lieut., R.C.E.M.E., i/c M.T. Vehicles, M.D. No. 5, No. 5 Coy Workshop, Kent Blvd., Quebec. (S.1942. M.1945)
Leroux, J. P. Civil Aviation Br., Dept. of Transport, Montreal. For mail: 1490 St. Zotique E. (S.1937. Jr.1941. M.1942)
Leslie, Roy C. Dist. Contracting Engr., Canadian Bridge Co. Ltd., 217 Bay St., Toronto. (S.1921. Jr.1925. A.M.1930. M.1939)
Leslie, W. A. Grant 157 Kenny St., Norwood, Man. (S.1945)
L'Espérance, Gaston 5037 Adam St., Montreal 4. (S.1945)
Lespérance, Paul-Emile 7125 Christophe Colomb St., Montreal 10. (S.1945)
Lessard, C. Camille Cons. Engr., 32 Blvd. des Alliés, Quebec. (A.M.1922. M.1940)
Lessard, Roger Prof. Math. & Engrg., Hull Technical School, 109 Wright St., Hull, Que. (S.1938. M.1945)
Lester, J. F. Engr.-Agent, Sir Alfred McAlpine Ltd. For mail, 44 Alexandra Rd., Penn., Wolverhampton, England. (A.M.1920. M.1940)
Letendre, Lucien J. A. Lalonde & Co. Ltd., Montreal. For mail: 1022 Mount Royal E. (S.1939. Jr.1943. M.1945)
Letourneau, Robt. 3131 Van Horne Ave., Montreal 26. (S.1945)
Letson, Harry F. G. Sec. to the Governor-General, Government House, Ottawa. (M.1936)
Letson, J. E. Transit & Storage Co., Wayne, Mich., U.S.A. (S.1910. Jr.1914. A.M.1920. M.1940)
Leuthold, A. K. Chief Engr., Brown Boveri (Canada) Ltd., Montreal. For mail: 4808 Lacombe Ave. (M.1944)
Levasseur, J. A. Maurice Montreal Technical School, 200 Sherbrooke St. W., Montreal. (S.1944. Jr.1945)
Levesque, C. Paul Dist. Elec. Engr., N.B. Electric Power Comm., Grand Falls, N.B. (S.1943. M.1946)
Levine, Samuel D. Tech. Advisor, Linde Air Products Co., Tonawanda, N.Y. For mail: 285 North Park Ave., Buffalo 16, N.Y. (S.1937. Jr.1942)
Levinoff, Samuel Design & Appln. Engr., Toronto Iron Works Ltd. For mail: 24 Gloucester Grove, Toronto. (S.1944. Jr.1946)
Levitt, Morton Tech. & Admin. Engr., Hammercraft Corp., Montreal. For mail: 5436 Hutchison St. (S.1944. Jr.1946)
Lewis, Aubrey A. Constrn. Engr. Can. General Electric Co., Petitcodiac, N.B. (S.1944)
Lewis, C. E. Can. Gen. Elect. Co., Toronto. For mail: 21 Sutherland Drive. (S.1937. Jr.1946)
Lewis, David J. Designer, Plate & Boiler Dept., Dominion Bridge Co. Ltd., Lachine. For mail: 1455 Drummond St., Montreal. (S.1922. A.M.1929. M.1940)
Lewis, David Owen. Cons. Engr., 1055 West 12th Ave., Vancouver, B.C. (A.M.1894. M.1907)
Lewis, E. Keith. Prod. Mgr., Polymer Corp., Sarnia, Ont. For mail: 335 N. Russell St. (S1929. Jr.1935. M.1941)
Lewis, G. D. Lieut., R.C.E.M.E., 167 Gilmour St., Ottawa. (S.1942. Jr.1946)
Lewis, Hymie. 743 Selkirk Ave., Winnipeg, Man. (S.1944. Jr.1946)
Lewis, Hugh M. Vice-Pres. & Gen. Mgr., Sorg Pulp Co. Ltd., Vancouver, B.C. For mail: 4890 Hudson St. (A.M.1920. M.1940)
Lewis, Ronald W. J. Chem. Engr., Aluminum Co. of Canada, Arvida, Que. For mail: 826-2nd St. (Jr.1945)
Lewis, Stanley T. Dist. Engr., Can. Pac. Rly., Regina, Sask. For mail: 2128 Retallack St. (M.1938)
Lewis, W. M. Road Supt., Township of Ernestown. For mail: R.R. No. 4, Napanee, Ont. (M.1942)
Lewis, W. R., 272 Cedarvale Ave., Toronto 13. (S.1946)
Lexier, H. L. Gen. Mgr. Queen City Cleaners Ltd., Regina, Sask. (Jr.1940)
Ley, Albert G. Asst. Supt., Maritime Electric Co. Ltd., Grafton St., Charlottetown, P.E.I. (M.1943)
Leydon, T. F. 37 Fenwick St., Halifax, N.S. M.1940)
L'Heureux, L. J. Gen. Del., Gravelbourg, Sask. (S.1943. Jr.1946)
L'Heureux, Marcel L. Dist. Sales Mgr., Paving Material Divn., Barrett Co. Ltd., Montreal. For mail: 1553 Laird Blvd., Town of Mount Royal, Que. (M.1945)
L'Heureux, Paul-Emile. Asst. Engr., Tech. Serv., City of Montreal. For mail: 6591-3rd Ave., Rosemount, Montreal. (S.1936. Jr.1940)
L'Hoir, Georges-A. Pres., L'Hoir Aluminum & Stainless Steel Co., 229 St. Laurent, Levis, Que. (M.1945)
L'Homme, L. P. Southern Canada Power Co. Ltd. For mail: 5800 Deschenes St., Montreal 36. (S.1937. Jr.1940)
Lichty, Lyall J. (S.1931)
Lilley, L. G. C. Lt. Col., Exec. Officer, R.C.E., Headquarters, Army Bldg., Ottawa. (S.1935. Jr.1937. M.1946)
Lillie, Douglas F. Mill Shift Boss, Beattie Gold Mines Ltd., Duparquet, Que. For mail: Box 102. (S.1943)
Lillie, Herbert. Asst. Elec. Engr., Ford Motor Co. of Canada, Windsor. For mail: 45 St. Louis Ave., Riverside, Ont. (A.M.1939. M.1940)
Limoges, Jacques. La Société d'Entreprises Générales Ltée., Amos, Que. For mail: P.O. Box 484. (M.1944)
Lindsay, Colin. Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 1160 Broadview Ave. (S.1942. Jr.1946)
Lindsay, Chas. Crawford. Cons. Civil Engr. & Q.L.S., M. D. Barclay Inc., 159 Craig St. W., Montreal. (S.1908. A.M.1919. M.1940)
Lindsay, C. Gordon. 3473 University St., Montreal. (S.1944)
Lindsay, D. A. Mgr., Maine & N.B. Electrical Power Co., Woodstock, N.B. (M.1945)
Lindsay, D. Lorne. Asst. Mech. Engr., G. Lorne Wiggs & Co., Montreal. For mail: 5811 Côte St. Luc. (Jr.1942)
Lindsay, Gerald A. E. Design Engr., Westinghouse Electric Corp., Lansdowne, Md. For mail: 1213 Leeds Terrace, Halethorpe 27, Md. (S.1941. M.1945)
Lindsay, Guy A. Engr. i/c Gen. Engrg. Dept., of Transport, Ottawa. (S.1914. A.M.1922. M.1940)
Lindsay, Thos. Alfred. Gen. Mgr. Automatic Electric (Can.) Ltd., 284 King St. W., Toronto. (M.1940)
Lindsey, A. S. Plant Engrg., H. J. Heinz Co. of Canada, Leamington, Ont. For mail: 175 Erie St. S. (S.1946)
Lindsey, C. R. Supvg. Engr., Shawinigan Engineering Co., Montreal. For mail: Shalalth, B.C. (A.M.1916. M.1940)
Lingley, H.P. Asst. Engr., Dept. Public Works of Canada, Saint John, N.B. For mail: 73 Elliott Row. (S.1930 Jr.1936. M.1946)
Linke, R.H. Instmn., City of Edmonton. For mail: 18 Algonquin Apts., Edmonton, Alta. (Jr.1941)
Linney, John A. Design Elec. Instal. on Aircraft, Can. Pac. Airlines, Winnipeg. For mail: 195 Douglas Park Road, St. James, Man. (S.1946)
Linton, A.P. Chief Bridge Engr., Dept. Highways & Transportation of Sask., Regina, Sask. (S.1908 A.M.1913. M.1935)
Linton, W. Reginald Radio Inspr., Radio Divn., Dept. of Transport, 1 Front St. W., Toronto. (M.1940)
Lion, Edgar Track Dept., Can. Pac. Rly. Montreal. For mail: 5121 Western Ave. (S1944)
Lippé, L.E.H. City Engr., City Hall, Joliette, Que. (M.1946)
Litchfield, Robt. D. Jr. Engr., Abitibi Power & Paper Co. Ltd., "The Inn", Smoth Rock Falls, Ont. (S.1946)
Little, Edward C. Supt. South. Divn., Welland Ship Canal, Dept. Transport. For mail: 26 Parkway Drive, Welland, Ont. (S.1913. Jr.1919. A.M.1921 M.1940)
Little, E.M. Gen. Mgr., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. For mail: P.O. Box 1487. (M.1944)
Little H. Sales Mgr., & Dir., R & M Bearings Canada Ltd., Montreal. For mail: 5409 Vannutelli Ave. (S.1931. Affil.1943)
Little, Harold Robt. Lawson & Little, Archs., 660 St. Catherine St. W., Montreal. (S.1909. A.M.1913. M.1940)
Little, John F. 737 Queen's Road, Ajax, Ont. (S.1946)
Little, J.G. Works Mgr., Electronics Divn., Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (M.1943)
Livernoche, Roger 112 rue des Sulpiciens, L'Epiphanie, Que. (S.1941)
Livingston, Chas. B. Engr., Commercial Dept., Wire & Cable Divn., Can. Gen. Elec. Co., Toronto. For mail: 160 Glen Road. (S.1942. Jr.1945)
Livingston, David A. 3791 West 41st Ave., Vancouver, B.C. (S.1909. A.M.1909. M.1940)
Livingston, Peter Archibald P.O. Box 86, Morden, Man. (S.1945)
Livingstone, D. D. 516-19th Ave. N.W. Calgary, Alta. (Jr.1944)
Livingstone, James George Process Engr., Imperial Oil Ltd., Sarnia, Ont. (Jr.1945)
Livis, Seymour 1469 Drummond St., Montreal. (S.1945)
Llewellyn, L. W. Asst. Resch. Engr., National Research Council, Ottawa. For mail: 200 Elgin St. (Jr.1929. A.M.1937. M.1940)
Lloyd, David S. Vice-Pres. & Gen. Mgr., Dominion Oxygen Co. Ltd., 159 Bay St., Toronto. (S1923. Jr.1928. A.M.1933. M.1940)
Lloyd, M. F. R. Canal Supt. Dept. Nat. Res. of Can. Pac. Rly. For mail: Box 84, Magrath, Alta. (A.M.1922. M.1940)

Lloyd, W. E. Pacific Mills Ltd., Beaver Cove, Vancouver Island, B.C. (S.1944)
Lloyd, Warren G. Divn. Plant Engr., Bell Telephone Co. of Canada, Toronto. (M.1941)
Loane, G. Herbert Asst. Outside Plant Engr., Can. Nat. Telegraphs, Toronto. For mail: 122 Walmer Rd. (S.1941. Jr. 1946)
Lobb, R. K. 9750-91st St., Edmonton, Alta. (S1945)
Lochhead, John S. Can. Dir., Designers for Industry Inc. (Cleveland), Cons. Engrs., 1434 St. Catherine St. W., Montreal. (S.1934. Jr.1941. M.1945)
Lochhead, Kenneth Young Bldg. Supt. & Opers. Mgr., Hudson's Bay Co., Georgia & Granville Sts., Vancouver, B.C. (S.1931. Jr.1935. M.1940)
Lochhead, Stuart G. Strl. Designer, Dominion Bridge Co. Ltd., Lachine. For mail: 66 Strathearn Ave., Montreal West (S.1928. Jr.1931. A.M.1939. M.1940)
Locke, Chas. Wm. Evans Res. Mgr., Pacific Mills Ltd., Ocean Falls, B.C. For mail: P.O. Box 376. (S.1930. A.M.1937. M.1940)
Locke, Murray D. 4716 Grosvenor Ave., Montreal 6. (S.1945)
Lockeberg, Rolf S. 542 Wellington St., Ottawa. (S.1938. M.1946)
Lockhart, C. O. 31 Portledge Ave., Moncton, N.B. (S.1944)
Lockwood, C. K. Sales Mgr., Stainless Steel & Alloys Divn., Shawinigan Chemicals Ltd., 107 Craig St. W., Montreal. (S.1935. M.1940)
Lockwood, R. O. Lub. Engr., McColl-Frontenac Oil Co., Calgary. For mail: Davidson, Sask. (Jr.1946)
Loden, C. A. Office Engr., Imperial Oil Ltd., Regina, Sask. For mail: 4 Huntington St. (S.1943. Jr.1946)
Loebenberg Leopold 3609 University St., Montreal 2. (S.1944)
Logan, R. S., Jr. 45 Aberdeen Ave., Westmount, Que. (S.1922. A.M.1933. M.1940)
Logan, W. A. Asst. Transm., Engr., Maritime Telegraph & Telephone Co., Hollis St., Halifax, N.S. (M.1943)
Logie, E. R. 21 Kennedy Park Road, Toronto 9. (A.M.1921.. M.1940)
Logie, W. A. Engr., Relay Dept., Quebec Hydro Elec. Comm., Montreal. For mail: 520-44th Ave., Lachine, Que. (S.1938. Jr.1945)
Logue, Ottis I. Tech. Advisor to Exec. Dir., City of Saint John. For mail: 65 Elliott Row, Saint John, N.B. (S.1944)
Loiselle, J. C. A. F. Byers Constrn. Co., Montreal. For mail: 20 Finchley Ave. (S.1936. Jr. 1946)
Lolli, Vincent 1247 St. Timothy St., Montreal. (S.1945)
Lombard, R. A. Boiler Inspn. & Insurance Co. of Canada, Montreal. For mail: 230 Riverside Drive, St. Lambert, Que. (S.1932. M.1946)
Lomer, G. B. Mech. Engr., Power Corp. of Canada Ltd., Montreal. For mail: 4340 Pie IX Blvd. (A.M.1927. M.1940)
London, W. P. Mech. Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1934. M.1942)
Long, Ludovic A. Asst. Radio Engr., Radio Aviation, Dept. Transport of Canada, Dominion Public Bldg., Moncton, N.B. (S.1943. Jr.1946)
Longley, F. F. Vice-Pres., Lock Joint Pipe Co., P.O. Box 269, East Orange, N.J., U.S.A. (A.M.1911. M.1920)
Longpré, Arphile Asst. Engr., City of Quebec. For mail: 9 Raymond Casgrain St., Quebec. (M.1944)
Longstaff, John C. Concrete Designer, Canadian Kodak Co. Ltd., Mount Dennis. For mail: 114 Glen Road, Toronto. (A.M.1931. M.1940)
Longworth, Jack Instr., Civil Engrg., University of Alberta, Edmonton. For mail: Bellevue, Alta. (S.1944)
Longworthy, W. H. 1616 Hampshire Road, Victoria, B.C. (Jr. 1944)
Longworthy, W. O. Asst. to Chief Engr., Imperial Oil Ltd., Regina, Sask. For mail: 669 Winnipeg St. (A.M.1936. M.1940)
Loomis, D. McK. Res. Engr., Defence Industries Ltd., Station No. 19, Chalk River, Ont. (M.1942)
Loomis, J. G. M. Construction Equipment Co. Ltd., Montreal. For mail: 1694 Lincoln Ave. (S.1936. Jr.1941)
Loranger, Aimé 24 St. John Road, Laprairie, Que (Affil. 1942)
Lord, E. E. Engr. i/c Constrn., Smith Bros. & Wilson Ltd., 104 Dominion Bank Bldg., Regina, Sask. (A.M.1923. M.1940)
Lord, Guy M. 561 Dorchester St. E., Montreal 24. (S.1944)
Lord, G. Ross Assoc. Prof., Mech. Engrg., University of Toronto, Toronto 5. (S.1927. A.M.1934. M.1940)
Lord, J. H. Gen. Mgr., Lord & Cie Ltée., 4700 Iberville, Montreal. (M.1944)
Lord, Roger Asst. to Res. Engr., Power House, Beauharnois Light Heat & Power Co., P.O. Box 100, Beauharnois, Que. (S.1939. M.1943)
Lormier, W. C. Foster Wheeler Ltd., St. Catharines, Ont. For mail: 20 Russell Ave. (Jr.1938. M.1940)
Loring, Harold C. Pres., Harold C. Loring Associates, Cons. Engrs., Chester Basin, N.S. (M.1944)
Lorrain, Alexandre A. Dist., Engr., Dept. of Colonization of Quebec, LaSarre, Abitibi Co., Que. (M.1945)
Lotts, Gordon Richard Plant Engr., H. J. Heinz Co. of Canada, Leamington, Ont. (S.1946)
Loucks, George I. In Training, McColl-Frontenac Oil Co. Ltd., Toronto. For mail: Box 20, Invermay, Sask .(S.1943. Jr.1946)
Louden, T. N. Gen. Mgr., Hamilton Bridge Western Ltd., Commercial Bldg., Edmonton, Alta. (M.1943)
Loudon, T. R. Prof. Civil Engrg. & Aeron., University of Toronto, Toronto 5. (A.M.1910. M.1919)
Lount, Albert Murray. Engr.-in-Trng., Hydro-Elect. Power Comm. of Ont., Toronto. For mail: 77 Royal York Road South. (S.1945)
Love, Alex. Engr., Strl. Divn., Hamilton Bridge Co. Ltd. For mail: 40 Paisley Ave. S., Hamilton, Ont. (A.M.1920. M.1934)
Love, A. Eric A. 35 Whitney Ave., Sydney, N.S. (S.1946)
Love, D. D. Aluminum Co. of Canada Ltd., Arvida, Que. (S.1944)
Love, E. R. Asst. Prof. of Elec. Engrg., University of Manitoba, Winnipeg, Man. For mail: 903 Palmerston Ave. (S.1931. M.1942)
Love, Herbert W. Lt. Col., Dir. Works & Constrn., N.D.H.Q., Ottawa. For mail: 330 Cooper St. (Jr.1937. M.1945)
Love, John Gordon. Demonst. Dept. Civil Engrg., University of Toronto. For mail: 321 Bloor St. W., Toronto 5. (S.1941. Jr.1946)
Lovell, John. Dftsm., Defence Industries Ltd., Montreal. For mail: 1170 Lloyd George Ave., Verdun, Que. (M.1942)
Lovell, W. E. Prof. Elec. Engrg., University of Saskatchewan, Saskatoon, Sask. (S.1911. A.M.1925. M.1936)
Lovett, Percy A. Partner, Engineering Service Co., 14 Prince St., Halifax, N.S. (S.1928. Jr.1931. A.M.1935. M.1940)
Low, Chas. M. Mgr., Lake St. Joseph Transportation Co. Ltd., Root Portage, Sioux Lookout P.O., Ont. (A.M.1921. M.1940)
Low, David D. Asst. Supt., Can. Nat. Rlys., North Battleford, Sask. For mail: 1422 Queen St. (A.M.1938. M.1940)
Low, D Richard. Bldg. Inspr., Supt.'s Office, Can. Pac. Rly., Regina, Sask. For mail: 2340 Rae St. (S.1945)
Low, Richard Alex. Asst. Prof. Civil Engrg., Queen's University, Kingston, Ont. (A.M.1929. M.1940)
Low, Robt. Douglas. Jr. Engr., Survey & Constrn., P.F.R.A., Dept. of Agric., Cardston, Alta. For mail: Box 206. (S.1945)
Lowe, Howard T. (S.1940)
Lowe, Stanley C. Dominion Coal Co. Ltd., Canada Cement Bldg., Montreal. (S.1943. Jr.1946)
Lowrie, G. F. Chemist, Standard Chemical Co. Ltd., Toronto. For mail: 71 Breadalbane St. (S.1946)
Lowry, George H. Divn. Engr., Dept. Highways of Ont., Fort Frances, Ont. (A.M.1919. M.1940)
Loy, J. Austin. Supt. of Constrn. & Plant Engrg., Eastn. Divn., Bell Telephone Co., Montreal. For mail: 19 Stratford Rd., Hampstead, Que. (S.1919. Jr.1922. A.M.1927. M.1940)
Lucas, J. W. Testing Labs., Dept. of Public Works, Ottawa. (S.1928. Jr.1932. A.M.1936. M.1940)
Lucas, Ronald Owen. 826 Dorchester Ave., Winnipeg, Man. (S.1946)
Luck, Cecil G. J. Port Engr. at Churchill, National Harbour Board, Churchill, Man. (A.M.1920. M.1940)
Lucyk, J. Specfn. Engr., Aerovox Canada, Hamilton, Ont. For mail: 77 Park Row S. (Jr.1941)
Ludwick, Alexander Peter. 1515 Renfrew St., Vancouver, B.C. (S.1946)
Ludwig, R. E. 317-9th St. E., Saskatoon, Sask. (S.1944)
Luke, Edward C. G/C, R.C.A.F., No. 1 Air Command H.Q., Trenton, Ont. (A.M.1936 M.1940)
Lukes, H. Norman. Ispr., Mech. Branch, Dept. Public Works, Old Court House Bldg., Calgary, Alta. (Jr.1944)
Lumb, Wm. Ewart. Sales Engr., Canada Cement Co. For mail: 309 Frontenac St., Kingston, Ont. (A.M.1936. M.1940)
Lumsden, Hugh A. Cons. Engr., Hamilton. For mail: Port Nelson, Ont. (S.1905. Jr.1911. A.M.1913. M.1940)
Lund, C. N. 292 N. College Ave., Sarnia, Ont. (S.1946)
Lundie, James. Divn. Engr., Can. Pac. Rly., Woodstock, N.B. (Jr.1936. A.M.1939. M.1940)
Lundie, W. E. Mech. Supt., British American Oil Co. Ltd., Clarkson, Ont. (M.1945)
Lundman, E. 57 Carmen Ave., Winnipeg, Man. (S.1945)
Lundy, H. S. Strl. Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (M.1943)
Lundy, James A. Sr. Techr., Can. Car & Foundry Co. Ltd., St. Laurent. For mail: 769 Mt. Royal Ave. E., Montreal 34. (M.1946)
Lunn, F. R. Pres., G. J. Lunn Mfg. Co. Ltd., 613 Chatham St., Montreal. (S.1927. A.M.1938. M.1940)
Lupien, Leo City Engr., City Hall, Louiseville, Que. (M.1944)
Lupton, J. M. Strl. Designer, Dominion Bridge Co. Ltd., Winnipeg, Man. For mail: 508 Niagara St. (S.1934. M.1940)
Lupu, Melvin 859 Rockland Ave., Outremont, Que. (S.1946)
Lusby, G. W. Engr., Ford Motor Co. of Canada, Windsor. For mail: 133 Esdras Place, Riverside, Ont. (S.1925. Jr.1931. A.M.1937. M.1940)
Lusby, T. P. Pres., T. P. Lusby & Co. Ltd., Halifax, N.S. For mail: 8 Cartaret St. (M.1941)
Luscombe, W. C. Murray Res. Elec. Engr., Dominion Textile Co. Ltd., Magog, Que. (S.1941. Jr.1944)
Lutes, Eric Instrmn., Can. National Rlwys., Cape Tormentine, N.B. (S.1941. Jr.1946)
Lyall, Duncan M. Westminster Hospital, London, Ont. (S.1946)
Lyall, James Russell Strl. Engr., Engrg. Dept., City Hall, Vancouver, B.C. (M.1945)
Lye, G. R. K. Constrn. Supt. Leland Electric Canada Ltd., Guelph. For mail: 38 N. Sherbourne St., Toronto 5. (S.1946)
Lye, Robt. G. 4493 West 12th Avenue, Vancouver, B.C. (S.1946)
Lyle, Wallace E. B.C. Power Comm., Victoria. For mail: 4612 West 11th Ave., Vancouver, B.C. (S.1946)
Lyman, Stephen M. Indus. Engr., Canadian Industries Ltd., P.O. Box 10, Montreal. (M.1945)
Lynch, F. C. C. Chief, Bureau of Geology & Topography, Dept. Mines & Resources, Ottawa. For mail: 483 Wilbrod St. (Affil.1916. A.M.1924. M.1940)
Lynch, James A. Jr. Resch. Engr., National Research Council, Ottawa. For mail: 567 Broadview Ave. (M.1944)
Lynch, John Duncan Engrg. Dftsmn., Foster-Wheeler Ltd., St. Catharines, Ont. For mail: 168 Welland Ave. (S.1946)
Lynch, J. F. Works Engr., Plastics Divn., Candn. Industries Ltd., Brownsburg, Que. (Jr.1932. M.1942)
Lynde, C. J. Chief Engr., Maple Leaf Milling Co. Ltd., 68 Yonge St., Toronto 1. (M.1943)
Lynn, H. R. Dir., Lynn MacLeod Engrg. Supplies Ltd., Drummond Bldg., Montreal. (A.M.1920. M.1940)
Lyon, G. M. Dom. Water & Power Bureau, Winnipeg. For mail: 45 Imperial Ave., St. Vital, Man. (S.1929. A.M.1938)
Lyons, G. S. Engr., Bell Telephone Co., Montreal. For mail: 4552 Draper Ave. (S.1922. Jr.1930. M.1942)
Lyons, J. H. K. Indus. Engr., Can. General Electric Co., Peterborough. For mail. Bridgenorth, Ont. (M.1946)
Lyons, J. N. Bridgewater N.S. (M.1940)
Lyster, H. M. Gen. Mgr., Dom. Welding Engrg. Co. Ltd., 6898 Notre Dame St. E., Montreal. (A.M.1920. M.1940)
Lytle, C. H. B. 160 Assiniboine Drive, Winnipeg. (S.1945)

M

Mable, W. H. (Jr.1941)
MacAfee, Ralph Evans Mgr., Eastn. Br., Babcock-Wilcox & Goldie-McCulloch Ltd., Canada Cement Bldg., Montreal 2. (A.M.1920. M.1931)
McAllister. C. D. Sr. Asst. Engr., Dept. Public Works of Can., 115 Prince William St., St. John, N.B. (M.1942)
McAlpine, Robt. F. Wm. Stairs Son & Morrow Ltd., Halifax, N.S. For mail: 34 Young Ave. (Jr. 1929. A.M.1939. M.1940)
McAra, P. Graham Asst. Supt., City of Regina Street Railway. For mail: 7 Angus Cres., Regina, Sask. (A.M. 1934. M.1940)
McArthur, Alex. A. Sales Engr., Can. Westinghouse Co., Toronto. For mail: 263 St. George St. (S.1939. Jr.1946)
McArthur, D. R. B. Major, Directorate of Mech., Engrg., N.D.H.Q., New Army Bldg., Ottawa (S.1940. Jr.1946)
McArthur, Donald Smith 97 Spadina Road, Toronto. (S.1938. Jr.1943)
McArthur, D. Stewart Prodn. Engr., Dow Chemical of Can., Sarnia, Ont. For mail: 189½ Wellington St. (S.1940. Jr.1944)
McArthur, Franklin. Township Engr. of Etobicoke, Dundas St., Islington, Ont. (A.M.1909. M.1919)
MacArthur, John A. Design Engr., Longlac Pulp & Paper Co. Ltd., 263 Adelaide St. W., Toronto. (M.1945)
McArthur, John C. Gen. Mgr., McArthur Constrn. Regd., Russell, Ont. (S.1944)
MacArthur, J. L. Engr., N.B. Internl. Paper Co., Dalhousie, N.B. For mail: P.O. Box 1. (S.1943)
McAulay, D. R. 98 Cumberland St., Toronto. (S.1946)

McAulay, Graham F. Jr. Engr. on Constrn., City of Edmonton Power Plant. For mail: 9413-101st St., Edmonton, Alta. (S.1937. Jr.1941)
MacAulay, Roy D. 163 Jackson St. W., Hamilton, Ont. (S.1942. Jr.1946)
Macaulay, Robt. V. Vice-Pres., Bell Telephone Co., Montreal. For mail: 727 Roslyn Ave., Westmount, Que. (M.1927)
McAvity, G. Clifford. Mng. Dir., T. McAvity Sons Ltd., St. John, N.B. (Affil.1919)
McBride, Ernest W. Asst. Mgr. of Mills, Abitibi Power & Paper Co. Ltd., 408 University Ave., Toronto. (S.1920. Jr.1928. A.M.1935. M.1940)
McBride, Ian F. Boyd. 9823-113th St., Edmonton, Alta. (S.1945)
MacBride, J. M. Asst. Engr. of Track., Can. Pac. Rly., Windsor Station, Montreal. (S1939. Jr.1945)
McBride, J. Wallace. 402 Ambassador Hotel, Winnipeg, Man. (S.1938. Jr.1942)
McBride, Wm. T. Strl. Design., Bridge Engr's Office., Can. Nat. Rlys., Toronto. For mail: 49 Runnymede Road. (S.1946)
McCabe, Russell I. Works Mgr., Sherbrooke Machineries Ltd., P.O. Box 669, Sherbrooke, Que. (S.1923. A.M.1939. M.1940)
McCaffrey, Bruce I. Jr. Resch. Engr., Radio Br., National Research Council, Ottawa. For mail: 392 Riverdale Ave. (S.1946)
McCaffrey, Keith Allan. Test Course, Can. Gen. Elec. Co., Peterborough, Ont. For mail: 20 Aylmer St. (Jr.1946)
McCaffrey, Walter R. Dir., Candn. Standards Assn., National Research Bldg., Ottawa. (M.1939)
McCaghey, Norman F. Supt. Properties & Welfare, Price Bros. & Co. Ltd., Kenogami, Que. (S.1913. Jr.1920. A.M.1923. M.1940)
McCall, Lawrence Victor. 174 Canterbury Place, East Kildonan, Man. (S.1945)
McCall, T. L. Chief Mining Engr., Dominion Steel & Coal Corp., Sydney, N.S. For mail: 28 Bayview St. (M.1930)
MacCallum, Donald C. Adminre. Engr., Canadair Ltd., Cartierville. For mail. 498 Wood Ave., Westmount, Que. (M.1945)
McCallum, Francis. Dist. Engr., P.F.R.A. Dept. of Agriculture, Federal Bldg., Saskatoon, Sask. (S.1938. M.1946)
McCallum, J. F. 194 Prince St., Charlottetown, P.E.I. (S.1942. Jr.1946)
MacCallum, Peter M. Asst. Engr., Bell Telephone Co., Montreal. For mail: 332 Chester Ave., Town of Mount Royal, Que. (Jr.1940)
MacCallum, W. A. Fisheries Experimental Station, Halifax, N.S. (S.1941. M.1944)
McCammon, J. W. Gen. Mgr., Quebec Hydro-Elec. Comm., Montreal. For mail: 1321 Sherbrooke St. W. (Jr.1913. A.M.1924. M.1938)
McCann, E. H. Phillips Electrical Works. Ltd., Brockville, Ont. (S.1934. A.M.1939. M.1940)
McCann, H. J. Jr. Mgr. Sydney Br., Wm. Stairs Son & Morrow Ltd. For mail: 76 Woodill St., Sydney, N.S. (M.1944)
McCann, Wm. Neil. Res. Engr., Montreal East Refinery, McColl-Frontenac Oil Co. For mail: 100 St. Cyr St., Montreal East. (S.1934. Jr.1936. M.1943)
McCannell. D. A. R. City Engr., City Hall, Regina, Sask. (S.1914. A.M.1917. M.1930)
McCarey, J. N. Engr., Stephens-Adamson Mfg. Co., Belleville, Ont. For mail: 273 Ann St. (Jr.1937)
McCarter, D. C. 116 Pricefield Rd., Toronto. (S.1945. Jr.1946)
McCarthy, C. W. P.O. Box 218, Truro, N.S. (M.1940)
McCarthy, Douglas F. Chief Engr., Town Planning Consultants Ltd., Toronto. For mail: 4 Avalon Blvd. (M.1944)
MacCarthy, H. B. National Harbours Board, Ottawa. For mail: 110 Lisgar St. (Jr.1930. M.1940)
McCarthy, Thos. V. 11 Lowther Ave., Toronto 5. (A.M.1919. M.1940)
McCavour, S. T. Chief Engr. & Joint Mgr., Great Lakes Paper Co. Ltd., Fort William, Ont. For mail: 1416 Cuthbertson Place. (M.1941)
McCaw, Alexander. Box 478, Transcona, Man. (S.1946)
McCay, James T. Asst. Gen. Mgr., National Heating Products Ltd., 660 St. Catherine St. W., Montreal. (Jr.1946)
McClary, N. H. Asst. Dist. Airway Engr., Dom. Dept. of Transport, Tegler Bldg., Edmonton, Alta. (M.1945)
McClary, Robt. E. Inst., Dept. Elec. Engrg., Univ. of Alberta. For mail: 10926-83rd St., Edmonton, Alta. (S.1946)
McClelland, James I. Rainy River, Ont. (S.1946)
McClintock, G. A. Overseas. (S.1914. A.M.1925. M.1940)
McColeman, Hugh A. Elec. Engr., Aluminium Laboratories Ltd., Montreal. For mail: 1340 Regent Rd., Town of Mount Royal, Que. (S.1936. Jr.1942)
McColl, B. J. Asst. to Supvr., Design Office, Canadair Ltd., Cartierville. For mail: 1340 Regent Rd. Town of Mount Royal, Que. (S.1943. Jr.1946)
McColl, W. R. Foreman, Bloom & Billet Mills, Steel Co. of Can. Ltd., Hamilton, Ont. For mail: 17 Paisley St. S. (S.1933. Jr.1938)
McColough, Reginald W. Exec. Asst. to Minister of Highways & Public Works of N.S., Hollis St., Halifax, N.S. (A.M.1918. M.1938)
McConkey, Thos. C. Vice-Pres., B. J. Coghlin Co., Montreal. For mail: 4070 Highland Ave. (S.1904. A.M.1913. M.1940)
MacConnell, H. Bruce Estimator & Gen. Supt., Barrett-McQueen Co. Ltd., Fort William, Ont. For mail: 211 S. John St. (M.1943)
McConnell, S. Bruce Dist. Engr., Can. Pacific Rlwy., North Bay, Ont. For mail: Haileybury, Ont. (S.1899. A.M.1905. M.1916)
McCord, J. E. Donald Lieut., R.C. Signals, Research, N.D.H.Q. For mail: 4055 West 36th Ave., Vancouver, B.C. (S.1944. Jr.1946)
McCorkindale, D. H. 235 Belsize Drive, Toronto. (S.1941)
McCormack, Donald N. Design Engr., Spruce Falls Power & Paper Co., Kapuskasing, Ont. For mail: 9 Dominion Ave. (S.1927. Jr.1928. A.M.1937. M.1940)
McCormick, Archie T. Wpg. Dist. Mgr., Dominion Sound Equipments Ltd., 65 Rorie St., Winnipeg, Man. (S.1928. A.M.1934. M.1940)
McCort, C. Roy Mgr. Devlpt. & Constrn., Ontario Paper Co. Ltd., Thorold, Ont. (Jr.1919. A.M.1920. M.1940)
McCoubrey, James H. Bridge Engr., Sask. Govt., Shaunavon, Sask. (A.M 1924. M.1940)
MacCoy, G. B. Engrg. Dept., Shawinigan Chemicals Ltd. For mail: 61 Maple Ave., Shawinigan Falls, Que. (S.1941. Jr.1946)
McCoy, Lyle Vice-Pres. & Gen. Mgr., Canadian Car & Foundry Co., Montreal. For mail: 97 Brock Ave. N., Montreal West. (A.M.1919. M.1940)
McCracken, T. A. 102 Moberley Ave., Toronto 6. (S.1946)
McCrady, Donald C. Asst. Gen. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 602 Stewart St. (S.1935. Jr.1942)
McCrady, L. deB. 74 South Battery, Charleston, S.C., U.S.A. (M.1921)
McCrary, J. W. Overseas. (S.1943)
MacCrimmon, D. D. Box 45, Williamstown, Ont. (A.M.1926. M.1940)
McCrone, Donald G. Asst. Sulphite Engr., E. B. Eddy & Co., Hull, Que. For mail: 378 Huron Ave., Ottawa. (Jr.1929. A.M.1934. M 1940)
McCrory, Jas. A. Vice-Pres. & Chief Engr., Shawinigan Engrg. Co. Ltd., Montreal. For mail: 3940 Côte des Neiges Rd. (A.M.1921. M.1926)
McCrudden, Harry E. Staff Supvr., Bell Telephone Co. of Canada, Beaver Hall Hill, Montreal 1. (S 1913. Jr.1919. A.M.1927. M.1940)
McCuaig, Donald A. Westn. Dist. Mgr., Ferranti Electric Ltd., Electric Railway Chambers, Winnipeg, Man. (M.1944)
McCubbin, Geo. A. Priv. Prac., P.O. Box 327, Chatham, Ont. (A.M 1899. M.1919)
McCulloch, O. J. Cons. Engr., 1440 St. Catherine St. W., Montreal. (S.1916. A.M.1927. M.1940)
McCulloch, Urban F. Civil Engr., Foundation Co. of Can., Montreal. For mail: 98 Salaberry Rd., Chateauguay Heights, Que. (S.1942. Jr.1946)
McCune, Victor Edwin Highway Constrn., Dept. Public Works of Alta., Edmonton. For mail: Lougheed, Alta. (S.1945)
McCurdy, L. B. Chief Engr., Dominion Structural Steel Ltd., 6894 Clanranald Ave., Montreal. (A.M.1920. M.1940)
McDermid, George Engr., Winnipeg Electric Co. For mail: 190 Niagara St., Winnipeg, Man. (A.M.1934. M.1940)
MacDermot, S. G. Mgr., Constrn Dept., Candn. Johns-Manville Co. Ltd., Montreal. For mail: P.O. Box 14, Ste. Rose, Laval Co., Que. (A.M.1919. M.1940)
McDermott, A. G. P. Asst. Contrn. Engr., N.B. Telephone Co. Ltd., Saint John, N.B. (S.1941. Jr.1945)
McDermott, B. D. Civil Engr., Fraser-Brace Co., Montreal. For mail: 5826 Coolbrook Ave. (S.1939. Jr.1946)
McDiarmid, L. G. Gen. Mgr. & Chief Engr., Insulation Industries Ltd., Vancouver, B.C. For mail: 8620 Hudson St. (Jr.1945)
McDiarmid, Robt. B. Res. Elec. Engr., Dept. of Transport, Williamson Bldg., Edmonton, Alta. (Jr.1945)
McDiarmid, F. John Asst. Gen. Sales Mgr., John Inglis Co. Ltd., 14 Strachan Ave., Toronto. (M.1942)
McDill, Wm. A. Vocational Teacher, Winnipeg Public School Board. For mail: 3744 Heather St., Vancouver, B.C. (S.1946)
Macdonald, Albert Edward Prof., Civil Engrg. & Head of Dept., Univ. of Manitoba, Winnipeg, Man. (S.1919. Jr.1922. A.M.1932. M.1936)
Macdonald, Allan G. Sub. Lt. (E), R.C.N.V.R., Edgewater Auto Court, R.R. No. 1, Victoria, B.C. (Jr.1945)
Macdonald, A. J. Temp. Asst. Engr., Dept. Public Works of Can., P.O. Box 12, Glace Bay, N.S. (A.M.1907. M.1940)
MacDonald, Arthur Lamond Major, Inspr. Elec. Engrg. Stores, Inspection Board of Canada, 70 Lyon St., Ottawa. (S.1938. M.1945)
MacDonald, A. T. Dept. Highways of N.S., Kentville, N.S. (M.1940)
McDonald, Chas. A. Sr. Checker, Dftg. Dept. Horton Steel Works Ltd., Fort Erie North, Ont. For mail: 86 Niagara Blvd. (S.1946)
Macdonald, C. B. Res. Dir., A Monk & Co. Ltd., Engrs. & Contractors, London, Eng. For mail: Apartado No. 173, Maracaibo, Venezuela, S.A. (S.1914. A.M.1919. M.1931)
MacDonald, C. D. Asst. Prof. of Engrg. & Plant Supt., Mount Allison Univ. For mail: P.O. Box 462, Sackville, N.B. (M.1943)
MacDonald, Cecil E. 5355 Coolbrook Ave., Montreal. (S.1943)
McDonald, C. K. Shawinigan Water & Power Co., Montreal. For mail: 5967 Cote St. Antoine Rd. (A.M.1924. M.1940)
MacDonald, Donald H. Grad. Stu., Cornell Univ., 301 Bryant Ave., Ithaca, N.Y., U.S.A. (S.1945)
MacDonald, Don L. Elec. Engr., Edmonton Transportation System. for mail: 11244-126th St., Edmonton, Alta. (Jr.1946)
Macdonald, Donald Philips, 24 West St., Moncton, N.B. (S.1944)
MacDonald, Donald S. Vice-Pres., Bird Constrn. Co. Ltd., 7th & Smith Sts., Regina, Sask. (A.M.1932. M.1940)
McDonald, F. R. Dir., Peacock Bros. Ltd., Montreal. For mail: 4940 Ponsard Ave. (M.1945)
MacDonald, F. S. Sherbrooke Machineries Ltd., Sherbrooke, Que. (M.1945)
MacDonald, George E. Supvry. & Instrmn. Dept. of Labour of N.S., Halifax, N.S. For mail: 256 Oxford St. (S.1937. M.1941)
Macdonald, Gordon S. Res. Engr., Standard Chemical Co. Ltd. (Toronto), Amherst, N.S. For mail: Hampton, N.B. (M.1942)
MacDonald, I. L. Devlpt. Engr., Dominion Rubber Co., Montreal. for mail: 3581 Durocher St. (S.1946. Jr.1946)
Macdonald, I. M. Comptroller's Dept., Can. Westinghouse Co., Hamilton, Ont. For mail: 163 Jackson St. W. (S.1941. Jr.1944)
Macdonald, J. A. Elec. Supt., Dominion Iron & Steel Corp., Sydney, N.S. (M.1944)
Macdonald, John Butler Pres., Macdonald & Macdonald Ltd., 718 Granville St., Vancouver, B.C. (M.1941)
Macdonald, J. C. Public Utilities Commr. of B.C., Central Bldg., Victoria, B.C. (S.1908. A.M.1912. M.1923)
Macdonald, Jas D. A. Asst. City Engr., City Hall, Edmonton, Alta. (M.1941)
Macdonald, John E. Overseas (S.1929. A.M.1938. M.1940)
MacDonald, John T. Asst. Engr., Hinde & Dauch Paper Co., Toronto. For mail: 12 Playter Blvd. (Jr.1939)
MacDonald, Jas. Wm. Asst. Supt., Sarnia Refinery, Imperial Oil Ltd. For mail: R.R. No. 3, Sarnia, Ont. (Jr.1920. A.M.1927. M.1940)
MacDonald, J. Winston Supt., Western N.S. Electric Co. Ltd., Yarmouth, N.S. For mail: P.O. Box 941. (M.1940)
McDonald, K. D. Sales Engr., Asphalt Dept., Imperial Oil Ltd., 56 Church St., Toronto 2. (A.M.1920. M.1940)
MacDonald, Leslie S. Contract Engr., Frankel Bros. Ltd., Toronto. For mail: 20 Pine Crescent. (S.1915. A.M.1921. M.1940)
MacDonald, M. J. Overseas. (Affil.1940)
MacDonald, Murray V. Factory Layout, Northern Electric Co., Montreal. For mail: 51 Chester Ave., Town of Mount Royal, Que. (S.1931. Jr.1932. M.1940)
McDonald, N. G. (Jr.1919. A.M.1922. M.1940)
MacDonald, P. J. 51 Chester Ave., Town of Mount Royal, Que. (A.M.1919. M.1940)
MacDonald, R. E. Student Engr., Dominion Iron & Steel Co., Sydney, N.S. For mail: 183 Bentinck St. (Jr.1946)
McDonald, R. M. University of New Brunswick, Fredericton, N.B. (S.1945)
MacDonald, W. A. Asst. to Elec. Engr., Dominion Steel & Coal Corp., Sydney, N.S. For mail: 27 Tain St. (A.M.1939. M.1940)
MacDonald, Wm. C. Dist. Airway Engr., Dept. of Transport, Dominion Bldg., Moncton, N.B. (A.M.1919. M.1940)
MacDonald. W. D. N.B. Electric Power Comm., P.O. Box 820, Saint John, N.B. (M.1942)
MacDonald, Wm. Duncan Reinf. Conc. Design Dept., Dominion Bridge Co., Winnipeg, Man. For mail: 358 Maplewood Ave. (S.1943)
MacDonald, Walter Elwood City Water Works Engr., Ottawa. For mail: 91 Powell Ave. (A.M.1922. M.1940)
MacDonald, Wm. E. Mount Allison University, Sackville, N.B. (S.1945)
Macdonald, Wm. G. Chief Engr., N.S. Light & Power Co. Ltd., P.O. Box 848, Halifax, N.S. (A.M.1929. M.1940)
Macdonell, C. I. S. Divn Engr., Dept. Highways of Ont., Box 70, Sudbury, Ont. (A.M.1920. M.1940)
MacDougall, C. Donald Apptce., Can. Westinghouse Co., Hamilton, Ont. For mail: 163 Jackson St. W. (S.1944)
McDougall, D. H. Cons. Engr., Royal Bank Bldg., Montreal 1. (M.1913)

Macdougall, Douglas Keith Instrmn., Dept. Public Works of N.B. For mail: Box 243, Chatham, N.B. (S.1943. Jr.1946)

McDougall, George E. Bridge Engr., Dept. Nat. Def., Army, Northwest Highway System, Whitehorse, Yukon. (S.1942. Jr.1944)

McDougall, George K. Partner, McDougall & Friedman, Cons. Engrs., 1235 McGill College Ave., Montreal 2. (S.1904. A.M.1912. M.1919)

McDougall, J. Cecil Arch. & Engr., 1235 McGill College Ave., Montreal 2. (A.M.1919. M.1940)

McDougall, John F. Asst. Mgr. & Sec. Treas., McDougall & Secord Ltd., Edmonton, Alta. For mail: 10305-116th St. (S.1928. A.M.1936. M.1940)

McDougall, J. Lyle Price Bros & Co. Ltd., Kenogami, Que. (Jr.1930. A.M.1939. M.1940)

MacDougall, L. W. Shaughnessy Hospital, Vancouver, B.C. (S.1942. Jr.1946)

McDougall, R. Lorne 1462 Guy St., Montreal 25. (S.1945)

McDougall, W. A. Jr. Dftsmn., Canadian Bridge Co., Walkerville. For mail: 1133 Walker Rd., Windsor, Ont. (S.1941. Jr.1943)

McDowell, C. J. Process Engr., Dominion Engrg. Co. Ltd., Lachine. For mail: 127 Clandeboye Ave., Montreal 6. (S.1941. Jr.1946)

McDunnough, Ralph B. 4656 Sherbrooke St. W., Westmount, Que. (A.M.1927. M.1940)

McEachern, A. C. Job Supt., Northern Constrn. & J. W. Stewart, Granville St., Vancouver, B.C. (Jr.1939. M.1945)

MacEachern, Clinton Whitman Asst. Chemist on Prodn., General Latex & Chemical (Canada) Ltd., Verdun. For mail: 3587 Lorne Ave., Montreal. (S.1942)

McEachern, Sinclair Plant Mgr., Ross Engrg. of Canada Ltd., 425 River St., Verdun, Que. (M.1945)

McElhanney, Thos. A. Supt., Forest Prod. Lab., Dept. Mines & Resources, Isabella & Metcalfe Sts., Ottawa. (A.M.1922. M.1940)

McElroy, G. R. Jr. Engr., Can. Industries Ltd., Montreal. For mail: 5160 St. Hubert St. (S.1942. Jr.1944)

McElwain, D. M. R.R. No. 3, Ripples, N.B. (S.1943. Jr.1946)

McEown, W. R. Inspr. Elec. & Gas., Dept. Trade & Commerce, Dominion Public Bldg., Winnipeg, Man. (S.1941. Jr.1943)

McEwen, A. B. Dept. Mgr., Defence Industries Ltd., P.O. Box 10, Montreal. (S.1910. Jr.1914. A.M.1918. M.1940)

MacEwen, Ewen Engr., Reed, Shaw & McNaught Ltd., 360 St. James West, Montreal. (M.1945)

McEwen, H. J. Dist. Mgr. Can. Westinghouse Co, 320-8th Ave. W., Calgary, Alta. (A.M.1921. M.1940)

McEwen, J. E. 153 Welland Ave., Toronto. (S.1946)

McEwen, M. N. Asst. Engr., Dept. Highways of Ont., Kenora, Ont. (Jr.1937. A.M 1939. M.1940)

MacFadyen, Allan B. 9 Humewood Drive, Toronto 10. (S.1942. Jr.1946)

McFarland, W. I. Power Plant Engr., City of Edmonton. For mail: 12013-103rd Ave., Edmonton, Alta. (Jr.1931. A M.1936. M.1940)

McFarlane, Howard W. Asst. Prof. Civil Engrg., Univ. of New Brunswick, Fredericton. For mail: 210 Lancaster Ave., West Saint John, N.B. (S.1942. Jr.1946)

MacFarlane, Peter Wm. Supt. Bldgs. & Grounds, McGill University. For mail: 3551 Carleton Rd., Montreal. (Affil. 1935)

Macfarlane, Robt. M. Engr., Bell Telephone Co., Montreal. For mail: 25 Centre St., Chambly Canton, Que. (S.1936. Jr.1946)

McFaul, Wm. L. City Engr. & Mgr. of Waterworks, City Hall, Hamilton, Ont. (A.M.1919. M.1925)

McGaan, Wm. Horwood Box 32, Station B, Montreal. (S.1906. A.M.1912. M.1940)

McGavin, Chas. J. 1041 Marine Drive, West Vancouver, B.C. (A.M.1921. M.1936)

McGeachy, D. D. C. Wm. Kennedy & Sons, Owen Sound, Ont. For mail: 1166-1st Ave. W. (S.1938. Jr.1944. M.1946)

McGeachy, R. A. Mtce. Engr., Imperial Oil Ltd., Sarnia, Ont. (M.1945)

McGee, G. L. Chief Bldg. Supplies Divn., Soldier Settlement & Veterans' Land Act, Ottawa. For mail: 551 Broadway Ave. (M 1943)

McGee, L. D. Industrial Development Bank, Montreal. For mail: 2258 Old Orchard Ave., Montreal 28.

McGee, R. O. Patent Attorney, 63 Sparks St., Ottawa. (M.1945)

MacGibbon, J. Alex. Works Engr., Alkali Divn., Can. Industries Ltd., Windsor, Ont. (S.1937. Jr.1940)

MacGill, Elizabeth M. G. Cons. Engr., (Aeron.) 86 Bloor St. W., Toronto 5. (A.M.1938. M.1940)

McGillis, Lester Mgr., Indust. Devlpt. Dept., Shawinigan Water & Power Co, Montreal. For mail: 225 Lazard Ave., Town of Mount Royal, Que. (S.1922. Jr.1928. A.M.1935. M.1940)

Macgillivray, Andrew. (A.M.1916. M.1921)

Macgillivray, A. M. Antigonish Harbour, N.S. (A.M.1904. M.1940)

McGillivray, D. L. Imperial Oil Ltd., Sarnia, Ont. For mail: 139 Charlotte St. (M.1945)

MacGillivray, J. A. Asst. Supt. & Engr., Greater Winnipeg Sanitary District. For mail: 240 Niagara St., Winnipeg, Man. (Jr.1917. A.M.1919. M.1940)

Macgillivray, M. S. Engr., Can. Industries Ltd., Montreal. For mail: 4100 Côte des Neiges Rd. (A.M.1935. M 1940)

McGinnis, A. D. Gen. Mgr., McGinnis & O'Connor, King & Queen Sts., Kingston, Ont. (S.1938. Jr.1940. M.1945)

McGinnis, Thos. A. Owner, McGinnis & O'Connor, King St. E., Kingston, Ont. (S.1908. A.M.1912. M.1923)

McGorman, D. G. Pres., National Hardware Specialties Ltd., Wallaceburg, Ont. (M.1940)

McGorman, S. E. Chief Engr., Essex Terminal Railway, Walkerville, Ont. For mail: 1929 Alsace Ave. (M 1921)

MacGowan, Andrew R. Hoboken Manufacturers Railroad Co., Hoboken, N.J., U.S.A. (S.1903. A.M.1909. M.1940)

MacGowan, W. H. Asst. Engr., Mtl. Divn., Bell Telephone Co. For mail: 151 Sherbrooke St. W., Montreal. (S.1938. Jr.1946)

McGrail, Thos. E. Cons. & Sales Engr., 63 Sparks St., Ottawa. (A.M 1922. M.1940)

MacGregor, Alexander Ross R. P. Allsop, Cons. Engr., 1221 Bay St., Toronto. (S.1946)

McGregor, D. R. Engrg. Dept., Can. General Electric Co., Peterborough, Ont. For mail: Walkerfield House, Charlotte St. (S.1933. Jr.1942)

McGregor, James Cons. Engr., 6 Thorn Road, Bearsden, Glasgow, Scotland. (A.M.1909. M.1920)

MacGregor, Jas. G. Asst. Mgr., Can. Utilities Ltd., 215 Sixth Ave. W., Calgary, Alta. (S.1929. A.M.1935. M.1940)

MacGregor, K. R. W. S. Fullerton Construction Co., Windsor, Ont (A.M.1934. M.1940)

McGregor, L. S. Mech. Engr., Can. National Rwys., Toronto. For mail: 369 Keewatin Ave. (S.1935. M.1945)

MacGregor, Wm. R. Demonstrator, Science Faculty, Queen's University, Kingston, Ont. (S.1943)

McGugan, Angus Sec. Mgr., Can. Shipbuilding & Ship Repairing Assn., Chateau Laurier, Ottawa. (A.M.1938. M.1940)

McGuinness, Tom Supt., Regina Municipal Railway, City of Regina, Sask. For mail: 1925 Athol St. (M.1936)

McGuinness, W. N. Engr., Northern Electric Co. Ltd., Montreal. For mail: 69 King's Rd., Valois, Que. (A.M.1929. M.1940)

McGuire, J. Frank Sales Mgr., Alliance Electric Works Ltd., Montreal. For mail: 1593a Ducharme Ave. (Jr.1935. M.1943)

McHenry, Morris J. Dir. of Promotion, Hydro-Elect. Power Comm. of Ont., Toronto. For mail: 58 Royal York Rd. N. (M.1938)

McHugh, John 1075 Gilford St., Vancouver, B.C. (A.M.1918. M.1940)

McIlhargey, P. E. Engr., Paper Mach. Divn., Canada Iron Foundries Ltd., 227 St. Maurice St., Three Rivers, Que. (M.1945)

McIlquham, W. S. Hydraul. Engr., Dominion Engrg. Works Ltd., Montreal. For mail: 4055 Grand Blvd. (Jr.1926. A.M.1937. M.1940)

McInnis, J. F. Engr. on Design, Mtce. & Constrn., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1941. M.1946)

MacInnes, M. (S.1940)

McIntee, Arthur Francis Asst. Engr., Toronto Terminals Railway Co. For mail: 21 Sherwood Ave., Toronto 12. (A.M.1921. M.1940)

McIntire, Earl John Vice-Pres., Dinsmore-McIntire Ltd., Security Bldg., Windsor, Ont. (A.M.1920. M.1940)

McIntosh, E. D. Purch. Agent, Canada Starch Co. Ltd., Sun Life Bldg., Montreal. (S.1914. A.M.1920. M.1940)

McIntosh, J. H. Works Mgr., Associated Portland Cement Mftrs. Ltd., Kent, Eng. For mail: Stone Place Road, Horn's Cross, Greenhithe, Kent, England. (S.1920. A.M.1930. M.1940)

McIntosh, Lawrie G. Develpt. Engr., T. S. Simms & Co., St. John, N.B. (S.1946)

McIntosh, Wm. G. Asst. Regl. Surplus Propty. Engr., War Assets Corp., Vancouver, B.C. For mail: 1955 Hard St. (S.1935. Jr.1941)

McIntyre, A. J. 780 Ingersoll St., Winnipeg, Man. (S.1946)

McIntyre, Duncan Jr. Engr., P.F.R.A., Dom. Dept. of Agriculture, Regina, Sask. For mail: 1029 Lindsay St. (S.1944)

McIntyre, Donald J. 528 King St. W., Chatham, Ont. (S.1940. Jr.1946)

McIntyre, D. V. 77 Parklea Drive, Leaside, Toronto 12. (S.1930. Jr.1936. A.M.1939. M.1940)

McIntyre, J. Spence Pres., International Engrg. Corp., Box 51, Montreal. (M.1942)

McIntyre, T. M. Res. Engr., Campbell River Hydro Devlpt., H. G. Acres & Co., Campbell River, B.C. (M.1945)

MacIsaac, Donald F. Prop. & Mgr., Atlantic Constrn. Co., 163 Water St. N., Halifax, N.S. (M.1940)

McIsaac, Ronald Divn. Engr., Can. National Rwys., New Glasgow, N.S. (M.1940)

MacIsaac, Vernon W. Mech. Engr., Ford Motor Co. of Canada, Windsor, Ont. For mail: 410 Giles Blvd. W. (S.1920. A.M.1927. M.1940)

Mackay, Angus G. Mgr., N.S. Construction Co. Ltd., Roy Bldg., Halifax, N.S. (M.1941)

MacKay, Donald A. 74 Glen St., Ottawa. (S.1945)

MacKay, Donald E. A. Jr. Resch. Engr., Mech. Divn., National Research Council, Ottawa. For mail: 32 Carlyle. (S.1945)

McKay, Donald W. Overseas. (Jr.1939)

MacKay, Ernest Prof. of Maths., Ecole Polytechnique, Montreal. For mail: 255 Outremont Ave. (M.1943)

MacKay, E. G. MacKay & MacKay, Imperial Bldg., Hughson St. S., Hamilton, Ont. (A.M.1921. M.1940)

MacKay, Frank H. Asst. Engr., Great Lakes Power Co. Ltd., Sault Ste Marie, Ont. For mail: 135 Cathcart St. (M.1945)

MacKay, F. R. Jr. Engr., Foundation Co. of Canada, 1538 Sherbrooke St. W., Montreal. (S.1946)

McKay, Hugh A., Pres. & Engr., McKay-Cocker Constrn. Ltd., London, Ont. For mail: 439 Regent St. (S.1921. Jr.1925. A.M.1928. M.1940)

MacKay, I. N. Mech. Engrg., National Research Council, Chalk River. For mail: Deep River, Ont. (S.1935. A.M.1940. M.1940)

MacKay, J. A. Roadmaster, Can. Nat. Rlwys., Halifax, N.S. For mail: Box 53, Bedford, N.S. (A.M.1927. M.1940)

MacKay, J. D. City Engr., City Hall, Fredericton, N.B. (M.1942)

McKay, James F. Chem. Engr., Naugatuck Chemicals, Elmira, Ont. For mail: Box 423, (S.1943. Jr.1946)

MacKay, Jas. J. Pres., MacKay & MacKay, Imperial Bldg., Hamilton, Ont. (M.1921)

McKay, J. Kenneth Divn. Engr., Dept. Highways of N.S., Clyde River, N.S. (S.1907. Jr.1912. A.M.1920. M.1940)

Mackay, L. Gen. Supt. & A/Gen. Mgr., Manitoba Power Comm., Notre Dame Ave. E., Winnipeg. (S.1924. Jr.1930. M.1940)

MacKay, Norman A. Engr., Steel Sales Dept., Dominion Steel & Coal Corp., Montreal. For mail: 4735 Ridgevale Ave. (S.1937. Jr.1940)

Mackay, Robt. Gen. Supt., City of Calgary Light & Power, Utilities Bldg., Calgary, Alta. (A.M.1918. M.1940)

McKay, R. Donald Sanitary Engr., Dept. Public Health of N.S., Provincial Bldg., Halifax, N.S. (S.1932. Jr.1935. A.M.1938. M.1940)

McKay, Walter Regr. & Sec. Treas., Association of Professional Engineers of Ontario, 350 Bay St., Toronto. (Affil.1939)

Mackay, W. B. F. Instr., Dept. of Metallography, University of Minnesota, Minneapolis. For mail: 261 Wellington Cres., Winnipeg, Man. (S.1936. Jr.1941)

Mackay, W. Donald Dftsmn., Can. National Rwys., Prince Rupert, B.C. For mail: P.O. Box 925. (S.1945)

McKay, W. G. Asst Engr., Underwood & McLellan, Grain Bldg., Saskatoon, Sask. (S.1941. M.1944)

Mackay, W. R. Engr., Comml. & Distbn. Dept. Shawinigan Water & Power Co., Three Rivers, Que. (S.1940. Jr.1944)

Macke, W. R. Box 202, Mildmay, Ont. (S.1946)

McKeagan, Edwin A. Can. Gen. Elec. Co. Montreal. For mail: 4595 Melrose Ave. (M.1946)

McKechnie, T. S. Metal Inspr., Imperial Oil Ltd., Sarnia, Ont. For mail: 305 Maria St. (A.M.1936. M.1940)

McKee, Gordon Asst. to Pres., Kelco Engrg. Ltd., 352 Thomas St., London, Ont. (S.1936. Jr.1940. M.1945)

McKee, Neal T. Vice-Pres., Superheater Co., 60 E. 42nd St., New York 17, U.S.A. (M.1944)

McKeever, J. L. Gen. Engr., Can. Gen. Elec. Co., Park St., Peterborough, Ont. (M.1945)

McKellar, A. D. Jr. Engr., Dominion Engrg. Works, Lachine. For mail: 4152 Beaconsfield Ave., Montreal 28. (S.1943. Jr.1946)

McKelvie, John L. 217 Stuart St., Kingston, Ont. (S.1946. Jr.1946)

McKenna, Joseph V. Lecturer, Queen's Univ., Kingston, Ont. For mail: 129 Centre St. (Jr.1943)

Mackenzie, A. D. Constrn. Engr., Foundation Co. of Ont., Toronto. For mail: 506 Huron St. (S.1942. Jr.1946)

Mackenzie, Alexander M. Gen. Plant Pers. Supvr., Bell Telephone Co., Beaver Hall Hill, Montreal. (A.M.1912. M.1940)

Mackenzie, C. J. President, National Research Council, Ottawa. (Jr.1911. A.M.1914. M.1920)

Mackenzie, D. Campbell (M.1936)

Mackenzie, D. G. Rail N Ranch, Arcale Star Route, Tuscon, Arizona, U.S.A. (S.1920. A.M.1928. M.1940)

McKenzie, Eric John 844 Spruce St., Winnipeg, Man. (S.1946)

MacKenzie, Gordon L. Chief Engr., P.F.R.A., Dom. Dept. of Agriculture, McCallum-Hill Bldg, Regina, Sask. (S.1919. Jr.1922. A.M.1922. M.1938)

Mackenzie, Harry Supvr., Railway Drydocks, Atlantic Coast, Dept. Munitions & Supply, Halifax. For mail: 3 Edgemere Apts., Dartmouth, N.S. (M.1944)

MacKenzie, Hugh Engr. Mgr., West Coast Shipbuilders Ltd., Vancouver, B.C. For mail: 1049 W. 29th Ave. (M.1943)
MacKenzie, H. Ross Dep. Minister, Dept. Highways of Sask., Regina, Sask. For mail: 3220 Victoria Ave. (A.M.1916. M.1936)
MacKenzie, I. D. Shawinigan Engineering Co. Ltd., P.O. Box 6072, Montreal. (Jr.1941)
Mackenzie, John Dist. Highway Engr., Dept. Public Works, Rexton, N.B (M.1942)
Mackenzie, John Allen Dist. Engr., C.P.R., 40 King St., St. John, N.B. (Jr.1912. A.M.1925. M.1940)
MacKenzie, John E. Town Engr., Glace Bay, N.S (M.1940)
MacKenzie, John Fraser Divn. Engr., Can. Nat. Rlys., Edmundston, N.B. For mail: P.O. Box 741. (S.1914. A.M.1921. M 1940)
Mackenzie, J. F. F. Gen. Mgr., Robb Engr. Works Ltd., Amherst, N.S. (Jr.1920. A.M.1923. M.1940)
MacKenzie, John James Engr., Dftsmn., Schumacher MacKenzie Ltd., 334 Main St., Winnipeg, Man. (S.1938. M.1946)
MacKenzie, J. M. Jr. Engr., Engrg. Dept., City of Toronto. For mail: 31 Davisville Ave., Toronto 12. (S.1944)
Mackenzie, John Percival Dept. of Reconstruction Bldg No. 1, Wellington St., Ottawa. (A.M.1920. M.1936)
McKenzie, R B. Mgr., McKenzie Electric Ltd., 706-3rd Ave. S., Lethbridge, Alta. (S.1932. Jr.1937. M.1943)
Mackenzie, R. B. A. 11153 Saskatchewan Drive, Edmonton, Alta. (Jr.1946)
Mackenzie, Ray E. Prin. Civil Engr., U.S. Engineer Dept., Portland, Ore. For mail: R.R. No. 11, Box 19, Milwaukie, Ore., U.S.A. (M.1943)
MacKenzie, R. Fraser Instrmn., Campbellton Divn., Can. National Rwys. For mail: P.O. Box 355, Campbellton, N.B. (S.1943)
Mackenzie, Robt. K. 352-8th St. W., Owen Sound, Ont. (S.1938. Jr.1946)
MacKenzie, Wm. Jas. (A.M 1919. M.1940)
Mackenzie, W. L. Design. Engr., Dept. of Transport, Ottawa. For mail: 265 Harmer Ave. (S.1916. A.M.1924. M.1940)
McKeown, L. A. Tech. Dept., National Aluminate Corp., 6216 W. 66th Place, Chicago 38, Ill., U.S.A. (Jr.1944)
McKeown, Raymond John Engr., Service & Erection, Combustion Engrg. Corp., Montreal. For mail: 486 Mountain Ave., Westmount, Que. (M.1945)
McKergow, Chas. M. Prof., Mech. Engrg., McGill University, Montreal. (S.1903. A.M.1911. M.1921)
McKerlie, Jardine Mgr., Ontario-Great Lakes Divn., Wartime Merchant Shipping Ltd., Toronto. For mail: 54 Rowanwood Ave. (Affil.1942)
McKernan, E. W. Supt., Saguenay Power Co. Ltd., Isle Maligne, Que. (S.1941. M.1945)
Mackerras, John D. First Trust & Savings Bank of Pasadena, Lock Box 439, Pasadena 18, Calif., U.S.A. (S.1899. A.M.1900. M.1940)
McKerron, Donald 620 George St., Sydney, N.S. (S.1946)
Mackey, Keith B. (S.1943)
McKibbin, K. H. Lt. Col., O.C. A21 C.O. & E.M.E.T.C., Barriefield, Ont. (S.1935. Jr.1941. M.1943)
McKie, Wm. M. Can. Gen. Elec. Co., 212 King St W., Toronto. (S.1939. Jr.1946)
McKiel, Harold W. Dean, Faculty of Science, Mount Allison Univ., Sackville, N.B. (A.M.1919. M.1923)
McKillop, V. A. Asst. Mgr., Public Utilities Comm., Dundas St., London, Ont. (Jr.1926. A.M.1927 M.1940)
MacKimmie, R. D. Walkerfield House, Peterborough, Ont. (Jr.1941)
Mackin, Gerard Francis Test Course, Can. Gen. Elec. Co., 1302a St. Clair Ave. W., Toronto. (S.1946)
MacKinlay, Russell A. Albion St., Trenton, N.S. (S 1944. Jr.1946)
McKinney, C. Donald Elec. Engr., Shawinigan Water & Power Co. Ltd., 107 Craig St. W., Montreal. (S.1942. Jr.1946)
McKinney, John E. Dist. Plant Supt., Bell Telephone Co., 43 Eglinton Ave., E., Toronto. (A.M.1938. M.1940)
McKinney, J. Harold Asst. Engr., National Harbours Board, Saint John, N.B. For mail: 161 Germain St. (Jr.1920. A.M.1926. M.1940)
MacKinnon, A. H. Res. Engr., N.S. Dept. of Highways & Public Works. For mail: 105 Alexander St., New Glasgow, N.S. (S.1941. M.1942)
MacKinnon, Chas. Eric Mech. Engr. & Mgr., Cranbrook Foundry Co. Ltd., Cranbrook, B.C. (A.M.1936. M.1940)
Mackinnon, Donald L. Mgr. Bldg. Dept., Foundation Co. of Ontario, 1220 Bay St., Toronto. (S.1933. M.1944)
MacKinnon, Keith A. Cons. Radio Engr., P.O. Box 542, Ottawa. (M.1945)
MacKinnon, Murdoch A. i/c Sailing Directions & Nautical Research, Surveys & Engrg. Br., Dept. Mines & Resources, Confederation Bldg., Ottawa. (S.1913. A.M.1921. M.1940)
McKinnon, Ronald M. City Engr., Halifax, N.S. For mail: 36 Beech St. (A.M.1921. M.1940)
MacKinnon, Wm. Donald Inspn. Dept., Macdonald Bros. Aircraft Ltd., St. James. For mail: 45 Roslyn Apts., Osborne St., Winnipeg, Man. (S.1940. Jr.1946)
MacKinnon, Wm. Duncan Donnacona Paper Co. Ltd., Donnacona, Que. (S.1924. Jr.1939. A.M.1934. M.1940)
McKinnon, W. J. Jr. Engr, Dominion Oilcloth & Linoleum Co., Montreal. For mail: 5134 Azilda St. (Jr.1945)
MacKintosh, Colin D. Divn. Engr., Can. Pacific Rwy., E. & N. Rwy. Store, Victoria, B.C. (A.M.1911. M.1922)
Mackintosh, James Asst. Engr., Hydro Elec. Power Comm. of Ont., 620 University Ave., Toronto. (A.M.1911. M.1940)
Macklem, Oliver T. 18 Barrie St., Kingston, Ont. (S.1907. A.M.1913. M.1940)
McQnight, R. C. 7 Braemore Gardens, Toronto 10. (S.1906. Jr.1913. A.M.1922. M.1940)
McKnight, R. M. 19 Aberdeen Ave., Kingston, Ont. (S.1944)
McKnight, S. W. 36 Wentworth St. N., Hamilton, Ont. (S.1940. Jr.1946)
McLachlan, Duncan W. Engr., Design & Constrn., Dept. of Transport, Ottawa. (S.1902. A.M.1908. M.1920)
MacLachlan, John G. Mgr., Hudson Bay Rwy. For mail: Drawer 180, The Pas, Man. (A.M.1919. M.1940)
Maclachlan, K. S. Pres. & Mng. Dir., Standard Chemical Co., Toronto. For mail: 88 Old Forest Hill Road. (M.1940)
McLachlan, R. A. Chief Dftsmn., Pacific Divn., Dominion Bridge Co., Vancouver, B.C. For mail: 747 E. 9th St. (M.1946)
Maclachlan, Wills Consultant Employee Relations, Hydro-Elec. Power Comm. & Electrical Employers Assn., Toronto. For mail: 50 Oakwood Ave. (M.1920)
McLachlin, Hugh F. Port Nelson, Ont. (S.1931. Jr.1936)
McLagan, T. R. Gen. Mgr., Can. Vickers Ltd. and Indust. Cons. Engr., Dufresne, McLagan & Associates, Montreal. For mail: 44 Sunnyside Ave., Westmount, Que. (S.1921. A.M.1936. M.1940)
McLaggan, Wm. A. 2413-14th St. S.W., Calgary, Alta. (S.1946)
McLaren, A. A. Chief Engr., Seaboard Constrn. Corp., Mt. Kisco, N.Y. For mail: Bedford Road, Katonah, N.Y., U.S.A. (A.M.1920. M.1940)
McLaren, D. L. Elec. Engr., Can. Gen. Elec. Co., 212 King St. W., Toronto. (A.M.1919. M.1940)
Maclaren, Ian Pres., Rochester & Pittsburgh Coal Co. (Canada) Ltd., 320 Bay St., Toronto. (M.1944)
MacLaren, James F. Partner, Gore & Storrie, Cons. Engrs., Toronto. For mail: 126 Golfdale Road. (A.M.1921. M.1940)
McLaren, John H. Chief Engr., Montreal Engrg. Co., 255 St. James St W., Montreal. (A.M.1912. M.1940)
MacLaren, James W. Jr. Engr., Gore & Storrie, Toronto. For mail: 26 Golfdale Road. (S.1946)
McLaren, Leo Engr., Rimouski Dist. Office, Dept. Public Works of Can. For mail: 20 Lepage St., Rimouski, Que. (M.1944)
Maclaren, W. O. Brian Colquhoun & Partners, Cons. Engrs., 18 Upper Grosvenor St., London W.1, England. (M.1942)
MacLatchey, C. W. Dist. Highway Engr., Dept. Public Works of N.B., Box 190, St. Stephen, N.B. (M.1943)
McLaughlin, G. F. A. Supt. Road Constrn., Armstrong Bros., Gen. Contrs., Perth, N.B. (S.1941. Jr.1946)
McLaughlin, I. M. Capt., R.C.E.M.E., Dept. National Defence, New Army Bldg., Ottawa. (S.1940. M.1945)
McLaughlin, Robt. H. B. Prof., Dept. Civil Engrg., Univ. of New Brunswick, Fredericton, N.B. (S.1941. Jr.1946)
McLaughlin, R. R. Prof. Chem. Engrg., University of Toronto, Toronto. (M.1943)
McLaughlin, W. G. Aiken & MacLachlan Ltd., St. Catharines, Ont. (Jr.1937)
MacLaurin, James G. Engr., Can. International Paper Co., Temiskaming, Que. (A.M.1919. M.1940)
McLean, Alex. F. Elec. Supt., Can. Tube & Steel Products Ltd., Montreal. For mail: 1225 Bishop St. (S.1940. Jr.1944)
McLean, C. E. Quebec North Shore Paper Co., Baie Comeau, Que. (S.1941. Jr.1946)
MacLean, Duart A. Surveys Engr., Dept. Mines & Resources, Victoria Museum, Ottawa. For mail: 43 Fulton Ave. (S.1944. Jr.1946)
McLean, Donald D. Jr. Engr., Can. Marconi Co., 2440 Trenton Ave., Town of Mount Royal, Que. (Jr.1946)
McLean, D. F. Electronics Engr., Candn. Research Institute, Toronto. For mail: 2 Lola Road. (S.1945)
Maclean, Donald Gordon Jr. Engr., Gore & Storrie, Toronto. For mail: 377 Huron St. (S.1942)
McLean, Donald Hugh Instr., Univ. of Minnesota. For mail: 2242 Hillside Ave., St. Paul 8, Minn., U.S.A. (S.1945. Jr.1946)
McLean, D. L. Supt., Greater Winnipeg Sanitary District. For mail: 701 McMillan Ave., Winnipeg. (S.1904. A.M.1912. M.1940)
MacLean, D. W. Forest Engr., N.B. Intrenl. Paper Co., Campbellton, N.B. For mail: P.O. Box 420. (Jr.1943)
MacLean, F. A. 327-9th St., New Westminster, B.C. (S.1944)
McLean, Gordon M. (S.1931. Jr.1936)
McLean, G. Roland Tech. Serv. Engr., Monsanto (Canada) Ltd., 378 St. Paul St. W., Montreal. (Jr.1944)
McLean, Howard J. Constrn. Supt., Montreal Engrg. Co. Ltd., 244 St. James St. W., Montreal. (Jr.1920. A.M.1924. M.1940)
McLean, H. J. G. Major, Headquarters, M.D. No. 7, St. John, Que. (A.M.1922. M.1940)
MacLean, James A. County Engr., Dept. Highways & Public Works of N.S., Port Hawkesbury, N.S. (M.1940)
McLean, John A. 591 Gilmour St., Ottawa. (S.1946)
McLean, J. N. 12 Cove Apts., Winnipeg, Man. (M.1943)
MacLean, M. D. Stress Analyst, Glenn L. Martin Co., Baltimore, Md. For mail: Charlo Station, N.B. (S.1944)
McLean, Murray D. Electronics Sales Engr., Northern Electric Co., Montreal. For mail: 2320 Lincoln Ave. (S.1937. Jr.1946)
MacLean, R. J. 3647 University St., Montreal. (S.1945)
McLean, W. A. Cons. Engr. Glen Ian, Liverpool Rd., Pickering, Ont. (A.M.1899. M.1912)
McLean, W. B. W. B. McLean & Co., Engrs., Montreal. For mail: 470-44th Ave., Lachine Que. (A.M.1906, M.1922)
Mclean, Wm. J. L. 4267 Old Orchard Ave., Montreal. (S.1946)
McLeish, John 299 First Ave., Ottawa, Ont. (M.1923)
McLeish, Wm. A. E. Divn. Engr. (Belgo Divn.) Consolidated Paper Corp., Shawinigan Falls, Que. (M.1941)
McLellan, Edgar K. River Philip Centre, Cumberland Co., N.S. (S.1944)
McLellan, John Strl. Checker, Dominion Bridge Co., Toronto. For mail: 173 St. Germain Ave. (M.1944)
McLellan, J. G. Sales Engr., Northern Electric Co., 1620 Notre Dame St. W., Montreal. (M.1946)
McLellan, Roy Alexander Partner, Underwood & McLellan, Grain Bldg., Saskatoon, Sask. (M.1938)
McLennan, Duncan O. Personnel Mgr., E. B. Eddy Co., Hull, Que. (A.M.1935. M.1940)
McLennan, G. R. Engr., Metropolitan Electric Co., Montreal. For mail: 5418 Sherbrooke St. W. (S.1921. Jr.1925. A.M.1931. M.1940)
McLennan, Kenneth R. 133 Madison Ave., Toronto 5. (S.1907. A.M 1912. M.1940)
Maclennan, W. E. Inspr. of Bldgs. & Weights & Measures, City of Fort William, Ont. For mail: 710 Catherine St. (A.M.1938. M.1940)
McLeod, Arthur M. Partner, Sheppard Electrical Laboratories, Ottawa. For mail: 346 Cambridge St. (S.1937. Jr.1940)
McLeod, C. Kirkland Mgr. & Chief Engr., Walter Kidde & Co. of Canada Ltd., 1449 Crescent St., Montreal 25. (Jr.1914. A.M.1921. M.1940)
McLeod, C. W. St. Lawrence Paper Mills Co., Three Rivers, Que. For mail: 1539 Blvd. St. Louis. (Jr.1945)
McLeod, Donald M. Stoney Creek, Sask. (S.1943. Jr.1946)
MacLeod, E. M. Asst. Powerhouse Supt., St. Maurice Power Corp., La Tuque, Que. (Jr.1930)
MacLeod, George Asst. Dist. Engr., Dept. Public Works of B.C., Court House, New Westminster, B.C. (Jr.1912. A.M.1920. M.1940)
Macleod, Gordon Inspr. of Commns., Can. Pacific Rwy. Depot, Calgary, Alta. (S.1936. Jr.1946)
McLeod, George C. Field Engr. i/c Constrn., C. D. Howe Co. Ltd. For mail: 1401 Ave. C. North, Saskatoon, Sask. (S.1942. Jr.1946)
MacLeod, Geo. G. W. Mgr., Mines Dept., Algoma Central Rwy. For mail: 192 Upton Rd., Sault Ste. Marie, Ont. (M.1936)
MacLeod, Gordon R. Engr., Ross Engrg. of Canada, 425 River St., Verdun, Que. (M.1946)
McLeod, Herdman Master Mechanic, Cadomin Coal Co., Cadomin, Alta. (M.1941)
MacLeod, H. J. Head, Dept. Mech. & Elec. Engrg., Univ. of British Columbia, Vancouver, B.C. (M.1930)
McLeod, Harry W. Princ. Asst. Engr., Can. Pacific Rwys., Winnipeg, Man. (A.M.1913. M.1940)
MacLeod, John Chief Engr., Steel Divn., Dominion Steel & Coal Corp. For mail: P.O. Box 584, Sydney, N.S. (A.M.1931. M.1940)
MacLeod, James Gordon Civil Engr., Candn. Refractories Ltd., Kilmar, Que. (S.1944. Jr.1945)
Macleod, J. S. 122 Mt. Pleasant Road, Toronto (A.M.1915. M.1940)

Macleod, Keith Truscon Steel Co., 2011 Burbank Ave., Wooster, Ohio, U.S.A. (S.1912. A.M.1922. M.1940)
McLeod, L. R. 914 Victoria Ave., Saskatoon, Sask. (S.1940. Jr.1944)
McLimont, D. W. 3429 Peel St., Montreal 2. (S.1946)
Maclure, Jas. H. C. Design & Sales Engr., Can. Fairbanks-Morse Co., 980 St. Antoine St. W., Montreal. (S.1942. M.1946)
MacMahon, Jas. W. 614 Grosvenor Ave., Westmount, Que. (S 1909. A.M.1913. M.1940)
McManamna, T. L. Pres. & Gen. Mgr., International Water Supply Ltd., 12 Maitland St., London, Ont. (A.M.1938. M.1940)
McManus, Edward F. Land Surveyor, 181 South Park St., Halifax, N.S. (M.1940)
McManus, L. H. Test. Engr., Dept. Public Works of Alta., Terrace Bldg., Edmonton, Alta. (S.1936. Jr.1938)
McManus, Michael H. Pres., M. H. McManus Ltd., Gen. Contrs., 290 Tower Rd., Halifax, N.S. (Affil.1926)
McManus, Ralph N. Lecturer, Dept. Civil Engrg., Univ. of Alberta, Edmonton, Alta. (S.1941. Jr.1943. M.1946)
McMaster, Arthur W. 629 Clarke Place, Westmount, Que. (S.1899. A.M.1909. M.1929)
McMath, A. A. B. Layout Engr., Stadler, Hurter & Co., Montreal. For mail: St. Hilaire East, Que. (S.1934. Jr.1938)
McMath, J. P. C. Design Engr., Wire & Cable Divn., Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (S.1936. Jr.1942)
McMeekin, G. Rex Pers. Divn., Consolidated Mining & Smelting Co., Trail, B.C. (Jr.1944)
McMichael, J. D. Estimator, Norman A. Smith Co., 154 Front St. E., Toronto. (S 1946)
McMillan, Colin B. Asst. Engr., Can. National Rwys., Montreal. For mail: 3605 Gouin Blvd. W., Cartierville, Que. (S.1936. Jr.1941)
McMillan, David Surveys Engr., Dept. Mines & Resources, Ottawa. For mail: 124 Ossington Ave. (A.M.1921. M.1940)
McMillan, H. W. Mfg. Consultant, Dominion Bridge Co., Lachine. For mail: 325-41st Ave. (A.M.1921. M.1940)
McMillan, James Purch. Agent, Calgary Power Co. Ltd., Calgary, Alta. (A.M.1934. M.1940)
MacMillan, J. D. Instrmn., Can. National Rwys., Quebec. For mail: 132 Moncton Ave. (S.1943. Jr.1946)
MacMillan, J. S. 1501 Mountain St., Montreal. (Jr.1939)
MacMillan, Kenneth Livingstone Chief Dftsmn., Canada Cement Co., Beaver Hall Sq., Montreal. (A.M.1940. M.1940)
McMillan, Ralph E. Elec. Engr., Candn. International Paper Co., P.O. Box 510, Three Rivers, Que. (S.1922. Jr.1930. A.M.1936. M.1940)
McMillan, T. Stewart Plant Engr., Conversion Plant, Canadair Ltd., Cartierville. For mail: 11430 de la Sorbonne St., Montreal 9. (S.1937. Jr.1940. M.1946)
McMillin, George R. Asst. Supt., Halifax Refinery, Imperial Oil Ltd., Box 490, Dartmouth, N.S. (M.1942)
McMordie, H. Campbell Job Capt., Strl. Design, Albert Kahn Assoc., Arch. & Engrs., Inc., Detroit. For mail: 1523 Pelissier St., Windsor, Ont. (S.1909. A.M.1920. M.1940)
McMordie, Robt. C. Asst. Engr., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 452 Castlefield Ave. (S.1930. A.M.1936. M.1940)
McMorine, J. G. S. Jr. Hyd. Engr., P.F.R.A., Dept. of Agriculture, McCallum-Hill Bldg., Regina, Sask. (S.1940. Jr.1941)
McMulkin, F. J. Ontario Research Foundation, 43 Queen's Park, Toronto 5. (Jr.1938)
McMulkin, George J. 80 St. George St., Toronto. (S.1944)
McMullen, E. R. A/Gen. Supt., Wayagamack Divn., Cons. Paper Corp. Ltd., Three Rivers. For mail: 718 Notre Dame St., Cap de la Madeleine, Que. (A.M.1939. M.1940)
McMullen, W. F. 45a Claxton Blvd., Toronto 10. (S.1933. M.1945)
McMurdo, H. G. 93 St. George St., Toronto. (S.1946)
McMurtry, L. C. Vice-Pres., Horton Steel Works Ltd., Fort Erie. For mail: 221 Highland Ave., Fort Erie North, Ont. (A.M.1927. M.1940)
Macnab, A. Cameron Mech. Engr., Dominion Woollens & Worsteds Ltd., Hespeler, Ont. (A.M.1939. M.1940)
Macnab, E. Nelson Gen. Mgr. & Indust. Engrg., General Electric Co., Schenectady, N.Y. For mail: 137 Strathearn Ave., Montreal West. (S.1942. Jr.1945)
Macnab, Ira P. Commr., Board of Commissioners of Public Utilities, Provincial Bldg., Halifax, N.S. (M.1919)
Macnab, John J. Civil Engr., Trenton, Ont. (S.1904. A.M.1907. M.1940)
MacNab, S. D. i/c Testing Labs., Engrg. Bldg., McGill University, Montreal. (A.M.1918. M.1940)
MacNab, T. M. Works Mgr., Demerara Bauxite Co., Ituni, British Guiana, S.A. (M.1946)
Macnabb, Thos. Creighton Gen. Supt., Can. Pac. Rly., Union Station, Toronto 1. M.1926)
Macnabb, T. C., Jr. Asst. Special Engr., Can. Pac. Rly., Union Station, Toronto 1. (S.1940. Jr.1943)
MacNair, Donald E., Jr. 52 Wellington St., Huntingdon, Que. (S.1945)
McNally, Patrick J. Job Supt., E. G. M. Cape Co., Montreal. For mail: 5850 Coolbrook Ave. (M.1945)
McNally, R. J. Brian Design Engr., Candn. Synthetic Rubber Co. Ltd., Sarnia. For mail: Oakwood Corners, R.R. No. 3, Sarnia, Ont. (S.1943. Jr.1946)
McNally, R. W. Serv. Engr., Mathews Conveyor Co. Ltd., Toronto. For mail: Box 513, Port Hope, Ont. (S.1942. Jr.1945)
Macnamara, Wm. Stafford Strl. Engr., Hamilton Bridge Co. For mail: 43 Dromore Cres., Hamilton, Ont. (A.M.1939. M.1940)
McNaughton, Andrew G. L. Chairman, Cdn. Sec., U.S.-Can. Joint Board on Defence, & Can. Rep., United Nations Atomic Energy Comm., Dept. External Affairs, Ottawa. For mail: 28 Goulburn St. (A.M.1914. M.1927)
McNaughton, Andrew Robt. Leslie Pres., Norcan Ltd., 160 Laurier Ave., Ottawa. (S.1937. Jr.1946)
McNaughton, J. H. Dominion Bridge Co., Vancouver, B.C. For mail: 4583 W. 12th Ave. (S.1945)
MacNaughton, J. W. Asst. Resch. Scientist, Candn. Armament Resch. & Devlpt. Establishment, P.O. Box 142, Quebec. (Jr.1946)
Macnaughton, M. F. Cons. Engr., Milton Hersey Co. Ltd., 980 St. Antoine St., Montreal. (S.1920. Jr.1926. A.M.1932. M.1940)
MacNearney, C. A. Divn. Engr., Dept. of Highways, Halifax, N.S. (M.1940)
McNeice, Leonard G. Comm.'s Engr., Orillia Water Light & Power Comm., 25 West St. N., Orillia, Ont. (S.1913. A.M.1919. M.1936)
MacNeil, Donald J. Cons. Geologist & Prof. of Geology, St. Francis Xavier Univ., Antigonish, N.S. (M.1943)
MacNeil, D. Paul Asst. Purchg. Agent, Aluminum Co. of Canada, Sun Life Bldg., Montreal. (Jr.1938. M.1943)
McNeil, J. N. Chief Field Engr., C. D. Howe Co. Ltd., Cons. Engrs, Port Arthur, Ont. For mail: 40 Ray Blvd. (M.1941)
MacNeil, R. J. Supvr. in Cryolite Plant, Aluminum Co. of Can., Arvida, Que. For mail: 813-5th St. (M.1945)
McNellis, R. S. Designer, United Steel Corp., Toronto. For mail: 179 Eglinton Ave. E. (M 1945)
McNicol, J. A. Estimat. Engr., Toronto Transportation Comm. For mail: 72 Gormley Ave., Toronto. (M.1920)
MacNicol, Nicol Commr. of Works, Forest Hill Village, 333 Lonsdale Rd., Toronto. (S.1919. Jr.1923. M.1935)
McNicoll, A. E. Designer, Dominion Bridge Co. Ltd., Lachine, Que. (S.1921. A.M.1925. M.1940)
McNiven, Hugh D. 330 Avenue Rd., Toronto. (S.1941. Jr.1946)
Macorquodale, Ian D. 1509 Sherbrooke St. W., Montreal 25. (S.1945)
Macphail, Alexander 50 Clergy St. E., Kingston, Ont. (M.1906)
McPhail, Alex C. 146 Springhurst Ave., Toronto 3. (S.1946)
McPhail, A. L. Supt., City Water Works Comm., Municipal Bldg., St. Catharines, Ont. (A.M.1928. M.1940)
Macphail, Jeffrey B. Hydraulic Engr., Shawinigan Engrg. Co., Montreal. For mail: 3117 Daulac Rd. (A.M.1920 M.1940)
Macphail, John Goodwill 406 Daly Ave., Ottawa. (S.1904. A.M.1910. M.1922)
Macpherson, Donald C. Partner, C. E. Macpherson, Box 242, Kingston, Ont. (S.1922. A.M.1938. M.1940)
McPherson, E. L. H.M.C.S. Stadacona, Halifax, N.S. (S.1938. Jr.1941)
McPherson, Frederick Instr., Dept. Civil Engrg., Univ. of Alberta, Edmonton, Alta. For mail: 9140-116th St. (S.1939. Jr.1941. M.1936)
McPherson, F. G. Alexandra Ave., Bridgewater, N.S. (A.M.1907. M.1940)
Macpherson, G. L. Chief Engr., Imperial Oil Ltd., Sarnia, Ont. For mail: 297 London Rd. (M.1939)
Macpherson, H. Nolan Gen Mgr., Permanent Timber Products Ltd., Eburne, B.C. For mail: 1525 W. 28th Ave., Vancouver, B.C. (A.M.1917. M.1936)
McPherson, John D. P. Engr., Foundation Co. of Can., 1538 Sherbrooke St. W., Montreal. (S.1942. Jr.1946)
MacPherson, J. S. Miles Res. Engr., Highway Reconstrn., N.B. Dept. Public Works, Fredericton, N.B. For mail: 161 Henry St. (S.1934. Jr 1937)
Macpherson, Norman W. Highway Commr. of Alta., Edmonton, Alta. (M.1941)
MacPherson, Ritchie Asst. to Sulphite Supt., Laurentide Divn., Cons. Paper Corp., Grand'Mère, Que. For mail: Laurentide Inn. (S.1945. Jr.1946)
McPherson, R. C. Combust. Engr., Northwestern Utilities Ltd., Edmonton, Alta. For mail: 7425 Saskatchewan Drive. (A.M.1939. M.1940)
MacQuarrie, Archie H. Candn. Bridge Co. Ltd., Box 157, Walkerville, Ont. (M.1941)
McQuarrie, A. M. Can. General Elec. Co. Ltd., Peterborough, Ont. For mail: 75 Lynch St. (Jr.1942)
MacQuarrie, Edison M. Priv. Prac., 553 Queen St. E., Sault Ste. Marie, Ont. (S.1920. A.M.1927. M.1936)
McQueen, A. W. F. Hydraul. Engr., H. G. Acres & Co., Niagara Falls, Ont. For mail: 2077 Corwin Ave. (S.1920. Jr.1927. A.M.1929. M.1939)
McQueen, Duncan R. Quarry Foreman, Can. Gypsum Co., Guelph, Ont. For mail: 65 Metcalfe St. N. (S.1930. A.M.1938. M.1940)
McQueen, Howard R. Cons. Engr., 5051 University Ave., San Diego, Calif., U.S.A. (A.M.1931. M.1940)
McQuire, R. D. Supvr., Bayer Ore Plant, Aluminum Co. of Can., Arvida, Que. (Jr.1945)
MacRae, A. E. Cons. Engr. & Patent Solicitor, 56 Sparks St., Ottawa. (A.M.1921. M.1940)
McRae, Don. A. 1029 McMillan Ave., Winnipeg, Man. (S.1946)
McRae, Ian F. Works Mngr., Can. General Elec. Co., Peterborough, Ont. For mail: 487 Hunter St. (A.M.1937. M.1940)
McRae, R. B. Plant Engr., Julius Kayser & Co. Ltd., Sherbrooke, Que. For mail: 516-A King St. W. (S.1937. M.1946)
McRae, Wm. Robertson Mng. Dir., Western Clay & Chemical Supply Co., 320—1st Ave. W., Calgary, Alta. (Jr.1945)
Macredie, J. R. C. Asst. Engr., Can. Pacific Rwy., Windsor Station, Montreal. (S.1931. Jr.1937. M.1943)
McRitchie, C. B. Partner, R. A. Rankin & Co., Cons. Engrs., 1420 Sherbrooke St. W., Montreal. (M.1942)
McRoberts, D. Asst. Engr., Vancouver Harbour, National Harbours Board, 3955 W. Broadway Ave., Vancouver, B.C. (M.1943)
McRostie, Gordon C. Asst. Engr., N. B. MacRostie, Cons. Engr., 193 Sparks St., Ottawa. (S.1942. Jr.1946)
MacRostie, Norman B. Cons. Engr., 193 Sparks St., Ottawa. (A.M.1921. M.1940)
McSorley, Thos. H. Highway Constrn. Engr., Dept. Public Works of N.B., Baie Verte. For mail: 111 King St., Fredericton, N.B. (S.1943)
McTaggart, Geo. D. Project Engr., Can. Industries Ltd., P.O. Box 10, Montreal. (M.1945)
MacVannel, D. P. Trainee, Otis-Fensom Elevator Co. Ltd., Victoria Ave. N., Hamilton, Ont. (S.1939. Jr.1945)
McVean, Harold G. Consultant, 66 King St. W., Toronto. (A.M.1912. M.1928)
MacVey, C. A. Bridge Engr., Dept. Public Works, Fredericton, N.B. (M.1942)
McVicar, D. A. 3506 University St., Montreal. (S.1946)
MacVicar, D. Campbell 162 Earl St., Kingston, Ont. (S.1945)
McWhirter, Donald C. Prod. Engr., Goodyear Tire & Rubber Co., New Toronto. For mail: 59 Queen's Ave., Mimico, Ont. (S.1943. Jr.1946)
McWilliam, Archibald, Strl. Dftsmn., Whitehead & Kales, River Rouge, Mich. For mail: 12393 Santa Rosa Drive., Detroit 4, Mich., U.S.A. (A.M.1931. M.1940)
McWilliams, David B. Mng. Dir., Dresser Manufacturing Co. Ltd., 60 Front St. W., Toronto. (M.1940)
Madden, Maurice Stuart Plant Engr., Canadian Arsenals Ltd., Lindsay, Ont. (A.M.1920. M.1940)
Maddock, C. O. Designer & Estimator, Intnl. Nickel Co. of Can. Ltd., Copper Cliff, Ont. For mail: Box 250. (A.M.1926. M.1940)
Mader, Gordon D. Project Engr., Atlas Constrn. Co. Ltd., P.O. Box 1176, Cornwall, Ont. (S.1944)
Madill, Floyd A. Seismograph Asst. Computer, Imperial Oil Ltd., Edmonton, Alta. For mail: 10027—114th St. (S.1940. Jr.1942)
Madill, J. T. Elec. Engr., Aluminum Co. of Can., Shipshaw. For mail: 857—5th St., Arvida, Que. (S.1940. Jr.1941)
Madore, Paul-René Jr. Stress Engr., Canadair Ltd., Cartierville. For mail: 2331 Gouin Blvd. W., Montreal 9. (S.1941. Jr.1946)
Madryga, Alexander Elec. Engr., Bell Telephone Co. of Can., London, Ont. For mail: 362 Piccadilly St. (S.1945. Jr.1946)
Magee, E. D. B. (S.1938. Jr.1946)
Maggs, P. J. Waterworks Supvr., Calgary Power Co. Ltd., Wetaskiwin, Alta. (M.1946)
Magie, L. DeW. 371 Reid St., Peterborough, Ont. (M.1920)
Magnan, Maurice J. Prodn. Engr., Eagle Pencil Co. of Can., Drummondville, Que. For mail: 459-d Lindsay St. (S.1941. Jr.1945)
Magnant, D. A. 5282 Pie IX Blvd., Montreal. (M.1942)
Magrath, Chas. Alexander 841 St. Charles St., Victoria, B.C. (M.1917. Hon.M.1938)
Maguire, R. A. (S.1944)
Magwood, Wm. Herbert Town Engr., P.O. Drawer 1089, Cornwall, Ont. (A.M.1905. M.1919)
Mahaffy, H. L. Constrn. Engr., Power Corp. of Can., 355 St. James St. W., Montreal. (S.1914. A.M.1925. M.1940)
Mahon, A. G. Asst. Engr., N.S. Power Comm., Halifax, N.S. For mail: 21 Bloomingdale Terrace. (S.1929. A.M.1937. M.1940)

Mahoux, R. J. 42 Joyce Ave., Outremont, Que. (S.1937. M.1942)
Mailhiot, Fernand A. Quebec Dept. of Health, 4 Notre Dame St. E., Montreal 1. (S.1941. Jr.1946)
Maillette, Origène, Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Main, Hardy L. Highway Engr., Divn. No. 6, Dept. Highways of Ont., Toronto. For mail: 39 Thompson Ave. (S.1939. Jr.1946)
Main, Thos. C. Gen. Mgr., Ducks Unlimited (Canada), Bank of Commerce Bldg., Winnipeg, Man. (A.M.1917. M.1940)
Mainguy, W. F. Pers. Mgr., Shawinigan Water & Power Co., Craig St. W., Montreal. (M.1943)
Maitland, Henry C. Nova Scotia Technical College, Halifax, N.S. (S.1945)
Major, Roger E. 156 St. Jean Ave., Longueuil, Montreal 23. (S.1944)
Malanchak, Steven H. 1311 Alexander Ave., Winnipeg, Man. (S.1946)
Malby, A. L. Asst. Indust. Control Engr., Candn. Gen. Elec. Co., Peterborough, Ont. For mail: 303 Rubidge St. (Jr.1936. M.1942)
Malby, George Thomas Asst. Mech., Supt., Aluminum Co. of Can., Arvida, Que. For mail: 846-7th St. (Jr.1938)
Malcolm, A. L. Res. Engr. i/c H.E. Pow. Devlpt. Constrn., Hydro Electric Power Comm. of Ont., St. Catharines. For mail: Campbellford, Ont. (A.M.1921. M.1940)
Malcolm, W. L. Dir. School of Civil Engrg., Cornell University, Ithaca, N.Y., U.S.A. (S.1907. A.M.1909. M.1920)
Malkin, Louis L. Demonstr., Ajax Div., Univ. of Toronto. For mail: Arbor Lodge, Ajax, Ont. (S.1944)
Malloch, Norman Sr. Instrmn. & Party Chief, Hydro Elec. Power Comm. of Ont. For mail: Arnprior, Ont. (A.M.1919. M.1940)
Malloff, Wm. Mech. Engr., Foundation Co. of Ont., Marathon, Ont. (S.1939. M.1945)
Mallory, Richard F. R.R. No. 6, Woodstock, N.B. (S.1945)
Malloy, R. A. Asst. Bridge Engr., Dept. of Public Works of N.B., Fredericton, N.B. (M.1942)
Malmgren, E. V. 651 Henderson Highway, Winnipeg, Man. (S.1946)
Malmgren, Harvey R. Dftsmn., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 149 Balsam Ave. (S.1938. Jr.1946)
Malo, Gérard Divn. Engr., Dept. of Roads of Que., Cookshire, Que. (S.1939. Jr.1946)
Malone, W. Harcourt 117 Marlborough St., Cornwall, Ont. (A.M.1936. M.1940)
Malone, Willis P. 507 Victoria Ave., Westmount, Que. (S.1925. Jr.1929)
Manchul, Edward D. Box 292, Rivers, Man. (S.1945)
Manley, Edward H. Supt. of Constrn., Anglin-Norcross Corp. Ltd. For mail: Box C-63, Westboro, Ont. (M.1945)
Mann, Arthur D. 30 St. Geneviève Ave., Quebec. (A.M.1938. M.1940)
Mann, G. C. Sales Engr., Candn. Allis-Chalmers Ltd., Montreal. For mail: 564 Valois Ave., Montreal. (S.1941. Jr.1946)
Mann, Ian D. Engr., Continental Can Co. of Canada, St. Laurent. For mail: 3434 McTavish St., Montreal (S.1946)
Mann, N. W. D. Overseas. (Jr.1941)
Mann, O. Nelson Prodn. Mgr., Westeel Products Ltd., Toronto. For mail: 67 Colin Ave. (S.1936. Jr.1937)
Mann, S. L. W. A/Sgt., Chem. Tech., Dept. National Defence, Experimental Station, Suffield, Alta. For mail: 2211-11th St. W., Calgary, Alta. (S.1944)
Manning, D. J. 4608 W. 10th Ave., Vancouver, B.C. (S.1945)
Manning, R. C. Chief Engr., Canadian Institute of Steel Construction, Toronto. For mail: 55 Devere Gardens. (A.M.1930. M.1938)
Manning, Walter J. Agent, Dept. of Transport, 101 Champlain St., Quebec. (S.1929. A.M.1938. M.1940)
Manock, W. R. Pres., Horton Steel Works Ltd., Fort Erie. For mail: Fort Erie North, Ont (A.M.1927. M.1940)
Mansbridge, Alf. S. Strl. Designer, Pulp Divn., Bloedel Stewart & Welch Ltd., 10 E. Hastings, Vancouver, B.C. (Jr.1920. A.M.1922. M.1940)
Manseau, Gilbert Cons. Engr., 544 Claremont Ave., Montreal 6. (Jr 1933. M.1945)
Manseau, Marcel Asst. Prof., Ecole Polytechnique & Indust. Engr., Stevenson & Kellogg Ltd., Sun Life Bldg., Montreal. (S.1938. Jr.1946)
Manson, A. B. Gen. Mgr. & Sec. Treas. Public Utilities Comm., Stratford, Ont. For mail: 107 Caledonia St. (S.1910. A.M.1914. M.1925)
Manson, C. A. Lt. Col., Asst. Dir., Directorate of Armament Devlpt., M.G.O. Branch, N.D. H.Q., New Army Bldg., Ottawa. (M.1945)
Mantha, Guy K. 5116 Côte St. Paul Rd., Montreal. (S.1946)
Mantle, J. B. Instructor, Univ. of Saskatchewan Saskatoon, Sask. (S.1941. Jr.1943)
Manuel, Oliver Hemphill Surveyor, Renous Naval Magazine, N.B. For mail: 81 Hawthorne Ave., St. John, N.B. (S.1940. Jr.1944)
Manzer, R. Wendell Res. Engr., Highway Constrn., Dept. Public Works of N.B., Fredericton, N.B. For mail: 142 Woodstock Rd (M.1942)
Maple, Harold E. Chief Engr., Q.M.G. Br., Dept. National Defence, New Army Bldg., Ottawa. (A.M.1917. M.1940)
Marantz, Oscar Instructor, Univ. of Manitoba, Winnipeg, Man. (S.1941. Jr 1943)
Marble, Wm. O. Partner, Hodgson, King & Marble, 1401 Main St., Vancouver, B.C. (M.1919)
Marceau, S. Gen. Engrg., Candn. Car & Foundry Co., Longue Pointe, Montreal. For mail: 85-4th Ave., Plage Laval, Que. (S.1940. Jr.1946)
March, J. Wade Asst. Prof. Civil Engrg., N.S. Technical College, Halifax. For mail: Lower Sackville, N.S. (Jr.1924. A.M.1930. M 1940)
Marchand, Fernand Jr. Engr., Defence Industries Ltd., Westmount. For mail: 1-b Woodlands, Lower Woodlands, Que. (S.1937. Jr.1943)
Marchand, R. Civil Engr., Angus Robertson Co Ltd., Montreal. For mail: 560 Duquesne St. (A.M.1937. M.1940)
Marchand, Yvon City Engr., City Hall, Sorel, Que. (M.1945)
Marchionni, D. A. 8060 Lajeunesse St., Montreal. (S.1946)
Marcotte, Benoit W. 4439 Adam St., Montreal 4. (S.1941. M.1945)
Marcotte, J. R. 3696 St. Hubert St., Montreal 24. (S.1944)
Marcotte, Roland Supt., Abrasive Co. of Can., Arvida. For mail: 909 Coulombe St., Arvida, Que. (Jr.1938. M.1943)
Margo, B. A. Cons. Mngment. Engr., 2247 Maplewood Ave., Montreal 26. (A.M.1939. M.1940)
Marien, Raymond Cons. Engr., Kingsland & Marien, Montreal. For mail: 11534 London St., Ville St. Laurent, Montreal 9. (M.1945)
Marion, J. A. D. Hydr. Engr., National Research Council, Ottawa. For mail: 238 York St. (S.1946)
Marion, J. Paul Power House Supt., Quebec Hydro-Electric Comm., Rapid No. 7, Cadillac, Que. (Jr. 1939. M.1945)
Mark, Alexander Gee Hing Stress Analyst, Canadair Ltd., Montreal. For mail: 70 Chestnut Park Ave., Toronto. (S.1946)
Markow, George Robt. 1081 Bathurst St., Toronto. (S.1946)
Markowski, Jacques 1303-A Logan St., Montreal 24. (S.1944)
Marksfield, Harry Test Course, Candn. General Electric Co., Peterborough, Ont. (S.1946. Jr.1946)
Marlatt, Chas. D. Indust. Control Serv., Canadian General Electric Co., Vancouver, B.C. For mail: 782-15th Ave. E. (Jr.1945)
Marlatt, Chas. E. Consolilated Mining & Smelting Co., Trail, B.C. For mail: 302 Kootenay Ave. (S.1922. Jr.1925. A.M.1931. M.1940)
Marmur, Ben 4283 St Urbain St., Montreal 18. (S.1945)
Marr, Norman Asst. Controller & Asst. Chief Engr., Dom. Water & Power Bureau, Dept. Mines & Resources, Laurentian Bldg., Ottawa. (S.1909. Jr.1911. A.M.1916. M.1928)
Marr, R. B. 9 Connors St., Fairville, N.B. (S1942. Jr.1946)
Marrotte, Louis-H. Supt. Transm. & Sub-Stations, Quebec Hydro-Electric Comm., 107 Craig St. W., Montreal. (A.M.1920. M.1922)
Marsan, Chas. Asst. Engr., Water & Sewer Serv., City of Montreal. For mail: 7078 Garnier St., Montreal 35. (M.1945)
Marshall, Douglas R. i/c Automotive Equipt., No. 2 Power House, City of Regina. For mail: 1220 Princess St., Regina, Sask. (S.1946)
Marshall, D. M. Asst. Constrn. Engr., University of Alberta. For mail: 6318 Jasper Ave., Edmonton, Alta. (S.1944. Jr.1944)
Marshall, Geoffrey J. Cons. Engr. on Constrn., Hubbards, Halifax Co., N.S. (M.1944)
Marshall, H. A. Indust. Serv. Engr., Imperial Oil Ltd., Saint John, N.B. For mail: 199 King St. E. (S.1943. Jr.1946)
Marshall, I. M. 194 Holmwood Ave., Ottawa. (A.M.1921. M.1940)
Marshall, J. A. P. Chief Mun. Engr., Dept. Highways of Ont., Toronto, Ont. For mail: 334 Riverside Drive. (Jr.1912. A.M.1916. M.1940)
Marshall, J. L. Canadian Broadcasting Corp., 1440 St. Catherine St. W., Montreal. (Jr.1939. M.1943)
Marshall, Mortimer H. 1734-7th St. W., Calgary, Alta. (A.M.1911. M.1916)
Marshall, Welsford Allen Designing Engr., Dominion Structural Steel Ltd., 6894 Clanranald Ave., Montreal. (S.1937. Jr.1943)
Marsolais, Irénée Dist. Engr., Drainage Bureau of Que., Drummondville, Que. For mail: P.O. Box 370. (S.1941. Jr.1943)
Marston, Guy R. County Engr. for Norfolk, Court House, Simcoe, Ont. (A.M.1921. M.1940)
Martel, Jean-Marie Mgr., F.-X. Martel, Lumber, P.O. Box 97, LaSarre, Que. (S.1943)
Martel, Pierre Capt., Tech. Staff Officer, Directorate Armament Devlpt., New Army Bldg., Ottawa. (S.1937. Jr.1944)
Martin, Arthur L. Strl. Design & Dftg., Aluminum Laboratories Ltd., Montreal. For mail: 2015 University St. (Jr.1941. M.1944)
Martin, C. D. Sales Engr., Northern Electric Co. Ltd., Halifax. For mail: 263 Tower Rd., Halifax, N.S. (S.1938. Jr.1941. M.1941)
Martin, E. B. City Engr., Moncton, N.B. For mail: 35 Cameron St. (A.M.1920. M.1940)
Martin, E. H. 679½ Jubilee Ave., Winnipeg, Man. (S.1945)
Martin, Frank J. Overseas (Jr.1931. A.M.1936. M.1940)
Martin, G. A. B. Serv. Engr., Victor X-Ray Corp. of Canada, Medical Arts Bldg., Winnipeg, Man. (M.1946)
Martin, G. E. Suptg. Engr., Dept. Public Works, Hunter Bldg., Ottawa. (A.M.1913. M.1940)
Martin, Gerald N. Combustion Sales Engr., Dominion Bridge Co. Ltd., P.O. Box 280, Montreal 32. (Jr.1937. M.1944)
Martin, H. Milton, Jr. Asst. Works Mgr., Dominion Tar & Chemical Co. Ltd., Morse St., Toronto. (S.1937. A.M.1940. M.1940)
Martin, J. Adolphe Canadair Ltd., Cartierville, Que. For mail: 7167 St. Denis St., Montreal 10. (S.1938. Jr.1946)
Martin, John C. Engr. on Constrn., C.N.R., Toronto. For mail: 639 Millwood Road, Toronto. (S.1944. Jr.1946)
Martin, Jas. H. Control Chemist, Flintkote Co. (Newfoundland) Ltd. For mail: 69 Belhaven Road, Toronto. (S.1946)
Martin, John Henry. (S.1942)
Martin, J. P. 6361 Molson St., Montreal 36 (S.1945)
Martin, Lucien Bridge Engr., Dept. Public Works of Que., Parliament Bldgs., Quebec. (Jr.1932. A.M.1934. M.1940)
Martin, L. T. Vice-Pres. & Mng. Dir., Gleeson Martin Ltd., Ottawa Electric Bldg., Ottawa. (M.1921)
Martin, P. R. Shawinigan Chemicals Ltd., Shawinigan Falls, Que. (S.1938)
Martin, Richard F. 131 Beatrice St., Toronto. (S.1946)
Martin, R M.. Box 535, Banff, Alta. (A.M.1923. M.1940)
Martin, Tom E. Chem. Engr., U.S. Industrial Chemicals Ltd., Baltimore, Md., U.S.A. For mail: 414 Marlyn Ave. (S.1937. Jr.1946)
Martin, W. A. 17 Jane St., Toronto. (S.1946)
Martin, Wm. David Gen. Engrg, Price Bros. & Co. Ltd. Staff House, Riverbend, Que. (S.1943. Jr.1946)
Martin, Wm. Stormont 4260 Beaconsfield Ave., Montreal 28. (S.1942. Jr.1946)
Martindale, E. S. Bureau of Mines, Rochester & Lydia Sts., Ottawa. (A.M.1919. M.1940)
Martineau, J.-Henri 2304 Souvenir St., Montreal 25. (S.1944)
Martineau, J. Omer Asst. Chief Engr., Dept. Roads of Que., Parliament Bldgs., Quebec. (M.1935)
Martino, Antoine 6243 De Normanville St., Montreal 10. (S.1945)
Martyn, O. W. Res. Engr., Dom. Dept. of Transport, Winnipeg. For mail: 257 Angus Cres., Regina, Sask. (A.M.1938. M.1940)
Martyn, Robt. Edison Chief Dftsmn., Gas & Oil Refineries Ltd., Hartell, Alta. (S.1944)
Marvin, R. A. Sales Engr., Northern Electric Co. Ltd., 65 Rorie St., Winnipeg, Man. (A.M.1939. M.1940)
Mason, Courtney L. Engrg. Dept., Foster Wheeler Ltd., St. Catharines, Ont. For mail: 177 Queenston St. (M.1940)
Mason, E. Chief Designing Engr., Consolidated Mining & Smelting Co., Trail, B.C For mail: 1930 Oak St. (M.1946)
Mason, F. H. Lt. Cdr., R.C.N.V.R., 449 Annette St., Toronto 9. (A.M.1921. M 1940)
Mason, G. M. Tech. Dir., Arvida Works, Aluminum Co. of Can. For mail: 1 Radin Road W., Arvida, Que. (M.1945)
Mason, G. A. R. 3023-3rd St. W., Calgary, Alta. (S.1934. M.1945)
Mason, H. L. K. (S.1938. Jr.1946)
Mason, Orley B. Asst. Mgr., Escanaba Paper Co., Escanaba, Mich., U.S.A. (S.1933. A.M.1937. M.1940)
Mason, V. K. Civil Engr., Ward-McKee Engrg. Ltd., 112 Merton St., Toronto. (S.1942. M.1946)
Masse, F. A. Price Bros. & Co, Staff House. Riverbend, Que. (Jr.1932)
Massé, Gaston Gen. Supt. & Elec. Engr., Gas & Electricity Dept., City of Sherbrooke, P.O. Box 754, Sherbrooke, Que. (M.1946)
Masse, Robert, 4065 Papineau, Montreal 24. (S.1944)
Massey, Denton Overseas. (S.1920. A.M.1930. M.1940)
Massie, J. H. C. 76 Glen Road, Toronto. (S.1946)
Massue, Huet Statistical Engr., Shawinigan Water & Power Co., Craig St. W., Montreal. (S.1912. A.M 1918. M.1938)
Mather, George R. Asst. Engr., Geodetic Survey, Dom. Dept. Mines & Resources, Ottawa. (S.1946)

Mather, R. H. Mgr., Commrl. & Distrbn. Dept., Shawinigan Water & Power Co., Montreal. For mail: 5583 Queen Mary Road. (A.M.1919. M.1940)
Mather, W. A. Vice-Pres. Western Lines, Canadian Pacific Railway, Winnipeg, Man. (A.M.1911. M.1920)
Matheson, Armen Asst. Engr., Hydro-Electric Power Comm. of Ont., Toronto. For mail: 507 Atlas Ave. (M.1940)
Matheson, Donald T. 327 South St., Halifax, N.S. (S.1946)
Matheson, J. G. 276 St. James St. W., Montreal. (S.1946)
Matheson, M. A. Gen. Sales Mgr., International Petroleum Co., Plaza San Martin, Lima, Peru, S.A. (Jr.1936. M.1942)
Mathewson, P. L. Research Engr., Canadian National Railways, Montreal. For mail: 11 Bowling Green, Pointe Claire, Que. (M.1940)
Mathieson, J. R. (S.1935. Jr.1937)
Mathieson, T. Stanley Designing Engr., Link Belt. Ltd., Toronto. For mail: 3 Southwood Drive. (Jr. 1928. A.M.1937. M.1940)
Mathieu, Olier Divn. Engr., Quebec Dept. of Roads, L'Assomption, Que. (M.1943)
Matte, Gérard 36—10th St., Quebec. (S.1946)
Matte, Gilbert 36—2nd Ave., Ville St. Pierre, Montreal. (S.1942)
Matte, Paul Dist. Engr., Quebec Dept. of Mines, Val d'Or. For mail: 15—5th St., Bourlamaque, Que. (S.1945)
Matte, Raymond Engr. & Contractor, 4369 Coolbrook Ave., Montreal 28. (M.1942)
Matthews, B. Frank Works Mgr., Dominion Truck Equipt. Co. Ltd., 60 Ottawa St., Kitchener, Ont. (M.1944)
Matthews, Clifford B. Asst. to City Engr., City Hall, Belleville, Ont. (Affil.1941)
Matthews, C. Robt. Jr. Engr., Candn. Celanese Ltd., Drummondville, Que. For mail: 349 St. Edward St. (S.1942. M.1945)
Matthews, J. Gordon Staff Engr., Kenville Gold Mines, 622 Victoria St., Nelson, B.C. (S.1943. Jr.1946)
Matthews, Samuel Ceramic Engr., Dominion Fire Brick & Clay Products Ltd., Claybank, Sask. (A.M.1935. M.1940)
Matthews, W. H. 427 Borebank St., Winnipeg, Man. (S.1945)
Mattice, E. S. Boucherville, Que. (S.1887. A.M.1895. M.1902)
Mattson, R. J. Project Officer, Central Technical Power Board, Govt. of India, Simla, India. (A.M.1934. M.1940)
Maude, J. H. Chief Designer, Indust. Mach. Divn., Dominion Engineering Co., Montreal. For mail: 4835 Patricia Ave. (A.M.1934. M.1940)
Maughan, R. G. Strl. Designer, (Bridge Engr.) Candn. National Railways, Toronto. For mail: 481 Summerhill Ave. (S.1944. Jr.1946)
Maxwell, Douglas G. Jr. Engr., Winnipeg Electric Co. For mail: 369 Home St., Winnipeg, Man. (S.1944)
Maxwell, Marvin W. Chief of Devlpt., Dept. Resch. & Devlpt., Canadian National Railways, 360 McGill St., Montreal. (A.M.1919. M.1940)
May, Wm. T. Cons. Mining Engr., 807 Lexington Ave., Westmount, Que. (M.1945)
Mayberry, W. G. 10 Earl Haig Ave., Toronto. (S.1946)
Mayhew, E. C. Col., 185 Metcalfe St., Ottawa. (S.1935. M.1940)
Mayrand, J. Marc 4836 Christophe Colomb St., Montreal 34. (S.1945)
Mazur, John T. Engrg. Supvr., Plant No. 1, Massey-Harris Aircraft, Weston, Ont. For mail: 162 William St. (S.1939. Jr.1943)
Mead, Daniel W. Prof. Emeritus Univ. of Wisconsin & Cons. Engr., Mead & Scheidenhelm, New York, and D. W. Mead, 550 State St., Madison 3, Wis., U.S.A. (Hon.M.1944)
Meadd, Howard E. Plant Engr., Howard Smith Paper Mills Ltd., Cornwall, Ont. For mail: 214 Bedford St. (S.1920. A.M.1923. M.1940)
Meade, John Campbell (A.M.1918. M.1940)
Meadows, Clifford Austin Gen. Mgr., Meadows Critoph & Co., Cons. Engrs., 118 Richmond W., Toronto. (S.1911. A.M.1916. M.1940)
Meadows, W. R. 401 Queens Ave., New Westminster, B.C. (A.M.1939. M.1940)
Meagher, R. D. Gas Plant Operator, British American Oil Co., Toronto. For mail: 137 Waverley Road. (S.1938. Jr.1941)
Meals, Casper D. Chief Engr., Wire Rope Divn., Bethlehem Steel Corp., Williamsport, Penn., U.S.A. For mail: 1521 Sheridan St. (M.1935)
Mechin, F. C. Asst. to Pres., i/c Personnel, Imperial Oil Ltd., Toronto. For mail: 19 Teddington Park Ave. (A.M.1917. M.1938)
Medforth, G T. Mng. Engr., Canada Electric Co. Ltd., Amherst, N.S. (A.M.1923. M.1940)
Medlar, George E. Engr., Office & Water Divn., Windsor Utilities Comm., Canada Bldg., Windsor, Ont. (Jr.1922. A.M.1930. M.1940)
Medlen, E. M. Office Engr., Lands & Parks Br., Dept. Mines & Resources, Ottawa. For mail: 227 Third Ave. (A.M.1921. M.1940)
Meek, Robt. L. Bldgs. Engr., Bell Telephone Co., 1050 Beaver Hall Hill, Montreal. (M.1945)
Meek, V. M. Controller, Dom. Water & Power Bureau, Dept. Mines & Resources, Ottawa. (A.M.1914. M.1925)
Meier, Chas. Sales & Constrn. Engr., Brown Boveri (Canada) Ltd., 1111 Beaver Hall Hill, Montreal. (M.1944)
Mekeel, David L. Steel Mill Consultant, Royal York Apts., Pittsburgh 13, Pa., U.S.A. (M.1942)
Melanson, W. A. S. Dist. Highway Engr., Dept. Public Works of N.B., 700 Main St., Moncton, N.B. (M.1942)
Meldrum, Alan H. British American Oil Co. Ltd., Clarkson. For mail: P.O. Box 81, Oakville, Ont. (Jr.1938)
Melillo, Vincent, Mgr., Canadian Terrazzo & Marble Co. Ltd., 259 Jean Talon St. W., Montreal. (S.1940. Jr.1946)
Mellon, P. D. Vice-Pres. Candn. Natural Gas Light Heat & Power Co., 215-6th Ave. W., Calgary, Alta. (M.1941)
Mellor, A. G. 619 Belmont Ave., Westmount, Que. (S.1932. Jr.1943)
Mellor, J. H. Chief Engr., Candn. Copper Refiners Ltd., Montreal East. For mail: 331 Clarke Ave., Westmount, Que. (S.1930. Jr.1934. M.1945)
Meloche, R. Distbn. Engr., Southern Canada Power Co. Ltd., 355 St. James St. W., Montreal. (M.1945)
Melrose, T. M. Dist. Mgr., Canadian Dredge & Dock Co., Montreal. For mail: 4378 Coolbrook Ave. (M.1945)
Melsted, V. J. Mech. & Elec. Supt., Aluminum Co. of Canada, Isle Maligne, Que. (S.1910. A.M.1913. M.1940)
Melville, James L. Brig., Chairman, Canadian Pensions Comm., Dom. Govt. For mail: 61 Cartier St., Ottawa. (A.M.1922. M.1940)
Ménard, Jean 11916 Reed Blvd., Cartierville, Que. (S.1941. Jr.1946)
Ménard, Raymond Asst. Divn. Engr., Que. Dept. Roads, Iberville, Que. (S.1937. Jr.1942)
Ménard, Robt. L. Dept. Hydraulic Resources, Parliament Bldg., Quebec. (S.1941)
Mendel, Arthur H. Priv. Prac. Elec. Engr., 1252 Stanley St., Montreal 25. (S.1944. Jr.1946)
Mendelsohn, Albert Major, R.C.E.M.E., Cdn. Staff College, R.M.C., Kingston. For mail: P.O. Box 177, Ste. Agathe des Monts, Que. (S.1937. Jr.1946)
Menges, Edwin A. H. Chief Engr., Disher Steel Constrn. Co., 80 Commissioners St., Toronto. (A.M.1930. M.1936)
Menzies, J. R. Sr. Sanitary Engr., Dist. No. 3, Dept. National Health & Welfare, 379 Common St., Montreal 1. (S.1926. Jr.1927. A.M.1939. M.1940)
Mercer, George Overseas. (S.1940. Jr.1946)
Mercer, Keith Owner, Keith Mercer Regd., 1100 Craig St. E., Montreal 24. (M.1945)
Mercer, Wm. E. Overseas. (S.1940)
Merchant, J. A. Reconnaisance Engr., Water Rights Br., Dept. Lands of B.C., Parliament Bldg., Victoria, B.C. (S.1944. Jr.1946)
Mercier, Chas. Ed. Engr., J. A. Lalonde & Co., Cons. Engrs., Outremont. For mail: 5294 St. Denis St., Montreal. (S.1938. Jr.1946)
Mercier, Jules Sales Engr., Can. Gen. Elec. Co., Quebec. For mail: 64 Ste. Foye Rd. (S.1938. Jr.1943)
Mercier-Gouin, Pierre, 445 Prince Albert Ave., Westmount, Que. (S.1944)
Meredith, Wm. R. (S.1944)
Merkley, Murray R. 5872 McLynn Ave., Montreal 29. (S.1941)
Merrett, J. S. 224 Lansdowne Ave., Winnipeg, Man. (M.1940)
Merrill, Robt. J. Min. Engr. & Geol., Towagamac Exploration, Miller Hall, Queen's University, Kingston, Ont. (S.1944. Jr.1946)
Merriman, H. O. Engr. i/c Interference Station, Radio Divn., Dept. of Transport, Ottawa. For mail: 308 MacKay St. (M.1940)
Merritt, R. J. Mgr. Electric Steam Radiator Co. of Can., Windsor, Ont. (S.1940. Jr.1944. M.1945)
Mersereau, J. A. Dist. Highway Engr., N.B. Dept. of Public Works, P.O. Box 160, Chipman, N.B. (M.1942)
Mersereau, M. E. Southern Canada Power Co., 355 St. James St. W., Montreal. (S.1946)
Mersereau, Oliver S. McAdam, N.B. (S.1944)
Mershon, Ralph D. Pickwick Arms Hotel, Greenwich, Conn., U.S.A. (M.1904)
Merson, L. N. 373 St. Joseph Blvd. W., Montreal. (S.1940. Jr.1946)
Merzetti, Herman J. 127 Leinster St., St. John, N.B. (S.1943. Jr.1946)
Messenger, W. A. Dir. of Operations, Barrett Co. Ltd., Montreal. For mail: 494 Victoria Ave., Westmount, Que. (S.1920. A.M.1928. M.1940)
Messervey, Donald F. P.O. Box 34, Bathurst, N.B. (S.1945)
Messervey, J. P. Mining Engr., Dept. Mines of N.S., Halifax, N.S. For mail: 14 Cherry St. (M.1944)
Messier, Marcel 7848 Henri-Julien St., Montreal. (S.1944)
Metcalf, M. L. 117 Kenaston Ave., Town of Mount Royal, Que. (S.1944)
Metcalf, Neil Chief Metalgst., Burlington Steel Co. Ltd., Hamilton, Ont. (M.1941)
Méthé, Philippe, Dir., Quebec Technical School, 185 Blvd. Langelier, Quebec. (S.1913. A.M.1928. M.1940)
Metherell, Chas. E. Jr. Chem. Engr., Price Bros. Ltd., Kenogami, Que. (S.1946)
Meurling, Alric F. P.O. 45, Marysville, N.B (S.1945)
Meuser, H. L. Col., Dir. of Engrs., Dept. National Defence, 425 National Defence Bldg., Ottawa. (S.1935. M.1946)
Mews, John Ewart Engr., John Burnet Parkin, Arch., Toronto. For mail: 79 Parkhurst Blvd. (S.1946)
Meyer, K. R. Prod. Mgr., Industrial Steel & Fibre Ltd., Terrebonne, Que. For mail: 1108 Elgin Terrace, Montreal 3. (M.1946)
Miall, Clifford 129-a Bedford Road, Toronto. (S.1946)
Miall, Edward, Jr. 249 Creighton St., Ottawa. (Jr.1934)
Miard, H. T. Asst. Dist. Airway Engr., Civil Aviation Divn., Dept. of Transport, Post Office Bldg., Lethbridge, Alta. (M.1942)
Michalenko, Andrew Asst. Prof., Elec. Engrg., University of Saskatchewan, Saskatoon, Sask. (M.1946)
Michaud, André J. S. Asst. Dist. Engr., Bridge Divn., Dept. Public Works of Que., Montreal. For mail: 10796 Durham St. (M.1941)
Michaud, Jos. A. Woodlands Mgr., Eastn. Divn., Consolidated Paper Corp., Grand'-Mère, Que. For mail: 30-3rd Ave. (M.1945)
Michaud, J. M. Mine Engr., King Mine, Asbestos Corp. Ltd., Thetford Mines, Que. For mail: P.O. Box 331. (M 1946)
Michaud, Maurice Mtce. & Constrn., Bridges, Dept. Public Works of Quebec, Sherbrooke, Que. For mail: P.O. Box 96. (S.1939. Jr.1946)
Michie, Victor War Assets Corp., Ottawa. For mail: 158 Breezehill Ave. (A.M.1909. M.1921)
Mickelson, Andrew J. Asst. Plant Engr., Great Lakes Paper Co. Ltd., Fort William. For mail: 49 Ray Blvd., Port Arthur, Ont. (A.M.1936. M.1940)
Middleton, John Constr. Lieut., R.C.N. (R), Naval Service Q.H., Elgin St., Ottawa. (M.1941)
Middleton, Jack Spencer Gordon Asst. City Engr., Box 1040, Swift Current, Sask. (Jr.1946)
Midgley, Frank H. Engr., Canadian Pacific Electric Lines, Preston, Ont. (S.1907. Jr.1912. A.M.1921. M.1926)
Midgley, George Henry Asst. Sales Mgr., Dominion Bridge Co., P.O. Box 280, Montreal. (Jr.1928. A.M.1935. M.1940)
Mieville, A. L. Mng. Dir., Bailimo Ltd., London, Eng. For mail: 34 Evelyn Mansions, Carlisle Place, London S.W.1, England. (A.M.1911. M.1924)
Mifflen, Sydney C. Office Engr. & Chief Mine Surveyor, Dominion Steel & Coal Corp., Glace Bay. For mail: 60 Whitney Ave., Sydney, N.S. (Jr.1918. A.M.1920. M.1930)
Migué, Guy 2114 St. André St., Montreal 24. (S.1944)
Mikkelborg, Gordon H. Proj. Engr., Woods Dept., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1942. M.1946)
Miles, C. W. E. Mtce. Engr., Imperial Oil Ltd., Montreal East. For mail: 22 Marien Ave., Montreal East 5. (Jr.1942. M.1945)
Miles, E. L. Contract Mgr., Aerocrete Constrn. Co. Ltd., Montreal East. For mail: 570 Milton St., Montreal. (A.M.1907. M.1918)
Miles, Edgar S. Engr., A. W. Robertson Ltd., Toronto. For mail: 200 Riverside Drive. (A.M.1911. M.1936)
Miles, Harold R. (A.M.1902. M.1919)
Milette, Jean-Paul 3686 Ste. Marguerite St., Three Rivers, Que. (S.1946)
Milhausen, Wm. J. Asst. Dist. Engr., Highways Br., Dept. Public Works of Man., Boissevain, Man. (S.1940. Jr.1946)
Millar, A. S. Engr's Asst., Bell Telephone Co., Beaver Hall Hill, Montreal. (S.1945)
Millar, D. M. Res. Engr., Dept. Public Works of Man., Winnipeg, Man. For mail: Wauneta Apt. (S.1944. Jr.1946)
Millar, Peter Gen. Supt., Dominion Bridge Co. Ltd., Montreal. For mail: 95 Easton Ave. (A.M.1931. M.1940)
Millenbach, J. P. Mine Mgr., Candn. Malartic Gold Mines Ltd., Box 9, Malartic, Que. (M.1946)
Miller, A. M. Refract. Engr., Dominion Steel & Coal Corp., Sydney. For mail: Sydney River, N.S. (S.1935. Jr.1941)
Miller, Chas. Asst. Gen. Supt., Beauharnois Light Heat & Power Co., Box 100, Beauharnois, Que. (S.1928. A.M.1935. M.1940)
Miller, C. Arthur Proj. Engr., Defence Industries Ltd., P.O. Box 10, Montreal. (Jr.1938)
Miller, Chas. H. 277 Gottingen St., Halifax, N.S. (S.1946)
Miller, D. C. R. Devlpt. Engr., Fiberglas Canada Ltd., Toronto. For mail: 108 Wychwood Park. (S.1932. M.1942)
Miller, D. W. Field Engr., Newmont Mining Corp. of Canada Ltd., 25 King St. W., Toronto 1. (S.1935. Jr.1938. M.1943)
Miller, Edgar 277 Gottingen St., Halifax, N.S. (S.1945)
Miller, E. C. Dir., T. Pringle & Son Ltd., 485 McGill St., Montreal. (A.M.1921. M.1940)
Miller, E. L. Aluminum Co. of South Africa, Pietermaritzburg, South Africa. (S.1936. Jr.1940)

Miller, Edward Percival Jr. Engr., Dom. Dept. of Transport, St. Catharines. For mail: 92 Queen St.. St. Catharines, Ont. (S.1946)
Miller, G. Grant Mgr., Halifax Office, E. S. Stephenson & Co., P.O. Box 1033, Halifax, N.S. (S.1932. Jr.1941. M.1941)
Miller, Harry Works Mgr., Wire & Cable Divn., Northern Electric Co., Montreal. For mail: 63 Merton Rd., Hampstead, Que. (A.M.1930. M.1940)
Miller, H. E. Dist. Engr., Dept. Public Works of Canada, Box 126, Charlottetown, P.E.I. (Jr.1920. A.M.1925. M.1940)
Miller, I. B. 375 Alfred St., Kingston, Ont. (S.1946)
Miller, John J. Mech. & Elec. Supt., Niagara, St. Catharines & Toronto Railway Co., St. Catharines, Ont. (S.1937. Jr.1940. M.1945)
Miller, John J. Tech. Asst. to Ore Plant Supt., Aluminum Co. of Can. Arvida, Que. For mail: 846-7th St. (Jr.1945)
Miller, John J. H. Bldg. Supt., Northern Electric Co. Ltd., 1261 Shearer St., Montreal. (S.1923. A.M.1931. M.1940)
Miller, John L. Pres. & Gen. Mgr., Herbert Morris Crane & Hoist Co., Stanley St., Niagara Falls, Ont. (A.M.1933. M.1940)
Miller, John L. Engr., Arthur Pearson, Vancouver. For mail: 2115 W. 18th Ave., Vancouver, B.C. (S.1941. Jr.1946)
Miller, J. O. (S.1941)
Miller, Lindsay Plant Engr., Johnson & Johnson Ltd., 7101 Notre Dame St. E., Montreal. (S.1932. Jr.1941. M.1944)
Miller, T. A. Asst. Matrls. & Process Engr., Trans Canada Airlines, Winnipeg. For mail: 121 Hill St., Norwood, Man. (S.1944. Jr.1946)
Miller, Warren C. City Engr., City Hall, St. Thomas, Ont. (S.1916. Jr.1920. A.M.1921. M.1929)
Miller, Wm. F. Dist. Inspr. of Elec. & Gas, Dept. Trade & Commerce, Sudbury, Ont. For mail: 250 Mackenzie St. (S.1930. A.M.1937. M.1940)
Miller, Wilfrid L. Candn. Westinghouse Co., Hamilton, Ont. (S.1921. Jr.1926. A.M.1931. M.1940)
Miller, W. M. Col., c/o Lloyds Bank Ltd., 6 Pall Mall, London, S.W.1, England. (S.1910. A.M.1922. M.1940)
Miller, W. St. J. Patent Attorney, 710—3rd St. W., Calgary, Alta. (A.M.1921. M.1940)
Miller, Zavie Mfg. Methods Engr., Northern Electric Co., Montreal. For mali: 673 de l'Epée Ave., Montreal 8. (S.1940. Jr.1946)
Millett, R. S. Forest Prod. Engr., Federal Govt. Lab., Ottawa. For mail: 146 Aylmer Ave., Ottawa. (A.M.1937. M.1940)
Milligan, Franklin S. Mgr., F. S. Milligan & Co., 388 Yonge St., Toronto. (S.1911. Jr.1913. A.M.1917. M.1940)
Milligan, G. H. Dist. Supvr., Calgary Power Co., 10323—106th St., Edmonton, Alta. (Affil.1941)
Milliken, Humphreys Chief Engr., Elec. Dept., Quebec Hydro Elec. Comm., 107 Craig St. W., Montreal 1. (M.1925)
Millman, Joseph Malcolm Cons. Engr., Morrison, Hershfield, Millman & Huggins, Toronto. For mail: 9 Wychwood Road, St. Catharines, Ont. (M.1942)
Millman, Robt. Noverre Civil Engr., H. S. Philips & Co.. Cons. Engrs., Hamilton. For mail: 81 Metcalfe St., Ottawa. (Jr.1944)
Mills, Arthur M. Divn. Engr., Dept. of Highways of Ont., Cochrane, Ont. (S.1919. A.M.1926. M.1940)
Mills, C. G., Jr. Commn. Engrg., Bell Telephone Co. For mail: 727 Ste. Geneviève, Three Rivers, Que. (S.1945)
Mills, Cecil G. Engrg. Divn., B.C. Electric Railway Co., Hastings & Carrall Sts., Vancouver, B.C. (M.1942)
Mills, F. O. Ganges, Salt Spring Island, B.C. (S.1906. A.M.1912. M.1940)
Mills, John Franklin Chemist & Analyst, Marathon Paper Mills of Canada Marathon, Ont. For mail: 89 Earl St., Kingston, Ont. (S.1946)
Mills, J. Roger Mgr., Gunite & Waterproofing Ltd., Montreal. For mail: 1280 Laird Blvd., Town of Mount Royal, Que. (M.1943)
Mills, J. S. P.O. Box 605, New Glasgow, N.S. (M.1940)
Mills, J. W. 72 Craig St., Ottawa. (S.1942)
Mills, R. V. 812 College Ave., Regina, Sask. (S.1944)
Mills, T. Stanley Chief Engr., Engrg. & Constrn. Service, Dept. Mines & Resources, Ottawa. For mail: 72 Craig S. (A.M.1919. M.1926)
Mills, W. Stuart Sales Engr., Peacock Bros. Ltd., Federal Bldg., Toronto. (Jr.1921. A.M.1939. M.1940)
Milne, A. H. Supt. Dept. of Bldgs., Montreal Protestant Central School Board, 3460 McTavish St., Montreal 2. (S.1914. Jr.1918. A.M.1920. M.1928)
Milne, Frank E. Serv. Engr., Otis-Fensom Elevator Co. Ltd., Victoria Ave. N., Hamilton, Ont. (M.1946)
Milne, George G. Plant Engr., Sask. Govt. Telephones, Regina, Sask. For mail: 2322 Cameron St. (M.1946)
Milne, Howard C. Asst. Engr., Public Utilities Comm., Dundas St., London, Ont. (S.1946)
Milne, James Michael Steam & Safety Engr., Donnacona Paper Co. Ltd. For mail: 3 St. George St., Donnacona, Portneuf Co., Que. (M.1945)
Milne, John R. Jr. Engr., P.F.R.A., Dom. Dept. of Agric., Public Bldg., Calgary, Alta. (Jr.1944)
Milne, Jas. R. B. Lake St. John Pulp & Paper Co., Dolbeau, Que. (Jr.1932. A.M.1939. M.1940)
Milne, W. G. Gen. Mgr., N. Slater Co., Hamilton, Ont. (A.M.1919. M.1935)
Milner, G. Techn. & Manual Editor, Trans Canada Air Lines, Stevenson Field, St. James, Man. (S.1944)
Milot, Camille Joint Chief Engr., Dept. Public Works of Que., Parliament Bldg., Quebec. (S.1919. Jr.1920. A.M.1922. M.1940)
Milot, Raymond Tel. Equipt. Engr., Northern Electric Co., Montreal. For mail: 7152—7th Ave., Ville St. Michel, Que. (S.1941)
Milrod, Ralph Supt., Victoria Engrg. Co., Toronto. For mail: 160 Chiltern Hill Rd., Toronto. (S.1946)
Milton, C. W. Divn. Engr., Canadian National Railways, Campbellton, N.B. (A.M.1939. M.1940)
Minard, Guy M. Asst. to Mng. Dir., Spruce Falls Power & Paper Co., Kapuskasing, Ont. (Jr.1929. M.1940)
Miners, Everett L. Asst. Gen. Mgr., C. M. Miners Constrn. Co., Saskatoon, Sask. For mail: 509-5th St. E. (Jr.1945)
Minshall, Harry H. Engr. i/c Erection Dept., Pacific Br., Dominion Bridge Co., Vancouver, B.C. For mail: 419 Inglewood Ave. (A.M.1938. M.1940)
Minty, G. R. R.C.A. Victor Co. Ltd., Montreal. For mail: 4826 Wellington St., Verdun, Que. (S.1941. Jr.1946)
Minue, P. W. Dist. Highway Engr., Fredericton, N.B. (M.1942)
Mireault, Gilbert 3571 Papineau Ave., Montreal 24. (S.1944)
Miron, Jacques Partner, Modern Engrg. Industries & Laurentide Engrg. Industries Ltd., Montreal. For mail: 544 Sherbrooke St. E. (S.1941. M.1945)
Misener, John S. Refinery Engr., Acadia Sugar Refinery Co., Woodside, Dartmouth, N.S. (M.1919)
Missler, John Sales Engr., Darling Bros. Ltd., Montreal. For mail: 51 Jasper Ave., Town of Mount Royal, Que. (M.1945)
Mitchell, C. N. Gen. Supt. of Constrn., Power Corp. of Canada, 355 St. James St. W., Montreal. (S.1911. A.M 1917. M.1940)
Mitchell, D. A. 40 Madison Ave., Toronto. (Jr.1938)
Mitchell, Earl Roe Sales Engr., Bailey Meter Co. Ltd., 980 St. Antoine St., Montreal. (S.1939. Jr.1945)
Mitchell, Frank L. Sr. Exec. Officer, Candn. Pulp & Paper Assn., Montreal, Que. For mail: 2071 Grey Ave. (Jr.1922. A.M.1930. M.1940)
Mitchell, Gordon Asst. Engr., Hydro-Electric Power Comm. of Ont., 620 University Ave., Toronto. (S.1914. A.M 1926. M.1940)
Mitchell, George Breck Res. Engr., T. Pringle & Sons Ltd., Union Hotel, Magog, Que. (M.1913)
Mitchell, John H. Refrig. Engr., Canadian Westinghouse Co., Hamilton, Ont. For mail: 222 Park Row S. (S.1940. Jr.1945)
Mitchell, J. L. Canadian Bridge Co., Walkerville. For mail: 423 Kildare Rd., Windsor, Ont. (S.1941. Jr.1946)
Mitchell, J. Murray Supvr. Serv. Observ. & P.B.X., Bell Telephone Co., Montreal. For mail: 596 Lansdowne Ave., Westmount, Que. (S.1922. Jr.1930. A.M.1935. M.1940)
Mitchell, J. T. Commr. of Patents, Patent Office, Ottawa. (A.M.1916. M.1940)
Mitchell, Kenneth McCallum Jr. Resch. Scientist, Candn. Armament Research & Devlpt. Establishment, B Wing, Valcartier, Que. (S.1946)
Mitchell, Kenneth R. Interm. Engr., Engineering Service Co., Halifax. For mail: 106 Chrichton Ave., Dartmouth, N.S. (S.1944. Jr.1946)
Mitchell, Keith W. Engr., Candn. Western Natural Gas Light, Heat & Power Co., Calgary, Alta. For mail: 215-6th Ave. W. (A.M.1938. M.1940)
Mitchell, L. E. Imperial Oil Ltd., P.O. Box 490, Dartmouth, N.S. (S.1930. A.M.1940. M.1940)
Mitchell, M. S. Partner, Meech, Mitchell & Meech, Arch. & Engrs., McFarland Bldg., Lethbridge, Alta. (S.1942. Jr.1944. M.1946)
Mitchell, R. W. Chief Engr., Pressure Pipe Co. of Canada, Montreal. For mail: 3284 Cedar Ave. (Jr.1912. A.M.1920. M.1940)
Mitchell, R. W. Plant Engr. Charles E. Frosst & Co., Montreal. For mail: 51 Balfour Ave., Town of Mount Royal, Que. (S.1933. Jr.1940)
Mitchell, Wm. G. Chief Dftsmn., Candn. Bridge Co. Ltd., Box 157, Walkerville, Ont. (M.1941)
Mitchell, W. Gordon Cons. Engr., 522 Pine Ave. W., Montreal. (M.1920)
Mitchell, W. M. Supvr., Mtce. & Constrn., Brunner Mond Canada Ltd., Amherstburg, Ont. (S.1923. A.M.1930. M.1940)
Mitchell, W. R. Estimator, Canadian Bridge Co. Ltd., Walkerville, Ont. (S.1934. M.1942)
Mitcheson, Septimus Chief Dftsmn., Montreal East Refinery, Shell Oil Co. For mail: 4156 Hingston Ave., Montreal. (A.M.1931. M.1940)
Miura, John H. Asst. Designer, Ricelicon Ltd., Toronto. For mail: 32 Berryman St. (S.1946)
Miville-Dechêne, Théo Dist. Engr., Dept. Public Works of Que. For mail: 96 Bougainville Ave., Quebec. (S.1922. A.M.1927. M.1940)
Mock, Wm. Installer, Central Office Equipt., Sask. Govt. Telephones, Regina, Sask. For mail: 270 Westman Chambers. (A.M.1938. M.1940)
Moeller, I. G. New Glasgow, N.S. (M.1940)
Moes, Gerry Pres., Hamilton Sterling Electrical Co., 428 Cannon St. E., Hamilton, Ont. (A.M.1930. M.1939)
Moffat, A. R. Civil Engr., Surveys & Engrg. Br., Dept. Mines & Resources, Cartier Bldg., Ottawa. (Jr.1925. A.M.1938. M.1940)
Moffat, Thomas Stuart Mgr., Forest Industries Ltd., Bridge St., St. John, N.B. (S.1925. A.M.1935. M.1940)
Moffat, Allan G. Asst. Engr., Township of Etobicoke, 4946 Dundas St., Islington, Ont. (S.1942. Jr.1946)
Moffatt, Edward H. Resch. Engr., Can. Car & Foundry Co., Pointe St. Chas., Montreal. For mail: 4870 Côte des Neiges Rd. (M.1943)
Moffatt, R. W. 1183 Dorchester Ave., Winnipeg, Man. (S.1910. A.M.1913)
Moir, D. A. 3479 Décarie Blvd., Montreal 28. (S.1945)
Mokrzycki, G. A. 2720-4th Ave., San Diego, Calif., U.S.A. (M.1944)
Moline, G. A. A. Chief Engr., Can. Westinghouse Co., 286 Sanford Ave. N., Hamilton, Ont. (M.1946)
Molland, Fred W. Plant Engr., Paranite Wire & Cable Corp., Marion, Ind., U.S.A. For mail: 1501 W. First St., Marion. (S.1937. Jr.1946)
Mollard, John D. Grad. Asst., Purdue University, 402 Northwestern Ave. W., Lafayette, Ind., U.S.A. (S.1943)
Mollard, John Ellis Dist. Supt., Sask. Power Comm., Swift Current, Sask. (S.1931. A.M.1935. M.1940)
Moller, H. P. Stadler & Hurter, Cons. Engrs., Montreal. For mail: 112 Dobie Ave., Town of Mount Royal, Que. (A.M.1937. M.1940)
Molleur, Gérald Co-Dir. of Persnl., Quebec Hydro Elec. Power Comm., 107 Craig St. W., Montreal. (S.1924. A.M.1932. M.1940)
Molyneux, Thos. E. Design & Field Inspn., C. D. Howe Co., Cons Engrs., Port Arthur, Ont. For mail: 32 Emerson Ave. (S.1942. Jr.1946)
Monaghan, Bernard M. Surveys Engr., Dept. Mines & Resources, Victoria Museum, Ottawa. (S.1946)
Monaghan, Cecil Z. Tech. Asst., Elec. Light & Power Dept., City of Edmonton. For mail: 11144-95a St., Edmonton, Alta. (S.1939. Jr.1941. M.1945)
Monarque, G. J. Chem. Engr., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1946)
Monat, Charles O. Pres., C. O. Monat & Co., 6520 Park Ave., Montreal. (M.1945)
Monet, Jocelyn, 3737 Lacombe Ave., Montreal 26. (S.1944)
Monette, Eddy Divn. Engr., Que. Dept. of Roads, 107 Turgeon St., Ste-Thérèse, Co. Terrebonne, Que. (M.1943)
Monette, G. Albert, 28 Ste. Anne St., Pointe-aux-Trembles, Que. (S.1944. Jr.1946)
Mongeau, Paul 5204 Delormier St., Montreal. (S.1944)
Monk, Angus O. Lt. Col., R.C.E.M.E., 117½ Earl St., Kingston, Ont. (M.1945)
Monkman, B. A. Chief Field Engr., Barrier Devlpt., Calgary Power Co., Seebe, Alta. (S.1940. Jr.1941)
Monkman, G. H. N. 10304-133rd St., Edmonton, Alta. (S.1910. Jr.1914. A.M.1921. M.1927)
Montague, John R. Asst. Hydraul. Engr., Hydro Electric Power Comm. of Ont., Toronto. For mail: 51 Chudleigh Ave. (A.M.1918. M.1940)
Montbriand, B. Commrl. Engr., Sask. Power Comm., Regina, Sask. For mail: 2056 Montague St. (A.M.1939. M.1940)
Montgomery, Edward W. Metalgl. Engr., Canadian Liquid Air Co., Montreal. For mail: 1205 Fort St. (Jr.1946)
Montgomery, Hugh R. Supvr. Constrn. Projects, Atlas Constrn. Co., 679 Belmont St., Montreal. (S.1928. A.M.1932. M.1940)
Montgomery, M. A. 4054 Grand Blvd., Montreal 29 (Jr.1938)
Montgomery, S. C. Mtce. Engr., Consolidated Mining & Smelting Co., Trail, B.C. (S.1911. Jr.1920. A.M.1929. M.1940)
Montgomery, S. J. Prof., N S. Technical College, Halifax, N.S. (M.1940)
Montgomery, Thos. 276 N. Brock St., Sarnia, Ont. (M.1922)
Monti, Thomas A. Asst. Prof., Ecole Polytechnique, Montreal. For mail: 4188 Northcliffe Ave. (S.1938. Jr 1946)
Montizambert, H. B. Plant Engr. & A/Supt., St. Raymond Paper Ltd., Desbiens, Que. (A.M.1926. M.1940)

Montizambert, H. St. J. Pres., Montizambert & Co., Vancouver, B.C. For mail: 601 Hastings St. W. (M.1913)
Monty, Guy 2011 Maplewood Ave., Montreal. (S.1944)
Moodie, Kenneth Combust. Engr., Dept. Public Works of B.C., Victoria, B.C. (S.1895. A.M.1911. M 1926)
Moon, C. L. Forest Prod. Engr., Forest Products Labs. of Can., Metcalfe & Isabella Sts., Ottawa. (M.1946)
Moon, C. G. 66 Yates St., St. Catharines, Ont. (S.1907. A.M.1911. M.1940)
Moon, George D. Divn. Supt., Toll Cable Plant, Eastn. Divn., Bell Telephone Co., Sun Life Bldg., Montreal. (S.1921. Jr.1928. A.M.1934. M.1940)
Moon, Thos. 24 Rosebank Ave., Halifax, N.S. (M.1940)
Mooney, D. R. 3432 St. Antoine St., Montreal. (S.1946)
Mooney, F. Melbourne Forest Prods. Resch., Forest Products Laboratories of Can., Metcalfe St., Ottawa. (S.1914. Jr.1921. A.M.1926. M.1940)
Mooney, John P. Mgr., Mooney Constrn. Co., 49 Canterbury St., St. John, N.B. (Jr.1918. A.M.1920. M.1940)
Moore, A. D. P.O. Box 304, Estevan, Sask. (S.1944)
Moore, Alexander G. Cons. Engr., 1217 Graham Blvd., Town of Mount Royal, Que. (S.1923. Jr.1930. A.M.1935. M.1940)
Moore, Chas. M. Hydraul. Engr., Dom. Dept. of Agriculture, Regina. For mail: Seven Persons, Alta. (S.1919. Jr.1920. A.M.1924. M.1940)
Moore, D. I. Constr. Lieut., R.C.N., 88 Argyle Ave., Ottawa. (Jr.1945)
Moore, Ernest V. Asst. Dist. Mgr., Coal Sales, Dominion Coal Co., 217 Bay St., Toronto. (A.M.1903. M.1919)
Moore, H. A. 125 Victoria Ave., Trenton, Ont. (M.1907)
Moore, Harry C. Priv. Prac., 360 King St., Fredericton, N.B. (M.1942)
Moore, H. H., Land Surveyor, Priv. Prac., 427 Riverdale Ave., Calgary, Alta. (S.1904. A.M.1909. M.1940)
Moore, H. J. Tel. Equip. Engrg., Northern Electric Co., Montreal. For mail: 1629 Lincoln Ave. (S.1945. Jr.1946)
Moore, James Alexander Engrg., Highway Mtce., Dept. Public Works of N.B., Coldbrook. For mail: 66 Hazen St., St. John, N.B. (M.1942)
Moore, John B. Chief Office Engr., Arthur G. McKee & Co., 2300 Chester Ave., Cleveland, Ohio, U.S.A. (S.1940. Jr.1943)
Moore, J. H. Assoc. Prof. Civil Engrg. University of New Brunswick, Fredericton, N.B. (A.M.1939. M.1940)
Moore, J. Ross Mech. Engrg. Dept., Davenport Works, Can. Gen. Elec. Co., Toronto. For mail: 144 Snowdon Ave. (S.1946)
Moore, R. A. Switchgear Engr., English Electric Co., St. Catharines, Ont. (S.1921. Jr.1926)
Moore, Robt. H. Sr. Mech. Engr., Falconbridge Nickel Mines Ltd. For mail: Box 282, Falconbridge, Ont. (S.1930. M 1941)
Moore, T. J. Dominion Water & Power Bureau, Box 235, North Bay, Ont. (A.M.1922. M.1940)
Moore, W. Herbert Proj. Engr., Can. Industries Ltd., Montreal. For mail: 390 Prince Albert Ave. (S.1925. A.M.1934. M.1940)
Moore, Wm. J. M. 1220 Craigflower Road. Victoria, B.C. (S.1946)
Moores, R. V. Engr. Dftsmn., Canadian Comstock Co. For mail: 29 Crang Ave., Toronto, Ont. (Jr.1940. M.1943)
Moran, John R. Asst. to Tech. Dir., Sidney Roofing & Paper Co. Ltd., Victoria. For mail: 2490 Harbour Rd., Sidney, B.C. (S.1946)
Moran, T. M. Vice-Pres. & Asst. to Pres., B.C. Electric Railway Co., & B.C. Power Co., Carrall St., Vancouver, B.C. (A.M.1929. M.1940)
More, John F. Partner, Major Manufacturers, R.R. No. 1, Dartmouth, N.S. (S.1944. Jr.1946)
Morehouse, R. H. Asst. Engr., Dept. of Transport, Ottawa. For mail: Burtt's Corner, N.B. (S.1943. Jr.1946)
Morency, Jean Chief Tech. Inform., Que. Dept. of Mines. For mail: 38 Chemin St. Louis, Quebec. (Jr.1937. M.1945)
Morgan, G. W. 17 Pagnuelo Ave., Outremont, Que. (S.1945)
Morgan, J. W. British American Oil Co. Ltd., Toronto. For mail: 185 St. Clair Ave. W. (Jr.1944)
Morgan, Merton B. Constrn. & Gen. Engrg., Irving Shipyards, St. John. For mail: R.R. No. 5, Fredericton, N.B. (M.1942)
Morgan, N. L. Asst. Inspn. Supt., Northern Electric Co., Montreal. For mail: 107 Kindersley Ave., Town of Mount Royal, Que. (A.M.1919. M.1940)
Morgan, P. H. c/o Canadian Bank of Commerce, 2 Lombard St., London E.C.3, England. (A.M.1934. M.1940)
Morgan, R. E. 107 Kindersley Ave., Town of Mount Royal, Que. (S.1944)
Morgan, R. T. Asst. Plant Engr., N.B. International Paper Co., Dalhousie, N.B. (Jr.1937)
Morin, Adrien, 49 St. Joachim St., Quebec. (S.1946)
Morin, Alphonse G. Divn. Engr., Que. Dept. of Roads, St. Tite, Laviolette Co., Que. (S.1938. M.1943)
Morin, Joseph-Henri 274 Bernard Ave. W., Montreal. (S.1943)
Morin, Roger Prévost, Terrebonne Co., Que. (S.1945)
Morison, G. A. Bldg. Inspr., Candn. Pacific Railway, Montreal. For mail: 2207 Melrose Ave. (S.1942. Jr.1945)
Morisset, Jos. E. Mill Engr., Donnacona Paper Co. For mail: 6 Sewell Place, Donnacona, Que. (A.M.1938. M.1940)
Morissette, Antonio Dist. Engr., Que. Dept of Roads. For mail: 1 Bois Joli, Quebec. (M.1941)
Morissette, Emile Assoc. Prof., Ecole Polytechnique, & Engr. i/c East Sec., Roads Dept., City of Montreal. For mail: 4037 Melrose Ave., Montreal. (M.1944)
Moritz, Charles Holland, Hotel Statler, Buffalo, N.Y., U.S.A. (A.M.1901. M.1909)
Moro, S. B. Jr. Refinery Mtce. Engr., Shell Oil Co., Montreal East. For mail: 7999 Durocher St., Montreal. (S.1944)
Morris, Alun G. 2530 Portage Ave., St. James, Man. (S.1946)
Morris, Carl R. Chief Dftsmn., Shawinigan Chemicals Ltd., Shawinigan Falls, Que. For mail: 7 Champlain St. (M.1944)
Morris, Harold K. Asst. Mgr. Purch. & Stores, Consolidated Paper Corp., Montreal. For mail: 7320 Maynard Ave. (S.1935. M.1945)
Morris, John Wm. Mng. Dir., City Service Co. Ltd., St. John's, Nfld. For mail: 22 Atlantic Ave. (M.1920)
Morris, L. R. Dftsmn., Canadian National Rwys., Winnipeg, Man. For mail: 688 Jubilee Ave. (S.1946)
Morris, Robt. M. Asst. Research Engr., National Research Council, Sussex St., Ottawa. (S.1940. Jr.1943)
Morris, Ronald Wm. Designer, Plant & Ground Equipt., Canada Air Lines, Winnipeg, Man. For mail: 20 Lipton St. (S.1939. Jr.1945)
Morris, W. V. Lecturer, University of Manitoba, Winnipeg, Man. For mail: 688 Jubilee Ave. (S.1941. Jr.1946)
Morrisey, T. S. 437 Mt. Pleasant Ave., Westmount, Que. (S.1910. Jr.1913. A.M.1924. M.1931)
Morrish, Robt. Roy Transitman, Can. Pacific Rwys., Toronto. For mail: Cherrywood, Ont. (S.1945)
Morrison, Chas. A. Maritime Dist. Mgr., Can. General Elec. Co., 129 Hollis St., Halifax, N.S. (M.1942)
Morrison, Carson F. Assoc. Prof. Civil Engrg., University of Toronto. For mail: 21 Douglas Cres., Toronto. (Jr.1929. A.M.1936. M.1940)
Morrison, Fred. C. Sales Engr., Lyman Tube & Supply Co., Maritime Bldg., New Glasgow, N.S. (Jr.1939. M.1941)
Morrison, George Spec. Applns. Engr., English Electric Co. of Canada, St. Catharines, Ont. For mail: 44 Yates St. (A.M.1924. M.1926)
Morrison, H. A. Dept. Highways of N.S., Amherst, N.S. (M.1940)
Morrison, Ibrahim F. Prof. Applied Mechs., University of Alberta, Edmonton, Alta. (M.1941)
Morrison, J. Alex Supvr. of Lab., Distbn. Dept., Consumers' Gas Co., Toronto. For mail: 931 College St. (S.1928. A.M.1937. M.1940)
Morrison, J. H. T. Dist. Highway Engr., Dept. Public Works of N.B., Campbellton, N.B. (M.1942)
Morrison, James R. Mining Engrg. Dept., Dominion Steel & Coal Corp., Sydney, N.S. (S.1905. A.M.1914. M.1940)
Morrison, Lloyd F. 836 West 13th Ave., Vancouver, B.C. (S.1943. Jr.1946)
Morrison, Robt. L. Proj. Engr., Fleet Aircraft Ltd., Fort Erie, Ont. For mail: R.R. No. 1, Fort Erie. (A.M.1939. M.1940)
Morrison, Wm. P. Sr. Asst. Engr., Dept. Public Works of Can., Halifax. For Mail: 43½ Dundas St., Dartmouth, N.S. (A.M.1898. M.1907)
Morrison, Wm. Stuart E. Temple Road, R.R. No. 1, Parksville, B.C. (A.M.1927. M.1940)
Morrissette, Roméo Cons. Engr., 15 Longval St., Cap-de-la-Madeleine, Que. (M.1945)
Morrow, Harold A. Pres., Morrow & Beatty Ltd., Box 782, Peterborough, Ont. (S.1888. A.M.1894. M.1902)
Morrow, Thos. Maclellan 21 Melbourne Ave., Westmount, Que. (A.M.1923. M.1940)
Morse, Cliff E. Asst. Tech. Engr., Dominion Glass Co., Montreal. For mail: 3777 Decarie Blvd. (S.1940. Jr.1946)
Morse, John Vice-Pres. Shawinigan Water & Power Co., Montreal. For mail: 3437 Harvard Ave. (A.M.1916. M.1926)
Morssen, Chas. Michael Cons. Engr., 417 St. Peter St., Montreal. (A.M.1909. M.1914)
Morton, A. M. Res. Engr., Rhokana Corp., Nkana, Northern Rhodesia. For mail: P.O. Box 9, Kitwe, Nor. Rho., Africa. (M.1936)
Morton, F. L. 10 Bryce Apts., Winnipeg, Man. (S.1945)
Morton, Ken W. Dist. Engr., B.C.-Yukon, Dept. Public Works of Can., Federal Bldg., New Westminster, B.C. (M.1945)
Morton Philip S. A. Can. Gen. Elec. Co., Toronto. For mail: 25 Hawthorne Ave. (Jr.1931. A.M.1939. M.1940)
Moseson, Stanley G. Asst. Gen. Mgr., Fred Mannix & Co., 332-7th Ave. W., Calgary, Alta. (S.1941. Jr.1945)
Mosher, A. F. 552 Wellington St., London, Ont. (S.1946)
Mosher, M. C. Chem. Engr., Cerro de Pasco Copper Corp., Morococha, Peru. (S.1943. Jr.1946)
Mosher, P. D. Asst. Engr., Dept. Public Works, Halifax, N.S. (M.1940)
Mosher, Ralph D. Box 653, Fort Frances, Ont. (S.1946)
Mosher, V. L. 2754 Hastings St. E., Vancouver, B.C. (S.1943. Jr.1946)
Mosley, Harold Gordon Field Asst. Mining Engrg. Dept., Dominion Steel & Coal Co., Sydney. For mail: 37 York St., Glace Bay, N.S. (Jr.1935. M.1940)
Moss, F. W. Pres., Moss Equipt. Co., 5316 York St., Montreal. (M.1943)
Motherwell, James S. Mech. Engr., Powell River Co. For mail: P.O. Box 639, Powell River, B.C. (Jr.1939. M.1944)
Mott, Harold E. Pres. & Gen. Mgr., H. E. Mott Co., Brantford, Ont. (S.1919. A.M.1926. M.1935)
Mouland, Gordon C. N.S. Technical College, Halifax, N.S. (S.1944)
Moule, Gerald W. Design Engr., City of Winnipeg Hydro-Electric System. For mail: 358 Winchester St., St. James, Man. (S.1935. Jr.1943)
Moull, Wm. C. Elec. Engr., Canadian & General Finance Co., 25 King St. W., Toronto. (S.1940. Jr.1946)
Moulton, Richard W. 1 Tupper Grove, Halifax, N.S. (S.1945)
Mount, W. R. Supt. & Waterworks Engr., City of Edmonton, Civic Block, Edmonton, Alta. (A.M.1921. M.1934)
Mousseau, François Strl. Conc. Designer, on loan to Defence Industries Ltd., Montreal. For mail: 4071 Parthenais St. (S.1941. M.1945)
Mowbray, Jack F. Asst. to Constrn. Engr., Intnl. Harvester Co. of Canada, Hamilton. For mail: Stoney Creek, Ont. (S.1946)
Mowchenko, Alexander Ardill, Sask. (S.1945)
Moxon, George B. Squad. Leader, Drawing Office, Aluminum Co. of Can., Montreal. For mail: 56 Chesterfield Ave., Westmount, Que. (A.M.1934. M.1940)
Moyer, R. L. 3300 Victoria Ave., Regina, Sask. (S.1946)
Mroz, Boris Mech. Design Engr., Dominion Bridge Co., Lachine. For mail: 381 Edward Charles St., Montreal. (S.1943. Jr.1946)
Mudry, Nestor 850 Selkirk Ave., Winnipeg, Man. (S.1944. Jr.1946)
Mueller, Emil K. Dist. Engr., Central North. Divn., Bell Telephone Co., Toronto. For mail: 177 Strathearn Road. (S.1921. A.M.1930. M.1940)
Mugaas, H. Surveyor, Lamaque Gold Mining Co., Bourlamaque, Que. (A.M.1932. M.1940)
Muggah, James E., Jr. 705 Official Row, Glace Bay, N.S. (S.1946)
Muir, C. B. Gen. Foreman & Asst. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 492 Monaghan Road. (S.1931. M.1941)
Muir, H. J. Office Mgr., Bailey Meter Co., 980 St. Antoine St., Montreal. (A.M.1936. M.1940)
Muir, W. Gordon Mgr., Maritime Industries Ltd., Amherst, N.S. (M.1944)
Muir, W. Kenneth Dftsmn., Dominion Bridge Co., Lachine. For mail: 73 Stratford Rd., Montreal 29. (S.1946)
Muirhead, C. R. (S.1943)
Muirhead, S. R. Chief Engr., Sask. Govt. Telephones, Regina, Sask. For mail: 371 Leopold Cres. (S.1920. Jr.1924. A.M.1930. M.1936)
Mulcahy, R. Rolland Res. Engr., Divn. Civil Engrg. & Mtce., Dept. Nat. Defence, Naval Service, Renous, N.B. (M.1945)
Mulhall, W. F. Liverpool, N.S. (S.1944)
Mulherin, J. K. C. Montreal Engrg. Co., Box 2400, Place d'Armes, Montreal. (S.1944)
Mulholland, Donal G. Jr. Engr. on Constrn., Northern Constrn. Co. & J. W. Stewart Ltd., Ocean Falls, B.C. (S.1946)
Mullen, T. J., Jr. Midwest Dist. Mgr., B. F. Sturtevant Co., Divn. of Westinghouse Electric, Ambassador Bldg., St. Louis 1, Mo., U.S.A. (S.1933. M.1945)
Muller, R. A. Transmn. Engr., Bell Telephone Co., Toronto. For mail: 140 Glenrose Ave., Toronto. (S.1943. Jr.1946)
Mulligan, Henry I. Design Engr., Bathurst Power & Paper Co., Queen Hotel, Bathurst, N.B. (S.1926. A.M.1935. M.1940)
Mullinger, H. H. 182 Woodmount Ave., Toronto. (S.1946)

Mullins, Harrison Alexander Canadian Industries Ltd., 1155 Beaver Hall Hill, Montreal (S.1937. Jr.1942)

Mullins, Reg. L. 132 Grey St., Sydney, N.S. (S.1946)

Mulock, R. H. Asst. Exec. Vice-Pres., Candn. Car & Foundry Co., Montreal. For mail: 3484 Marlowe Ave., Montreal. (S.1905. A.M.1912. M.1940)

Mumford, W. V. City Arch.'s Dept., City of Toronto. For mail: 83 Glenmore Rd., Toronto. (A.M.1929. M.1940)

Mundee, I. S. Asst. Equipt. Engr., N.B. Telephone Co., Saint John, N.B. For mail: 9 First St. (S.1941. Jr.1946. M.1946)

Munford, Thos. A. S. Divn. Engr., Can. Pacific Rwy., London, Ont. (A.M.1921. M.1940)

Munro, Alan H. Polymer Corp., Sarnia, Ont. For mail: 134 Vidal St. N. (S.1911. A.M.1920. M.1940)

Munro, D. D. Manitoba Paper Co., Pine Falls, Man. (S.1943)

Munro, David J. Supt. of Equipt., Montreal Tramways Co. For mail: 36 Dobie Ave., Town of Mount Royal, Que. (S.1921. Jr.1927. A.M.1939. M.1940)

Munro, Geo. N. Chief Engr., Water Rights Br., Dept. Natural Resources of Sask., Creamery Bldg., Regina, Sask. (A.M.1937. M.1940)

Munro, W. Hamilton Dir. & Gen. Mgr., Ottawa Light Heat & Power Co. For mail: 300 Cooper St., Ottawa. (A.M.1908. M.1920)

Munroe, L. R. Engrg. Dftsmn., Vancouver Town Planning Comm. For mail: 4146-West 15th Ave., Vancouver, B.C. (S.1944)

Munson, A. H. Dir., Indust. Relations, Dominion Bridge Co., Lachine. For mail: 8031 Western Ave., Montreal West. (S.1911. A.M.1916. M.1940)

Muntz, Eric P. Cons. Engr., Royal Bank Bldg., Montreal. (S.1913. A.M.1919. M.1927)

Murchison, J. G. Consultant to Ft. Wm. Planning Commission. For mail: 171 E. Mary St., Fort William, Ont. (Affil.1941)

Murdie, Wm. Campbell Legal Surveys & Map Service, Dom. Govt., Ottawa. For mail: 306 Clemow Ave. (A.M.1921. M.1940)

Murdoch, Gilbert G. Cons. Engr., 74 Carmarthen St., Saint John, N.B. (S.1905. A.M.1911. M.1919)

Murdock, Chas. Russell Town Engr. & Townsite Mgr., Spruce Falls Power & Paper Co., Box 319, Kapuskasing, Ont. (A.M.1912. M.1940)

Murphy, A. A. Mgr., A. A. Murphy & Sons Ltd., 216 First Ave. N., Saskatoon, Sask. (M.1938)

Murphy, A. G. S. Asst. Chief Engr., National Harbours Board, West Block, Ottawa. (Jr.1922. A.M.1931. M.1940)

Murphy, Daniel F. Engr., Foundation Co. of Canada, Montreal. For mail: 6805 Chabot St. (S.1936. Jr.1946)

Murphy, E. P. Deputy Minister of Public Works, Ottawa. For mail: Laurentian Club, (S.1909. A.M.1915. M.1940)

Murphy, Herbert John Supt., Public Utilities Comm., 5 Bayfield, Barrie, Ont. (S.1940. Jr.1946)

Murphy, John 23 Java St., Ottawa. (A.M.1904. M.1913)

Murphy, Jno. J. 480 Cooper St., Ottawa. (A.M.1890. M.1940)

Murphy, S. J. National Research Council, Ottawa. For mail: 163 Holmwood Ave. (A.M.1922. M.1940)

Murphy, Thos. R. H. Cons. Engr., Mead Investment Co., R.F.D. No. 1, Ridgefield, Conn., U.S.A. (A.M.1917. M.1940)

Murray, Archibald P.O. Box 34, Wolfville, N.S. (S.1904. A.M.1914. M.1940)

Murray, A. D. 1477 Atwater Ave., Montreal. (A.M.1920. M.1940)

Murray, D. C. 3rd Ave. S., Geraldton, Ont. (S.1946)

Murray, Donald M. Test Course, Can. General Electric, Peterborough, Ont. (S.1946)

Murray, Frederick R. Br. Mgr., Truscon Steel Co. of Can., Montreal. For mail: 4230 Westhill Ave. (M.1943)

Murray Hubert 1851 Theodore St., Montreal. (S.1942)

Murray, James A. Spec. Instr., School of Arch., University of Toronto. For mail: 63 Charles St. W., Toronto 5. (S.1943. Jr.1945)

Murray, John A. Mfg. Engr., Electronics Divn., Northern Electric Co., Montreal. For mail: 5301 Victoria Ave. (M.1945)

Murray, Ralph M. Sales Supvr., Flooring Divn., Building Products Ltd., Montreal. For mail: 5767 Côte St. Luc Rd. (M.1945)

Murray, William Alexander P.O. Box 401, Pictou, N.S. (S.1945)

Murray, William Alexander Georgeville, Que. (A.M.1898. M.1940)

Murray, Wm. J. Asst. to Dist. Engr., Power Transm., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 346 Foreman Ave. (Affil. 1940. M.1944)

Murray, W. M. Assoc. Prof. Mech. Engrg. Massachusetts Institute of Technology, Cambridge, Mass., U.S.A. (S.1932. A.M.1938. M.1940)

Murray, Wm. P. Constrn. Mgr., Dominion Bridge Co. Box 280, Montreal. (Jr.1911. A.M.1919. M.1940)

Murrin, W. G. 2106 S. W. Marine Drive, Vancouver, B.C. (M.1924)

Musgrave, A. S. G. Mun. Engr., Municipal Hall, Oak Bay, B.C. (A.M.1938. M.1940)

Musgrave, W. B. 1181 McGlaskon St., Niagara Falls, Ont. (A.M.1922. M.1940)

Mussen, Wm. H. C. Pres., Mussens Ltd., Phillips Place Bldg., Montreal. (Affil.1903)

Mustill, Leslie G. Dftsmn., Shell Oil Refinery, Montreal East. For mail: 1459 Letourneau St., Montreal. (S.1946)

Myers, G. A. Supt., Flintkote Co. (Nfld.) Ltd., Clarenville, Newfoundland. (S.1937. Jr.1941)

Myra, Allen Imperial Oil Ltd., P.O. Box 490, Dartmouth, N.S. (Jr.1939. M.1941)

N

Nachfolger, Nathan Elec. Engr., Northern Electric Co., Montreal. For mail: 4359 Esplanade Ave. (S.1942. Jr.1946)

Nadeau, Léopold Asst. Registrar, Corp. of Prof. Engrs. of Quebec. For mail: 412 Wiseman Ave., Outremont, Que. (S.1936. Jr.1946)

Nadeau, Yvon Town Engr., City Hall, Edmundston, N.B. (S.1939. Jr.1942. M.1944)

Naish, S. Gordon Eastn. Dist. Mgr., Peacock Bros. Ltd., Moore Bldg., Sydney, N.S. (Jr.1927. A.M.1934. M.1940)

Nancarrow, G. O. Inspn. Marine Craft, Ministry of Aircraft Prodn., England. For mail: 8 Island Road, St. Ives, Cornwall, England (A.M.1933. M.1940)

Nantel, Maurice Engr., Provincial Electricity Board. For mail: 1685 St. Joseph Blvd. E., Montreal 34. (S.1932. M.1945)

Napier, Chas. E. Sales Engr., Cons. Engines & Machinery Co., 200 Bay St., Toronto. (M.1945)

Napier-Hemy, H. F. Dftsmn., Yarrows Ltd., No. 1 Yard, Esquimalt, B.C. (M.1944)

Nargang, John W. Mtce. Engr., Aluminum Co. of Canada, Arvida, Que. For mail: Saguenay Inn. (Jr.1945)

Nariman, R. K. Cons. Engr., c/o Union Bank of India, Fort, Bombay, India. (M.1937)

Narod, Alvin Jackson Office Engr., Bloedel, Stewart & Welch Ltd., Port Alberni, B.C. (S.1944. Jr.1946)

Narsted, G. K. Chief Dftsmn., Aluminum Goods Ltd., 158 Sterling Rd., Toronto 9. (Jr.1941)

Narsted, John Gen. Supt. & Chief Engr. Canada Cement Co., Phillips Square, Montreal. (M.1945)

Nash, James Cundiff Elec. & Mech. Dftsm., Candn. Westinghouse Co., Hamilton, Ont. For mail: 147 Mountain Park Ave. (A.M.1922. M.1939)

Nash, Philip T. Tech. Asst., Nylon Divn., Canadian Industries Ltd., Kingston, Ont. For mail: 182 Frontenac St. (S.1944)

Nasmith, D. Forbes Prod. Devlpt. Engr., Aluminum Co. of Can., Arvida, Que. For mail: 838 Sixth St. (M.1945)

Nason, Edward McK. Asst. City Engr., St. Catharines, Ont. For mail: 27 Centre St. (S.1936. Jr.1940. M.1942)

Nathanson, Max Engr. & Mgr., Candn. Armature Works, 6595 St. Urbain St., Montreal. (S.1925. Jr.1929. M.1941)

Nathanson, Solomon Designer, Chas. Mayer, Cons. Engr., New York. For mail: 2520 Kings Highway, Brooklyn 29, N.Y., U.S.A. (S.1938. M.1946)

Nathanson, Theodore H. Stress Analyst, A. V. Roe (Canada) Ltd., Toronto. For mail: 376 Clarke Ave., Westmount, Que. (S.1942. Jr.1946)

Natress, D. Irving Divn. Engr., Hydro-Elec. Power Comm. of Ont., Toronto, Ont. For mail: 44 Chicora Ave. (S.1920. Jr.1925)

Neal, E. L. Asst. Control Supt., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. For mail: 438 St. Foye Rd. (S.1938. Jr.1946)

Neale, Wm. A. Mech Engr., Link-Belt Ltd., Eastern & Leslie, Toronto. (S.1946)

Neales, W. S. Locating Engr., Highways Divn., Dept. Public Works of N.B., Fredericton. For mail: Oromocto, N.B. (M.1942)

Near, F. M. Design Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 35 Secord Ave. (S.1942. Jr.1944)

Near, James D. Jr. Engr., Roadways Dept. Public Works of Toronto. For mail: 266 St. George St. (S.1940. Jr.1943)

Near, W. P. Vice-Chairman, Ontario Municipal Board, Toronto. For mail: 39 Alexandra Blvd. (A.M.1909, M.1920)

Neave, Roger Design Engr., Imperial Oil Ltd., Sarnia, Ont. For mail: 115 East St. S. (M.1941)

Neelands, Ernest Wesley Field Engr., Falconbridge Nickel Mines Ltd. For mail: Box 13, Falconbridge, Ont. (A.M.1912. M.1940)

Neil, A. S. Engr., Precision Machine & Foundry Ltd., Calgary, Atla. For mail: 744 Crescent Road. (A.M.1939. M.1940)

Neil, Chas H. Asst. Steam Supt., Consolidated Paper Corp., Three Rivers. For mail: 2255 Second Ave., Blvd. St. Louis, Three Rivers, Que. (S.1940. M.1946)

Neil, J. S. Supt. Constrn. & Mtce., McColl-Frontenac Oil Co., Langman Bldg., Calgary, Alta. (Jr. 1932. A.M.1937. M.1940)

Neilson, C. S. Design Engr., Canadian Bridge Co. Ltd., Walkerville. For mail: 1156 Windermere Road, Windsor, Ont. (S.1925. Jr.1931. M.1942)

Neilson, Jas E. Mgr., Stoker Divn., Foster Wheeler Ltd., St. Catharines, Ont. For mail: 215 Ontario St. (A.M.1940. M.1940)

Nelles, Douglas H 223 McLeod St., Ottawa. (S.1904. A.M.1906. M.1915)

Nelson, Edward Chief Engr., Northwestern Utilities Ltd. Edmonton, Alta. For mail: 11003-84th Ave. (A.M.1935. M.1940)

Nelson, Ernest W. Logging Engr., Y. W. Nelson, Timber Contractor, Raith, Ont. (S.1943)

Nelson, James B. Strl. Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (A.M.1922, M.1940)

Nelson, Leslie W. Instrmn., Hydro-Electric Power Comm. of Ont., Red Lake, Ont. (S.1945)

Nelson, M. Stuart Mgr. & Sec. Treas., Montreal Metalworked Products Ltd., 5290 St. Patrick St., Montreal. (Affil. 1926. A.M.1928. M.1940)

Nelson, Samuel James 250 E. 23rd Ave., Vancouver, B.C. (S.1946)

Nelson, S. Reed Steel Detailer, Dominion Bridge Co., Calgary, Alta. For mail: 2227-16th St. E. (S.1945)

Nelson, W. A. Sales Serv. Engr., Bailey Meter Co. 55 York St., Toronto. (S.1938. Jr.1940)

Nemetz, Alvin S. 6229 Angus Drive, Vancouver, B.C. (S.1946)

Nenniger, E. Partner, Arthur Surveyer & Co., Cons. Engrs., Dominion Square Bldg., Montreal. (Jr.1926. A.M.1928. M.1940)

Nepveu, Jean-Claude 4589 Fabre St., Montreal 34. (S.1945)

Nesbitt, A. Deane Investment Dealer; Nesbitt Thomson & Co., 355 St. James St., Montreal. (S.1933. Jr.1946)

Nesbitt, M. C. Supt., Dawson Wade & Co., Vancouver. For mail: Roper Ave., White Rock, B.C. (S.1928. Jr.1936. M.1941)

Nesbitt, Wm. P. Mech. Supt., Howard Smith Paper Mills, Cornwall, Ont. (Jr.1937. M.1943)

Nesham, L. C. Locating Engr., Can. Pacific Rwy., Mackey, Ont. For mail: 331 Second Ave. W., North Bay, Ont. (Jr.1919. A.M.1924. M.1940)

Ness, A. Franklin Machine & Tool Designer, Northern Electric Co., Montreal. For mail: 7290 Ouimet St., Verdun, Que. (S.1944)

Neufeld, C. Asst. Engr. of Bridges, Can. Pacific Rwy., Windsor Station, Montreal. (S.1936. M.1940)

Neumann, T. O. Partner, Coal Mine, Box 46, Pincher Creek, Alta. (Jr.1942. M.1940)

Nevitt, I. H. 1st Asst. Engr. i/c Sewage Treatment, City of Toronto, 1091 Eastern Ave., Toronto. (A.M.1910. M.1919)

Newby, W. M. Asst. Mech. Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1940. Jr.1943)

Newcombe, S. A. Equipt. Engr., Maritime Telegraph & Telephone Co., Halifax, N.S. For mail: 67½ Charles St. (M.1945)

Newell, Tom L. 1425 Bathurst St., Toronto. (S.1946)

Newhall, V. A. City Commr., Calgary, Alta. For mail: 1106 Premier Way. (A.M.1918. M.1940)

Newill, George E. Cons. Engr., 1178 Phillips Place, Montreal. (M.1920)

Newland, Alfred Candn. Res. Rep., Ruston & Hornsby Ltd. of England. For mail: c/o Gen. Del., Toronto. (M.1945)

Newman, F. H. Lecturer, Engrg. Drawing, University of Toronto, Ajax. For mail: 430 Douglas Ave., Toronto. (S.1942. Jr.1946)

Newman, Harvey E. Overseas. (S.1940)

Newman, Wm. A. Head, Dept. of Research, Can. Pac. Rwy., Windsor Station, Montreal. (M.1935)

Newton, James B. Cons. Engr., Fairmount, Annan, Dumfr., Scotland. (A.M.1921. M.1940)

Newton, Leslie J. Plant Supt., Building Products Ltd., Pont Rouge, Que. (M.1944)

Nicholas, Gordon A. Design, Cowin & Co., 1137 Pacific Ave., Winnipeg, Man. (M.1946)

Nicholl, Henry I. Asst. Supt. of Light & Power, City of Regina, Sask. For mail: 3113 Regina Ave.

Nicholls, John H. International Ecuadorean Petroleum Co., Guayaquil, Ecuador, S.A. (S.1945)

Nichols, J. T. Asst. Mech. Supt., Aluminum Co. of Can., Arvida, Que. For mail: 12 Radin Rd. (S.1931. Jr.1936. M.1942)

Nicholson, Edward 49 Garden Ave., Toronto 3. (A.M.1920. M.1940)

Nicholson, G. A. Town Engr., Pictou, N.S. (M.1940)

Nicholson, G. W. E. Vice-Pres. i/c Mfg., Union Bay & Paper Co., New York. For mail: 550 Park Ave., New York 21, U.S.A. (A.M.1926. M.1940)

Nicholson, R. A. V. Lands & Bldgs., Dept. National Defence, Ottawa. For mail: 336 Fairmont Ave. (Affil.1943)

Nicholson, Wm. V. Jr. Elec. Engr., Consolidated Mining & Smelting Co., Trail, B.C. For mail: 15 Aldridge Ave. (S.1946)

Nickerson, A. D. Transm. Engrg. Bell Telephone Co., 1050 Beaver Hall Hill, Montreal 2. (S.1929. A.M.1934. M.1940)

Nickle, H. D. Combustion Engrg. Co., 200 Madison Ave., New York 16, U.S.A. (M.1939)
Nicklin, Harold S. City Engr., City Hall, Guelph, Ont. (A.M 1920. M.1940)
Nicol, D. Stuart Prof., Elec. Engrg., Nova Scotia Technical College, Halifax, N.S. (M.1940)
Nicol, James D. Maxwell Constrn. Co., Vancouver. For mail: 4706 Douglas Rd., New Westminster, B.C. (M 1941)
Nicol, Wm. B. Chief Engr. Hamilton Bridge Co. For mail: 11 Emerald Cres., Burlington, Ont. (A.M.1939. M.1940)
Nicolls, Jasper H. H. Chemist, Fuel Research Labs., Bureau of Mines, Ottawa. For mail: 2 Sweetland Ave. (A.M.1927. M.1940)
Nicoloff, Peter C. F. 518 Old Weston Road, Toronto. (S.1946)
Nicolson, M. Salesman, Ray-O-Vac (Canada) Ltd., 8304-110th Ave., Edmonton, Alta. (S.1945)
Nicolson, R. H. Waterworks Dept., City of Edmonton, Alta. For mail: 10315-115th St. (S.1940)
Nix, Chas. E. Owner, J. E. Nix Co., Edmonton, Alta. For mail: 10224-130th St. (S.1929. Jr.1937. M.1941)
Nixon, E .E. Redland Court, Moose Jaw, Sask. (S.1943)
Nixon, George M. Instructor, University of Toronto, Ajax, Ont. For mail: 733 Queen's Road. (S.1941. Jr.1946)
Nixon, R. L. Bursar, King's College, Halifax, N.S. (A.M.1919. M.1940)
Nixon, W. H. Supr. of Constrn., Foundation Co of Ontario, Toronto. For mail: 56 Alvin Ave. (M.1941)
Noakes, Frank Assoc. Prof. Elec. Engrg., University of British Columbia, Vancouver, B.C. (M.1943)
Nobert, J. B. Chem. Engr. on Research, Building Products Ltd., Ville LaSalle. For mail: 2791 DesOrmeaux St., Montreal 5. (S.1943)
Nobes, Wm. Douglas, Demonstrator, Mech. Engrg., Queen's University, Kingston, Ont. For mail: 575 Earl St. (S.1946)
Noble, K. W. Jr. Engr., Can. International Paper Co., Chaleur Inn, Dalhousie, N.B. (S.1946)
Noble, W. L. Estimator, Can. Bridge Co., Walkerville, Ont. (S.1941. Jr.1943)
Noel, A. C. Jr. Engr., Plant Engrg. Dept., Bell Telephone Co., Quebec. (S.1946)
Noiseaux, Denis 122 Prince St., Sorel, Que. (S.1944)
Noiseaux, G. Fernand 413 Metcalfe Ave., Westmount, Que. (S.1944)
Noonan, R. Pres. & Gen. Mgr., Pioneer Electric Ltd., Box 411, Winnipeg, Man. (Jr.1939. M.1946)
Noonan, Robt. 162 Earl St., Kingston, Ont. (S.1945)
Noonan, W. F. Divn. Engr., Dept. Highways of Ont., Kingston, Ont. (M.1941)
Noonan, W. H. Priv. Prac., Roy Bldg., Halifax, N.S. (S.1913. A.M.1923. M.1940)
Norman, Arthur W. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 422 Metcalfe Ave., Westmount, Que. (S.1945)
Norman, Douglas Distbn. Transformer Engr., Can. Gen. Elec., Toronto. For mail: 300 South Kingsway. (S.1926. Jr.1931. A.M.1937. M.1940)
Norman, R. L. Control Engr., Halifax Refinery, Imperial Oil Ltd., Box 490, Dartmouth, N.S. (S.1932. M.1942)
Normand, J. J. 3677 St. Urbain St., Montreal 18. (S.1946)
Normandeau, Laurent Shipbldg. Engr., Marine Industries Ltd., Sorel, Que. (S.1940. Jr.1944)
Normandeau, Paul D. Asst. Mgr., Eagle Pencil Co., Drummondville, Que. (S.1936. Jr.1940)
Normandin, A. B. Vice-Pres., Provincial Electricity Board, Montreal. For mail: 175 Ave. des Erables, Quebec. (S.1907. A.M.1912. M.1933)
Norris, Chas. A. Exec. Engr., Montreal Locomotive Works, Montreal. For mail: 4155 Beaconsfield Ave. (S.1919. Jr.1925. A.M.1926. M.1940)
Norrish, B. E. Pres. & Mng. Dir., Associated Screen News Ltd., 5271 Western Ave., Montreal. (A.M.1912. M.1940)
Norrish, Wilbert H. Mines & Geology Br., Dept. Mines & Resources, Ottawa. (S.1912. Jr.1917. A.M.1920. M.1940)
Northcote, John A. John Deere Plow Co., Welland, Ont. For mail: 303 Niagara St. (S.1946)
Northey, Robt. K. Vice-Pres., Telfer Paper Box Co., Toronto. For mail: 179 Lyndhurst Ave. (A.M.1920. M.1940)
Northover, Arthur Head, Strl. Engrg. Dept., John Burnet Parkin, Arch., Toronto. For mail: 32 Inverleigh Drive. (S.1937. Jr.1940. M.1944)
Norton, A. D. Chief Tool Designer & Methods Supvr., Can. Car & Foundry, Fort William, Ont. For mail: 437 S. Vickers St. (Affil.1943)
Norton, Chas. D. Engr., Aerocrete Constrn. Co., Montreal East. For mail. 40 Lorne Ave., St. Lambert, Que. (S.1907. A.M.1915. M.1940)
Norton, Harold A. Chem. Engr., Shawinigan Chemicals Ltd., Shawinigan Falls, Que. For mail: 61 Maple Ave. (S.1943. Jr.1945)
Norton, Howard W. Jr. Engr., Diesel Divn., Dominion Engrg. Works, Lachine. For mail: 4164 Marcil Ave., Montreal. (S.1942. Jr.1944)
Norwich, Harry B. Divn. Engr., Ontario Divn., McColl-Frontenac Oil Co., Toronto. For mail: 36 Humber Trail. (S.1919. A.M.1925. M.1940)
Notley, Wm. Jas. 96 Evanson St., Winnipeg, Man. (S.1945)
Notman, J. Geoffrey Mgr. of Mfg., Dominion Engrg. Works Ltd., Montreal. For mail: 4655 Roslyn Ave. (S.1920. A.M.1930. M.1940)
Nourse, Arthur E. Asst. Engr., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 33 Gormley Ave. (S.1907. A.M.1914. M.1940)
Nourse, Hugh C. Motor Vehicles Engr., Bell Telephone Co., Montreal. For mail: 2096 Vendome Ave. (A.M.1919. M.1940)
Nowlan, B. C. Plant Engrg., Bell Telephone Co., Montreal. For mail: 5510 Queen Mary Rr. (S.1937. M.1942)
Noyes, Donald F. 1540 Queens Road, Charlotte, N.C., U.S.A. (M.1927)
Nunes, Ferdinand Dept. of Engrg., McGill University, Montreal. (S.1946)
Nunn, E. C. Jr. Engr., Bendix Radio Divn. of Bendix Aviation, Baltimore, Md., U.S.A. For mail: 26 W. Allegheny Ave. (S.1945)
Nunn, Thos. A. Field Engr., Nova Scotia Light & Power Co., Halifax, N.S. For mail: 141 Walnut St. (M.1942)
Nutter, J. C. John Inglis Co. Ltd., 14 Strachan Ave., Toronto 1. (S.1921. Jr.1926. A.M.1929. M.1940)
Nutter, James Ryan Bridge Inspr., Can. Pacific Rly., Windsor Station, Montreal. (S.1942. Jr.1945)
Nutter, N. F. Dist. Plant Supt., Western Union Telegraph Co., Truro, N.S. For mail: 78 King St. (M.1944)
Nyberg, Carl 11025-82nd Ave., Edmonton, Alta. (S.1946)

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Oakes, Cecil H. Asst. Admiralty Regional Offices (Wales). For mail: 68 Park Place, Cardiff, South Wales. (A.M.1936. M.1940)
Oaks, Harold Anthony Mining Engr., Priv. Prac. For mail: 43 Summit Ave., Port Arthur, Ont. (S.1920. Jr.1026. A.M.1930. M.1940)
Oatley, Henry Bigelow Vice-Pres., Superheater Co., 60 E. 42nd St., New York, U.S.A. (M.1921)
Oattes, M. E. Engrg Asst., Bell Telephone Co., Toronto. For mail: Carleton Place, Ont. (S.1945)
Oatway, Harold C. Stress Analyst, A. V. Roe Canada Ltd., Toronto. For mail: 86 Indian Grove. (S.1937. Jr.1942)
O'Bomsawin, Gérard 4785 Ste. Emilie St., Montreal. (S.1941)
O'Brien, J. A. Pres., M. J. O'Brien Ltd., 140 Wellington St., Ottawa. (Affil.1926)
O'Brien, Michael J. Elec. Test Studt., Can. Gen. Elect. Co., Peterborough, Ont. For mail: 277 John St. (S.1946)
O'Brien, W. S. 4278 Sherbrooke St. W., Westmount, Que. (S.1941)
O'Connor, G. D. Lieut., Veterans Guard of Canada, Intern. Camp 23, Monteith, Ont. For mail: 817 Ave. Royale, Beauport Ville, Que. (Jr.1921. A.M.1923. M.1940)
O'Connor, P.A. Major, D.E.O., M.D. 10, Fort Osborne Barracks, Winnipeg, Man. (Affil.1944)
Oddleifson, A. L. Jr. Engr., Winnipeg Elec. Co., Seven Sisters Falls, Man. (S.1929. Jr.1936. M.1943)
Oddson, Leifur T. Elecn.'s Helper, Winnipeg Hydro Elec. System. For mail: 163 Arlington St., Winnipeg, Man. (S.1946)
Odell, Russell K. Chief Devlpt. Divn., Dept. Mines & Resources, Ottawa. For mail: 361 Daly Ave. (A.M.1937. M.1940)
O'Donnell, John G. Mtce Engr., Dept. Public Works, Parliament Bldgs., Quebec. (Jr.1916. A.M 1921. M.1940)
O'Donoughue, Gerald 3834 St. Denis St., Montreal 18. (S.1937. Jr.1943)
Offer, L. Douglas Overseas Dept., Shell Petroleum Co., St. Helen's Court, London, E.C.3, England. (S.1944)
Ogilvie, James D. B. Welland Chemical Works Ltd., Niagara Falls, Ont. (S.1942)
Ogilvie, Noel John Can. Commr., Dom. Geodesist & Candn. Intrnl. Boundry Comm., Dept. Mines & Resources, Ottawa. (M.1916)
Ogilvy, James A. Mine Mgr., Arntfield Mining Corp., Arntfield, Que. (S.1926. A.M.1935. M.1940)
Ogilvy, Robt. F. Res. Engr., Aluminium Prodn. Co. of India, near Calucutta. For mail: 150 University Ave., Kingston, Ont. (S.1922. A.M.1932. M.1940)
O'Grady, J. R. Asst. to Bldg. Mgr., Price Bros. & Co., Quebec. For mail: 40 de Salaberry Ave. (S.1945)
O'Halloran, James Chief Engr., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. For mail: 277 Laurier Ave. (S.1919. Jr.1922. A.M.1934. M.1938)
Ohrner, W. E. Engrg. Dept., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 300 St. Clements Ave. (Jr.1946)
O'Keefe, Ronald T. Jr. Engr., Hyd. Dept., Hydro-Elec Power Comm. of Ont., 620 University Ave., Toronto. (S.1946)
Olafson, Ellaf A. Utah State Agric. College, Logan, Utah, U.S.A. (S.1941. Jr.1946)
Olafson, Harold S. Plant Engrg., Bell Telephone Co., Toronto. For mail: 590 Huron St. (S.1940. Jr.1946)
Olafson, M. Joseph Machine Designer, John E. Roebling's Sons Co., Trenton, N.J. For mail: 524 Hillcrest Ave., Morrissville, Pa., U.S.A. (S.1939. Jr.1943)
Old, Frank J. A. Engr., River St. Lawrence Ship Channel, Dept. Transport, Montreal. For mail: 364 Victoria Ave., St. Lambert, Que. (M.1945)
Oldfield, Allan Norman Jr. Mfg. Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1945)
Oldreive, D. Drake Field Engr., Dinsmore McIntire Ltd., Windsor, Ont. For mail: 77 Metcalfe St., St. Thomas, Ont. (S.1943. Jr.1946)
O'Leary, B. A. Mng. Dir. & Chief Engr., McDonald Constrn. Co., 76 Sullivan St., Halifax, N.S. (M.1940)
O'Leary, E. C. Operating Engr., Public Service Comm. of Halifax, N.S. For mail: 61 Henry St. (M.1941)
O'Leary, H. Gordon 604 S. Syndicate Ave., Fort William, Ont. (S.1906. A.M.1910. M.1940)
Oliphant, W. J. Burlington, Ont. (S.1946)
Olive, C. E. Lecturer, University of Toronto, Ajax, Ont. (M.1945)
Oliver, Cuthbert J. Asst. Supt., Elec. Distbn., Rio de Janeiro Tramway Light & Power Co., Caixo de Correo 571, Rio de Janeiro, Brazil. (S.1919. Jr.1924. A.M.1931. M.1940)
Oliver, Ernest Warren Box 64, Elgin, Leeds Co., Ont. (M.1912)
Oliver, H. E. (S.1946)
Oliver, J. Constrn. Engr., E. G. M. Cape & Co., Cornwall, Ont. For mail: 417-2nd St. W. (S.1936. Jr.1941)
Oliver, J. C. Asst. City Engr., City Engr's Office, City Hall, Vancouver, B.C. (A.M.1939. M.1940)
Oliver, Stuart E. Land Surveyor, Can. National Rlys., Montreal. For mail: 577 Roslyn Ave., Westmount, Que. (S.1909. Jr.1913. A.M.1919. M.1940)
Olscn, Aleksander Chief Civil Engr., Robt. A. Rankin & Co., 1420 Sherbrooke St. W., Montreal. (A.M.1934. M.1940)
Olsen, J. Norman, Jr. Elec. Engr., B.C. Power Comm., Victoria. For mail: 2127 Guelph St., Vancouver, B.C. (S.1946)
Olson, A. B. Power Plant Supt., Sask. Power Comm., Ave. A, Saskatoon, Sask. (A.M.1939. M.1940)
Olson, C. H. 10936-87th Ave., Edmonton, Alta. (S.1945)
Olson, H. T. Elec. Mtce., Churchill River Power Co. For mail: Island Falls, Sask., Via Flin Flon, Man. (Affil.1934)
Olsson, H. M. Chief Engr., C. D. Howe Co., Cons. Engrs., Port Arthur, Ont. (A.M.1936. M.1940)
Olts, George L. Constrn. Engr., New Brunswick Contractors Ltd., Fredericton, N.B. For mail: 222 Waterloo Row. (S.1937. M.1944)
Olynyk Alexander 6673 Des Erables St., Montreal 36. (S.1942. Jr.1946)
Onasick, Peter 85 Gorevale Ave., Toronto (S.1943. Jr.1946)
O'Neil, Wm. Jas. 83 Baby Pt. Road, Toronto. (S.1944)
O'Neill, G. W. Dftsmn. & Estimator, Manitoba Bridge & Iron Works Ltd., Winnipeg, Man. For mail: 435 Furby St. (A.M.1936. M.1940)
O'Neill, John Johnston Head, Dept. Geological Sciences & Dean of Engrg , McGill University, Montreal. (M.1942)
O'Neill, J. Neville 100 Cambridge St., Halifax, N.S. (M.1941)
Openshaw, J. Edward Pres., Openshaw & Bennet Ltd., Montreal. For mail: 4331 Montrose Ave., Westmount, Que. (S.1909. A.M 1913. M.1940)
Opsal, J. O. Mfg. Engr., Northern Electric Co., Montreal. For mail: 2428 St. Antoine St. (S.1945)
Orange, Frank A. Capt., R.C.E., Dept. National Defence, Ottawa. For mail: 344 Elgin St., Sudbury, Ont. (S.1927. A.M.1934. M.1940)
Orkin, Richard C. 137 Percival Ave., Montreal West. (S.1946)
Orlando, Edward E. Mgr., Central Station Sales, Can. Westinghouse Co., Hamilton, Ont. (A.M.1937. M.1940)
Orloff, Irving Bentonite Survey, Pembina Mountain Clays Ltd., Winnipeg, Man. For mail: 75 St. Cross St. (S.1941. Jr.1946)
Ormiston, R. W. Tantallon, Sask. (S.1942)
Orr, J. C. 262 Frontenac St., Kingston, Ont. (S.1944. Jr.1946)
Orr, J. D. 496 St. Clair Ave. E., Toronto. (S 1946)
Orr, L. G. Hydraul. Engr., P.F.R.A., Dom. Dept. Agriculture, Legislative Bldg., Winnipeg, Man. (M.1944)
Orr, W. A. Air Commodore, R.C.A.F , Ottawa. For mail: 405 Athlone Ave. (S.1932. Jr.1938. M.1941)

Orr, Weldon J. Engr., Dept. Public Works of Montreal. For mail: 3559 St. Famille St. (M.1945)
Orrock, John Wilson 62 Arlington Ave., Westmount, Que. (A.M.1896. M.1907)
Os, Hartvik Design. Engr., C. D. Howe Co., Port Arthur, Ont. For mail: 423 Rita St. (Jr.1925. A.M.1931. M.1940)
Osberg, Gunder Outside Plant Engr., Bell Telephone Co., Ottawa. For mail: 9 Woodlawn Ave. (Jr.1943)
Osborn, John F. Elec. Engr., Can. Gen. Elec., Peterborough, Ont. For mail: 554 Reid St. (S.1936. Jr.1943)
Osborne, Gurdon Hoard Mng. Dir., Ventilating & Blow Pipe Co., 714 St. Maurice St., Montreal. (A.M.1921. M.1940)
Osborne, J. S. Dept. of Engrg., McGill University, Montreal. (S.1939)
O'Shaughnessy, P. L. Field Engr. on Constrn., Coke Oven Co. of Canada, Hamilton, Ont. For mail: 18 Ontario Ave. (A.M.1937. M.1940)
Osipov, Louis 328 Magnus Ave., Winnipeg, Man. (S.1946)
Ostevik, Sigurd T. Richlea, Sask. (S.1945)
Ostiguy, Maurice Asst. Dist. Engr., Que Roads Dept. For mail: 11 Belmont St., Quebec. (S.1936. Jr.1942)
O'Sullivan, Gerald 175 Rosemount Ave., Weston, Ont. (S.1946)
O'Sullivan, J. J. Gen. Supvr. of Constrn., Que. & Maritimes, Wartime Housing Ltd., Montreal. For mail: 31 Springfield Ave., Westmount, Que. (M.1921)
O'Sullivan, Louis Asst. Gen. Mgr., Quebec Hydro-Elec. Comm., Montreal. For mail: 4017 Grey Ave. (S.1919. A.M.1925. M.1940)
Ott, H. George Civil Engr., Gunite & Waterproofing Ltd., Montreal. For mail: 3520 Van Horne Ave. (S.1946)
Ott, Thos. E. Stress Engr., Fleet Aircraft Ltd., Fort Erie. For mail: 2112 Arad St., Niagara Falls, Ont. (Jr.1945)
Ottem, Ray W. Asst. Engr., Sask. Dept. of Sanitation, Regina, Sask. For mail: Royal George Apt. (S.1943)
Otter, George E. Chief Engr., Fleet Aircraft Ltd., Fort Erie, Ont. (M.1944)
Ottewell, Barry D. C. Machine Engr., Candn. Gen. Elec. Co., Peterborough, Ont. For mail: 460 Monoghan Road. (A.M.1920. M.1940)
Ouellet, Aimé Sr. Resch. Asst., Candn. Armament Research & Development Establishment, Valcartier, Que. For mail: 46 Sheppard Ave., Quebec. (S.1945)
Ouellette, Robt. P. Strl. Designer, Dominion Bridge Co., Lachine. For mail: 4026 Vendome Ave., Montreal. (S.1941. Jr 1944. M.1945)
Ouimet, J. A. Asst. Chief Engr., Can. Broadcasting Corp., Montreal. For mail: 3967 Van Horne Ave. (S.1931. A.M.1937. M1940)
Ouimet, Pierre Stress Analyst, Canadair Ltd., Cartierville. For mail: 421 Mount Royal W., Montreal. (S.1943)
Ouimet, Séraphin Cons. Engr. & Que. Land Surv., 750 St. Gabriel St., Montreal 1. (M.1945)
Oulton, R. R. Elec. Engr., Canadair Ltd., Cartierville. (Jr.1939)
Ousman, W. D. 598 Greenwood Place, Winnipeg, Man. (S.1945)
Overend, A. Vincent Owner-Mgr., Electro-Music Products Co., Montreal. For mail: 1430 Sherbrooke W. (S.1944. Jr.1946)
Overgaard, E. C. 524 Sprague St., Winnipeg, Man. (S.1946)
Owers, Leonard E. A. Sanitary Engr., Ont. Dept. of Health, Toronto. For mail: Scarborough, Ont. (S.1945)
Oxley, D. C. Asst. Dist. Highway Engr., Dept. Public Works, Sussex, N.B. (M.1942)
Oxley, J. Morrow Partner, Chapman & Oxley, Archs., 57 Bloor St. W. Toronto 5. (S.1901. A.M.1908. M.1921)
Oxley, Loren A. (S.1943)
Oxley, Wm. M. Capt., R.C.C.S., Dept. National Defence, Ottawa. For mail: 11 Cooper St. (S.1935. Jr.1946)
Ozust, W B. 10561-76th Ave., Edmonton, Alta. (S.1946)

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Paavila, H. David, 1020 Alexandra St., Fort William, Ont. (S.1946)
Packard, Royal D. Chief Engr., Brown Corp., La Tuque, Que. For mail: P.O. Box 177. (M.1941)
Padley, Gilbert Aluminum Co. of Can., Kingston, Ont. For mail: 715 Johnson St. (Jr.1942)
Page, John E. Lands Dept., Hudson's Bay Co., Winnipeg, Man. (S.1944)
Page, Lorne A. Grad. Physics Studt., Cornell University, Rockefeller Hall, Ithaca, N.Y. (S.1943. Jr.1946)
Pageau, H. Albert Civil Engr., National Breweries Ltd., Montreal. For mail: 104-2nd Ave., Ville LaSalle, Que. (S.1944)
Pageau, Marcel Engr., Leblanc & Montpetit, Cons. Engrs., 513 Rachel E., Montreal. (S.1941. Jr. 1946)
Paget, Claremont E. Civil Engr. on Constrn., Long Lac Pulp & Paper Co., Box 129, Schreiber, Ont. (S.1945)
Paget, J. Arthur Mach. Design, Gutta Percha & Rubber Co., Toronto. For mail: 52 College St. (S.1945)
Paget, J. R. Pres., Assiniboia Engrg. Co., 300 Leeson-Lineham Blk., Calgary, Alta. (A.M.1920. M.1940)
Paget, K. K. Diamond Engrg. Co., Calgary, Alta. For mail: 222-38th Ave. S.W. (S.1941. M.1945)
Painchaud, François Benoit 38 rue Dubuisson, Beauport, Que. (S.1912. Jr.1916. A.M.1928. M.1940)
Painchaud, Robert 38 rue Dubuisson, Beauport, Que. (S.1944)
Paine, A. J. C. Staff Arch., Sun Life Assurance Co. of Can., Sun Life Bldg., Montreal. (A.M.1922. M.1940)
Paine, Frederick J. Jr. Designer, Dominion Bridge Co., Montreal. For mail: 3856 Draper Ave. (Jr.1946)
Painter, Gilbert W. Transpn. Engr., Can. Gen. Elec. Co., 214 King St. W., Toronto. (S.1933. Jr.1936. M.1946)
Paithouski, N. J. Constrn. Engr., Steel Co. of Can., Hamilton, Ont. (S.1940. Jr.1946)
Palframan, J. W. 465 Durie St., Toronto. (S.1946)
Palmason, John H. Supt. of Operations Western Region, Dominion Tar & Chemical Co., 1910-9th Ave., Calgary, Alta. (M.1945)
Palmer, F. H. Sr. Candn. Govt. Trade Commr. in Scandinavia. For mail: P.O. Box 14042, Stockholm 14, Sweden. (A.M.1919. M.1940)
Palmer, John Douglas Sales Engr., Commonwealth Elec. Corp., Welland, Ont. For mail: 33 Franklin St. (S.1945)
Palmer, K. W. (S.1937. Jr.1946)
Palmer, J. Paul Victor Jr. Engr., Manitoba Paper Co., Pine Falls, Man. (S.1941)
Palmer, Roland Foster (A.M.1918. M.1940)
Palmquist, D. E. Proj. Engr., Candn. Industries Ltd., Windsor, Ont. For mail: 549 Allendale. (S.1937. Jr.1944)
Pangman, A. H. Chem. Engr., C. E. Frost & Co., 3571 St. Antoine St., Montreal. (Jr.1933)
Papineau, Augustin Jean Engr., Quebec Provincial Electricity Board, 132 St. James St. W., Montreal. (M.1945)
Papineau, Gustave Joseph Land Surv. & Cons. Engr., Papineau & Frigon, 60 St. James W., Montreal. (A.M.1928. M.1940)
Papineau, Marcel L. Asst. to Inspr. of Mines, Quebec Bureau of Mines, Box 790, Noranda, Que. (S.1939. Jr.1942)
Papove, W. N. Consolidated Mining & Smelting Co., Trail. For mail: P.O. Box 393, Rossland, B.C. (S.1935. M.1943)
Paquet, Donat, Mng. Dir., A. Belanger Ltd., Montmagny, Que. For mail: P.O. Box 333, Montmagny. (M.1945)
Paquet, Jean-M. Engr., J. A. Y. Bouchard Inc., Quebec. For mail: 9 Bois-Joli. (S.1934. Jr.1938)
Paquette, Georges, Section Engr., Waterworks &Sewerage, City of Montreal. For mail: 6251—8th Ave., Rosemont, Montreal 36. (M.1943)
Paquette, Louis J. 359 Sherbrooke St. E., Montreal 24. (S.1945)
Paquin, Paul E. Canadian Liquid Air Co., 1111 Beaver Hall Hill, Montreal. (S.1940. Jr.1946)
Paquin, Roland 1660 Montcalm St., Montreal 24. (S.1944)
Paradis, Maurice 121 rue Garnier, Quebec. (S.1946)
Pardoe, Wm. S. Prof. Hyd. Engrg., University of Pennsylvania, Philadelphia. For mail: 701 Beacon Lane, Merion Sta., Pa., U.S.A. (A.M.1909. M.1922)
Paré, A. Euclide Chief Engr., Dept. Hydraulic Resources, Parliament Bldgs., Quebec. (A.M.1937. M.1940)
Paré, J. Léandre Supt. Engr., La Société d'Entreprises Générales Ltée, P.O. Box 309, Amos, Que. (S.1937. Jr.1946)
Paré, Yvon Stoker, (R.C.N.), H.M.C.S. Charlottetown, Fleet Mail, Victoria, B.C. (S.1944)
Parent, Albert 8065 DeGaspé St., Montreal. (S.1942)
Parent, Leonard E. Nakusp, B.C. (S.1946)
Parent, Michel 5576 Sterling Ave., Montreal 32. (S.1944)
Parent, Robert 3438 St. Hubert St., Montreal 24. (S.1944)
Parham, J. B. Inspg. Engr., Greater Vancouver Water District. For mail: 2474 West 33rd Ave., Vancouver, B.C. (S.1907. A.M.1913. M.1936)
Pariseau, Louis S. 4390 Marcil Ave., Montreal. (A.M.1887. M.1940)
Parish, Chas. E. Gen. Supt., J. L. E. Price Co., 680 Sherbrooke W., Montreal. (M.1946)
Parizeau, Maurice 8554 Des Belges Ave., Montreal 10. (S.1944)
Park, Fillmore Robt. Asst. Resch. Engr., Elec. & Radio Br., National Research Council. For mail: R.R. No. 1 Billings Bridge, Ont. (S.1936. M.1943)
Park, J. Kenneth Lieut., R.C.E., Chilliwack, B.C. For mail: 557-17th Ave., Lachine, Que. (S.1942)
Parke, C. S. Asst. Gen. Supt., Harshaw Chemical Co., Cleveland. For mail: 13901 Shaker Blvd., Shaker Heights, Ohio, U.S.A. (S.1917. Jr.1921. A.M.1930. M.1940)
Parker, B. L. Town Engr., Town Hall, Liverpool, N.S. (M.1940)
Parker, C. C. Hamilton Bridge Co. Ltd. For mail: 1160 King St. W., Hamilton, Ont. (S.1926. A.M.1936. M.1940)
Parker, D. H. Prodn. Mgr., Montreal Star Co., 245 St. James St. W., Montreal. (Affil.1933)
Parker, Edmund N. Mech. Designer, Dominion Bridge Co., Lachine. For mail: 163 St. Joseph St., Dorval, Que. (S.1937. Jr.1940)
Parker, John S. Kirk's Ferry, Que. (A.M.1928. M.1940)
Parker, W. A. A/Divn. Engr., Dept. Highways & Public Works of N.S., Halifax, N.S. For mail: 58 Union St. (M.1940)
Parker, W. E. Asst. Test Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 216 Deloraine Ave. (Jr.1941)
Parkin, J. H. Dir., Div. of Mech. Engrg., National Research Council, Ottawa. (M.1930)
Parkinson, G. W. Instr. & Lecturer, University of Saskatchewan. For mail: 707 Lansdowne Ave., Saskatoon, Sask. (A.M.1939. M.1940)
Parks, Donald S. Mount Allison University, Sackville, N.B. (S.1946)
Parks, John H. 513-24th Ave. W., Calgary, Alta. (A.M.1902. M.1911)
Parlee, Norman A. D. Dir. Resch. Devlpt., Dominion Steel & Coal Corp., Sydney, N.S. For mail: 109 Bentinck St. (Jr.1945)
Parmelee, E. H. 6 Perrault St., Ste. Anne de Bellevue, Que. (Affil.1926)
Parnum, Ewart 1768 Inglewood Ave., Hollyburn P.O., B.C. (S.1946)
Parratt, W. A. D. R.R. No. 2, West Hill, Ont. S.1946)
Parrish, Vernon M. Sales & Serv. Engr., Bailey Meter Co., McArthur Bldg., Winnipeg, Man. (Jr.1943)
Parry, Thos. M. Tech. Vice-Prin., Western Canada Composite High School, Calgary, Alta. For mail: 136-12th Ave. N.E. (M.1941)
Parsons, Alfred M. 98 Ontario St., Collingwood, Ont. (M.1942)
Parsons, R. A. Instrmn., Shawinigan Engineering Co. For mail: 24B St. Maurice Pk., Cap de la Madeleine, Que. (S.1937. Jr.1940)
Parsons, Roy Henry City Engr., Peterborough, Ont. For mail: 104 Douro St. (M.1915)
Parsons, R. Lloyd 331 Spring Garden Road, Halifax, N.S. (S.1942. Jr.1946)
Partridge, John K. Sr. Asst. Engr., Dept. Public Works of Can., 36 Adelaide St. E., Toronto. (M.1937)
Pascoe, Thomas Works Officer, Dept. National Defence, Experimental Station, Suffield, Alta. (M.1943)
Pask, Arthur Henry Asst. Proj. Engr., Canadian Industries Ltd., Montreal For mail: 1340 Regent Rd., Town of Mt. Royal, Que. (S.1935. Jr.1937. M.1941)
Pasquet, Pierre A. Design Engr., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1941. Jr.1944)
Paterson, E. L. Asphalt Sales Engr., Imperial Oil Ltd., 234 Smythe St., Vancouver, B.C. (A.M.1927. M.1940)
Paterson, James W. Woods Mgr., E. B. Eddy Co. Ltd., Hull, Que. (A.M.1936. M.1940)
Paterson, Roy J. Lab. Techn., British American Oil Co., Toronto. For mail: 625 Cosborn Ave. (S.1946)
Paterson, W. Howard Engr. of Rapid Transit, Toronto Transportation Comm., 35 Yonge St., Toronto. (Jr.1936. M.1942)
Patriarche, Valance H. G/C, R.C.A.F., 247 Elm St., Winnipeg, Man. (A.M.1937. M.1940)
Patrick, Gilbert H. Ducks Unlimited, Strathmore, Alta. (A.M.1917. M.1940)
Patrick, K. E. Asst. Supt., Greater Vancouver Water District. For mail: 3433 W. 12th Ave., Vancouver, B.C. (M.1943)
Patriquen, Frank A. Asst. Engr., Dept. Public Works of Can., Saint John, N.B. For mail: 10 Manawagonish Rd., Fairville, N.B. (S.1930. Jr.1934. M.1940)
Patry, Marcel 4731 Palm Ave., Montreal. (S.1944)
Patten, R. H. Assoc. Prof. Mech Engrg., McGill University, Montreal. (M.1945)
Patterson, Arthur L. Office Engr., Shawinigan Engrg. Co., Montreal. For mail: 360 Chester Ave., Town of Mount Royal, Que. (S.1914. A.M.1926. M.1940)
Patterson, D. S. Asst. Divn. Engr., Dept. Highways of Ont., Kenora, Ont. (A.M.1939. M.1940)
Patterson, Dan W. Supvr., Elec. Condr. Divn. Westn. Canada, Aluminum Co. of Can., Bank of Commerce Bld., Toronto. (S.1940)
Patterson, Earle Bedford Water Rights Br., Dept. Mines & Natural Resources, Winnipeg, Man. For mail: 337 Brock St. (A.M.1919. M.1940)
Patterson, E. G. Asst. Mgr., Long Lac Pulp & Paper Co., 263 Adelaide St. W., Toronto. (Jr. 1927. A.M.1936. M.1940)
Patterson, H. 5607 Queen Mary Road, Hampstead, Que. (S.1946)
Patterson, H. W. 2277 Lincoln Road, Walkerville, Ont. (Jr.1919. A.M.1921. M.1940)
Patterson, Ian S. Dist. Mgr., English Electric Co. of Can., P.O. Box 2910, Winnipeg, Man. (S.1928. Jr.1931. A.M.1938. M.1940)
Patterson, J. E. J. Dist. Highway Engr., Dept. Public Works of N.B., 62 King St., Woodstock, N.B. (M.1942)

Patterson, Jas. F. Supvg. Engr., Tel. App. Dept., Northern Electric Co., Montreal. For mail: 4561 Marcil Ave. (A.M.1929. M.1940)
Patterson, Roy Allen Test Course, Can. Gen. Elec., Peterborough. For mail: 392 Riverdale Ave., Ottawa. (S.1946)
Patterson, S. M. Supvr. Process Control, Bayer Ore Plant No. 2, Aluminum Co. of Can., Arvida, Que. For mail: Brittany Row. (Jr.1944)
Patterson, T. M. 270 Sherwood Drive, Ottawa. (Jr.1926)
Patterson, Wilfred Ernest Tech. Dir., Merck & Co. Ltd., 560 de Courcelles St., Montreal 30. (M.1942)
Patton, J. McD. Design. Engr., Bridge Br., Dept. Highways of Sask. For mail: 2324 Rae St., Regina, Sask. (A.M.1917. M.1936)
Patzalek, S. P. Design. Engr. & Partner, Hamilton Camera Supplies. For mail: 49 Leinster Ave. S., Hamilton, Ont. (S.1943)
Paul, R. B. Proj. Engr., Can. Gypsum Co., Windsor, N.S. (M.1946)
Paulin, F. W. Pres. & Mgr., Can. Engrg. & Contracting Co., Hamilton, Ont. For mail: 153 Fairleigh Ave. S. (S.1907. A.M.1913. M.1922)
Paull, Allen M. Office & Design. Engr., Highways Br., Dept. Public Works of Alta., Parliament Bldgs., Edmonton, Alta. (M.1941)
Paulsen, R. O. Estim. Engr., Toronto Iron Works Ltd., 629 Eastern Ave., Toronto. (Jr.1930 A.M.1937. M.1940)
Pauzé, Jean 382 St. Joseph Blvd. E., Montreal. (S.1941)
Pawlikowski, Joseph Elec. Engr., 495 Prince Arthur W., Montreal. (M.1945)
Pawson, Herbert E. Asst. Commrl. Mgr., Power Corp. of Canada, 355 St. James W., Montreal (M.1945)
Payan, C. F. Overseas. (S.1937. Jr.1946)
Payne, J. M. Mech. Engr., Canada Packers Ltd., 2200 St. Clair W., Toronto. (S.1944)
Payne, Robt. L. Marine Supt., Canadain Fishing Co., Vancouver, B.C. For mail: 1312 Acadia Rd. (S.1943)
Payton, Robt. H. Engr.'s Asst., Bell Telephone Co., London, Ont. For mail: 61 Wyatt St. (S.1940. Jr.1946)
Payton, R. N. Jr. Mech. Engr., Galt Metal Industries Ltd. For mail: 354 Dundas St., Galt, Ont. (S.1943)
Peabody, G. S. Serv. Engr., Can. Westinghouse Co., Montreal. For mail: 171-5th Ave., Ville LaSalle, Que. (S.1942. Jr.1944)
Peace, John T. Line Foreman, Bell Telephone Co., Toronto. For mail: 103 Earlscourt Ave (Affil.1941)
Peach, Wm. Herbert Vice-Pres., C. D. Howe Co., Cons. Engrs., Public Utilities Bldg., Port Arthur, Ont. (S.1925. Affil.1943)
Peachey, Cyril A. Works Mgr., Northern Electric Co., 1261 Shearer St., Montreal. (A.M 1937. M.1940)
Peacock, E. M. 16 Lytton Blvd., Toronto. (S.1944)
Peacock, Francis T. Pres. & Mng. Dir., Peacock Bros. Ltd., P.O. Box 6070, Montreal. (M.1905)
Peacock, R. F. Engr., Specialty Transformer Divn., Can. Gen. Elec. Co., Toronto. For mail: 127 Albertus Ave. (S.1937. Jr.1946)
Pearce, E. B. Engr. Dftsmn., Babcock-Wilcox & Goldie-McCulloch, Galt, Ont. For mail: 127 Concession St. (S 1940. Jr.1942)
Pearce, K. K. Engr., Brian R. Perry, Cons. Engr., Montreal. For mail: 83 St. Mathieu St., St. Laurent, Que. (A.M.1917. M.1940)
Pearce, Wm. J. Field Engrg., Union Pacific Rwy. Co., 1735-19th St., Denver, Colo., U.S.A. (A.M.1939. M.1940)
Pearse, Langdon Sanitary Engr., Sanitary District of Chicago. For mail: P.O. Drawer F., Winnetka, Ill., U.S.A. (M.1926)
Pearson, Arthur Cons. Engr., 4077 W. 13th Ave., Vancouver, B.C. (M.1943)
Pearson, Bernard Edward 3429 Peel St., Montreal 2. (S.1942)
Pearson, G. B. Engr.-in-Trng., Hydro Elec. Power Comm. of Ont., Toronto For mail: 298 Victoria Ave., Chatham, Ont. (S.1944. Jr.1946)
Pearson, J. H. A. 97 Balmoral Place, Winnipeg, Man. (S.1946)
Pearson, R. Frank Jr. Engr., A. J. MacRae, Contr., 809 Ave. A. N., Saskatoon, Sask. (S.1943. Jr.1946)
Pearson, Vernon Mech. Supt., Dept. Public Works of Alta., Edmonton, Alta. For mail: 9854-87th Ave. (A.M.1926. M.1937)
Peart, John D. Mgr., Teleph. & Electronic Sales, Northern Electric Co., 65 Rorie St., Winnipeg, Man. (A.M.1920. M.1940)
Peart, J. Walton Gen. Mgr. & Engr., Public Utilities Comm., 474 Talbot St., St. Thomas, Ont. (M.1944)
Peatfield, John H. Jr. Engr., Engrg. & Constrn. Serv., Dept. Mines & Resources, Banff, Alta. (S.1944)
Peck, Esmond H. Water Resources Dept., Shawinigan Water & Power, Montreal. For mail: 529 Lansdowne Ave., Westmount, Que. (M.1943)
Peck, Robt. C. Sales Engr., Aluminum Co. of Can., Bank of Commerce Bldg., Toronto. (S.1940. Jr.1941)
Peck, W. R. Chief Designer, Seats & Equipt., Ottawa Car & Aircraft Ltd. For mail: 404 Queen St., Ottawa. (M.1944)
Peckover, F. Lionel 233 Ellis Ave., Toronto 3. (S.1943. Jr.1946)
Peden, Alexander Stands. Engr., Dominion Bridge Co., Lachine. For mail: 161 Strathern Ave. N., Montreal West. (S.1903. A.M.1908. M.1925)
Peden, Ernest Strl. Design, Ross & Ross, Montreal. For mail: 6900 Sherbrooke W. (S.1907. Jr.1913. A.M.1919. M.1940)
Peebles, Archibald Assoc. Prof. Civil Engrg., Univ. of British Columbia, Vancouver, B.C. (S.1927. A.M.1935. M.1940)
Peebles, Andrew A. Chief Instr., Dept. Aeronautics, Provincial Institute of Technology & Art, Calgary, Alta. (M.1945)
Peebles, Jas. Arthur Instrmn., Water Serv. Dept., Can. National Rwys., Winnipeg, Man. For mail: 308 Lindsay St. (S.1944. Jr.1946)
Peele, Percy Frederick Sales Engr., Can. Elec. Co., Calgary, Alta. For mail: 248 Scarboro Ave. (A.M.1934. M.1940)
Peeling, Herbert O. Plant Engr., Can. Westinghouse Co., Hamilton, Ont. (M.1943)
Peers, A. F. Overseas. (A.M.1939. M.1940)
Pegler, Wm. A. Mgr., Detroit Stoker Co. of Can., Windsor, Ont. (S.1939. Jr.1946)
Pellegrino, Antonio, J. J. 48-13th Ave., Lachine, Que. (S.1943)
Pelletier, André 228 Roy St. E., Montreal 18. (S.1945)
Pelletier, Burroughs Dir., Quebec Bureau of Town Planning. For mail: 84 St. Louis Road, Quebec. (S.1918. A.M.1923. M.1940)
Pelletier, Denys M. 505 Champagneur Ave., Montreal 8. (S.1945)
Pelletier, Paul Creaghan & Archibald, Cons. Engrs., Montreal. For mail: 3915 Berri St. (Jr.1943. M.1945)
Penfold, Douglas K. Water Rights Engr., Govt. of B.C., Box 1198, Kelowna, B.C. (A.M.1929. M.1936)
Pengelley, C. Desmond Jr. Engr., Curtiss Wright Corp., St. Louis Airplane Divn., Robertson, Mo. For mail: Hotel Stuyvesant, Buffalo, N.Y., U.S.A. (S.1937. Jr.1946)
Pennock, W. B. Mgr., Pennock Engrg., 86 Gloucester St., Ottawa. (Jr.1919. A.M.1936. M.1940)
Pepall, J. E. Indian Aluminum, Chota Muri, Bihar, Providence, India. (S.1934. M.1945)
Pépin, Abias Pres., Abias Pépin Ltée, 245 St. Thomas St., Longueuil, Que. (M.1946)
Pépin, Maurice Gen. Mgr., Abias Pépin Ltée., 245 St. Thomas St., Longueuil, Que. (S.1941. M.1945)
Paquegnat, Marcel Supt. & Engr., Kitchener Water Comm., City Hall, Kitchener, Ont. (Jr.1912. A.M.1913. M.1940)
Percy, Ernest G. Coastal Asphalt Products Ltd., St. John, N.B. For mail: 216 Duke St. (M.1942)
Perkins, Douglas Harold Strl. Exam. Engr., Dept. of Bldgs., Toronto City Hall. For mail: 364 Victoria Park Ave., Toronto. (S.1944. Jr.1946)
Perley, E. Clint Mng. Dir., Corporation House Ltd., 160 Laurier W., Ottawa. (M.1943)
Perras, Camille Supvr. Line Dept., Montreal Tramways Co., 159 Craig W., Montreal (M.1945)
Perrault, G. 3708 St. André St., Montreal 24. (S.1944)
Perrault, Lucien Chief Engr., Industrial & Commercial Laboratories Ltd., 1440 St. Catherine W., Montreal. (A.M.1938. M.1940)
Perreault, H. C. 53 Bannerman Ave., Timmins, Ont. (S.1943)
Perrie, Wm. W. Chief Engr., Dept. Highways & Transportation of Sask. For mail: 2108 Princess St., Regina, Sask. (M.1938)
Perrin, Alfred Thos. 44 Kingsmount Park Road, Toronto. (A.M.1915. M.1929)
Perrin, George St. C. 16 Newcastle St., Dartmouth, N.S. (M.1940)
Perrin, J. V. Mgr., Woods Dept., Brown Corp., 71 St. Peter St., Que. (M.1944)
Perriton, Douglas E. Engr. i/c Mech. Sales, Dominion Bridge Co., P.O. Box 280, Montreal. (S.1920. Jr.1924. A.M.1928. M.1940)
Perron, Gilles A. Engr., Quebec Hydro Elec. Comm., Montreal. For mail: 10264 St. Hubert St. (S.1945)
Perron, Georges-Henri Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)
Perron, J. Euclide Gen. Contr., 129 Jacques-Cartier St., Chicoutimi, Que. (M.1945)
Perron Laurent 1576 Gouin Blvd. W., Montreal 12. (S.1944)
Perrott, S. Wright Carew Lodge, Stoke Poges, Bucks. England. (M.1907)
Perry, Aubrey H. Sr. Sanitary Engr., Dept. National Health & Welfare, P.O. Box 1012, Vancouver, B.C. (A.M.1935. M.1940)
Perry, Brian R. Cons. Engr. 680 Sherbrooke St. W., Montreal. (S.1914. A.M.1923. M.1931)
Perry, Fred L. Chem. Supvr., Imperial Oil Co., Imperoyal, N.S. For mail. 31 Queen St., Dartmouth. N.S. (J.1943. M.1945)
Perry, George Thomas Jr. Rescr. Engr., National Research Council, Ottawa. For mail: Box 23, Quarries P.O., Ont. (S.1938. Jr.1941)
Perry, P. Carleton Dist. Engr., Canadn. National Rwy., Saskatoon, Sask. (A.M.1920. M.1935)
Persoage, Nicholas P. 421 Home St., Winnipeg, Man. (S.1946)
Perttula, F. Allan Jr. Elec. Engr., Long Lac Pulp & Paper Co., Schreiber, Ont. For mail: 744 Queen St., Geraldton, Ont. (S.1946)
Peters, Arthur W. Distbn. Engr., Shawinigan Water & Power Co., Three Rivers, Que. (M.1943)
Peters, C. G. Engrg. Dept., Can. Pac. Rwy., Brandon, Man. For mail: 23 Alexandra Apts., (Jr.1941. M.1943)
Peters, Frederic H. Surveyor General & Chief Hydrographic Service, Dept. Mines & Resources, 105 George St., Ottawa. (S.1904. A.M.1907. M.1914)
Peters, Henry F. Asst. Dist. Engr. of Highways, Dept. Public Works of Man., Swan River, Man. (S.1930. M.1943)
Peters, J. H. 65 Palmerston Ave., Town of Mount Royal, Que. (S.1935. Jr.1940)
Peterson, Alfred Design & Process Engr., Distillers Corp., Ville LaSalle. For mail: 1343 Bélanger St. E., Montreal. (Jr.1937)
Peterson, Grant A. Jr. Engr., Sask. Power Comm., 1739 Cornwall, Regina, Sask. (S.1945)
Peterson, Robt. Soil Mechanics Engr., P.F.R.A., Dom. Dept. of Agriculture, University of Sask., Saskatoon, Sask. (S.1939. Jr.1942. M.1945)
Petford, H. S. Mgr., Dawes Black Horse Brewery, 740 St. Maurice St., Montreal. (A.M.1925. M.1940)
Petitpas, Marcel, Constrn., Fraser-Brace Ltd., Chalk River, Ont. (S.1942)
Petrie, John B. Mech. Supt., Dominion Steel & Coal Corp., Wabana, Nfld. (A.M.1919. M.1940)
Petrie, L. A. Proj. Engr., Polymer Corp., Sarnia, Ont. For mail: 367 Cameron St. (M.1943)
Petruchick, John Charton Engr., Dominion Rubber Co., Montreal. For mail: 3892 Colonial Ave. (S.1945)
Petuk, George Instrmn., Dept. Highways of Sask., Kindersley. For mail: 904 Rae St., Regina, Sask. (S.1946)
Petursson, Franklin, P.O. Box 204, Dryden, Ont. (S.1928. A.M.1935. M.1940)
Petursson, H. J. (Jr.1932. M.1942)
Phaneuf, Jean 10748 Grande Allée, Montreal. (S.1945)
Phaneuf, Rodolphe E. 5989 St. Hubert St., Montreal 10. (S 1944)
Phare, G. Rowland 3625 W. 15th Ave., Vancouver, B.C. (S.1946)
Phelan, M. A. Can. Refractories Ltd., 105 Walnut St. S., Hamilton, Ont. (S.1928. A.M.1936 M.1940)
Phelan, Thos. M. Contr.'s Engr., Carter Constrn. Co. For mail: 4 Dartmouth Cres., Mimico, Ont. (S.1946)
Phelps, C. S. Elec. Engr., St. Clair Processing Corp., Sarnia, Ont. For mail: 212 Ross Ave. (M.1945)
Phelps, George Engr. of Sewers, Dept. of Works, City Hall, Toronto. (A.M.1915. M.1940)
Phelps, G. D. Field Engr., Royalite Oil Co., Turner Valley, Alta. (A.M.1936. M.1940)
Phemister, W. Ian Design Loft Supvr., A. V. Roe (Canada) Ltd., Toronto. For mail: 445 Morrison St., Niagara Falls, Ont. (S.1938. Jr.1942)
Phénix, Gilles F. Henryville, Co. Iberville, Que. (S.1945)
Philips, Hector S. Partner, H. S. Philips & Co., Cons. Engrs., 63 John St. S., Hamilton, Ont. (A.M.1915. M.1922)
Phillips, Ernest A. City Engr., P.O. Box 307, Prince Rupert, B.C. (M.1944)
Phillips, Edward Horace Phillips, Stewart & Phillips, Central Chambers, Saskatoon, Sask. (A.M.1917. M 1940)
Phillips, E. Kent Cons. Engr. & Lecturer, Univ. of Sask., Saskatoon, Sask. (Jr.1929. A.M.1936. M.1940)
Phillips, F. R. Design. Engr., Toronto Harbour Commrs., 60 Harbour St., Toronto. (A.M.1921. M.1940)
Phillips, Frederick R. Chief Engr., A. Pearson, Cons. Strl. Engr., Vancouver, B.C. For mail: 4626 W. 3rd Ave. (S.1930. Jr.1938. M.1945)
Phillips, George L. Hamilton Bridge Co., 195 W. First Ave., Vancouver, B.C. (M.1942)
Phillips, H. J. D. Irving Ltd., Buctouche, N.B. (M.1942)
Phillips, Herbert F. Engrg. Dftsmn., Can. Bridge Co., Windsor, Ont. (S.1945)
Phillips, John B. Prof. Chem. Engrg., McGill University, Montreal. (Jr.1927. A.M.1934 M.1940)
Phillips, Roy A. Asst. Switchgr. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 230 Aylmer St. (S.1940. Jr.1946)
Phillips, R. E. Elec. Lieut., R.C.N.V.R., Instructor, University of Alberta, Edmonton, Alta. (S.1942. Jr.1944)
Phillips, Robt. Weston Sales & Service Engr., Bailey Meter Co., Montreal. For mail: P.O. Box 31, Chambly Canton, Que. (S.1931. Jr.1938. M.1945)
Phillips, Sidney Sales & Service, Engr. Diesel Divn., Dominion Engineering Co., Lachine, Que. (M.1941)

Phillips, W. Eric Pres., Duplate Canada Ltd. & Fibreglas Canada Ltd., Oshawa, Ont. (M.1944)
Phipps, Chas. F. Asst. Engr. of Transm. Line Design, Shawinigan Water & Power Co., Craig St. W., Montreal. (S.1924. Jr.1931. A.M.1938. M.1940)
Phoenix, Gerald L. Design Engr., C. D Howe Co., Cons. Engrs., Hamilton, Ont. For mail: 11 Forsythe Ave. S. (S.1942. Jr.1946)
Phomin, Barney Louis Asst. Engr., Harbours & Rivers, Dept. Public Works of Canada, Toronto. For mail: 229 Beatrice St. (S.1937. M.1946)
Phripp, C. Frank F/L, Test Pilot, R.C.A.F. For mail: 546 Huron St., Toronto 5. (S.1938. Jr.1946)
Picard, Marc A. 3677 St. Urbain St., Montreal. (S.1946)
Picard, Stan Mgr., Quebec Local Office, Unemployment Insurance Comm., 45 Blvd. Charest, Quebec. (A.M.1936. M.1940)
Piché, Arthur Asst. Engr., City of Quebec. For mail: 705 Royale Ave., Beauport, Que (Jr.1931. M.1941)
Piché, G. A. Mining Engr., Can. Johns-Manville Co., Asbestos, Que. (S.1945)
Piché, Gustave C. 3667 St. Hubert St., Montreal. (A.M.1913. M.1940)
Piché, Jean-Marie 3568 Marlowe Ave., Montreal 28. (S.1944)
Piché, Joseph Pierre Terrebonne, Que. (A.M.1899. M.1940)
Pichette, J. Jacques Mech. Engr., Trans-Canada Air Lines, Dorval. For mail: 4566 Hampton Ave., Montreal. (S.1941)
Pickard, James T. Trades Asst., Bldg. Mtce., University of Toronto. For mail: 7 Wolfrey Ave., Toronto. (S.1945)
Pickard, Norman S. 4400 Beaconsfield Ave., Montreal 28. (Affil.1944)
Pickard, T. D. P.O. Box 487, Sackville, N.B. (M.1942)
Pickering, A. E. Vice-Pres. & Mgr., Great Lakes Power Co., Sault Ste. Marie, Ont. (M.1921)
Pickering, John E. Utility Engr., Prodn. Control Dept., Polymer Corp., Sarnia, Ont. For mail: 209 North Vidal St. (S.1946)
Pickrell, W. J. Master Mech., N.B. Dist., Can. Pac. Rwy., Box 324, McAdam, N.B. (A.M.1919. M.1940)
Pidoux, John L. Strl. Designer, Dominion Bridge Co., Lachine. For mail: 4329 Walkley Ave., Montreal 28. (S.1930, Jr.1935. A.M.1938. M.1940)
Pierce, John G. Overseas (S.1941. Jr.1946)
Pierce, J. W. Ontario Land Surveyor, Bank of Commerce Bld., Peterborough, Ont. (M.1933)
Pierce, M. B. 1012 Melrose Ave., Saskatoon, Sask. (S.1946)
Piercy, A. K. Heating & Ventil. Engr., Green, Blankstein & Russell, Archs., Winnipeg, Man. For mail: 487 Campbell St. (S.1942. Jr.1946)
Piercy, Walter J. 9 Alwington Ave., Kingston Ont. (Jr.1938)
Piers, E. O. Temple 92 Birmingham St., Halifax, N.S. (S.1907. A.M.1913. M.1940)
Piette, Guillaume Engr., J. E. Ste. Marie, Contr., Quebec. For mail: 77 Manrèse St. (S.1938. Jr.1941)
Pigeon, André 1955 Des Carrières St., Montreal 35. (S.1944)
Pigeon, Paul 6440-1st Ave., Rosemount, Montreal 36. (S.1944)
Pigot, Chas. Hugh Res. Engr., Beauharnois Light, Heat & Power, Beauharnois, Que. (S.1924. A.M.1931. M.1940)
Pillman, R. A. 3792 West 33rd Ave., Vancouver B.C. (S.1946)
Pimenoff, C. J. 2045 Grey Ave., Montreal 28. (S.1931. A.M.1938. M.1940)
Pimenoff, V. J. 2045 Grey Ave., Montreal 28. (S.1945. Jr.1946)
Pinchbeck, G. R. Res. Highway Engr., Dept. Public Works, Edmonton, Alta. For mail: 11622-83th St. (Jr.1936. M.1941)
Pineau, Leo i/c Surveying, Sullivan Consolidated Mines, Sullivan Mines, Abitibi Co., Que. (M.1945)
Pineau, M. E. Indust. Sales Dept., Crane Co. Ltd., Montreal. For mail: 8838 St. Urbain St. (Jr.1932)
Pinet, Marcel Roads Dept. of Que. For mail: 283 Ave. Marguerite-Bouregois, Quebec. (M.1940)
Pinhey, C. H. Personal Investments, 63 Sparks St., Ottawa. (S.1887. A.M.1894. M.1940)
Pink, John F. Elec. Design, E. I. Du Pont De Nemours & Co., Wilmington. For mail: Y.M.C.A., Wilmington, Del., U.S.A. (S.1941. Jr.1945)
Pinsent, Ralph H. Millertown, Nfld. (S.1945)
Pinto, E. Arthur Transm. Engr., Standard Telephones & Cables Ltd., London. For mail: 32 Blenheim Gardens, London N.W.2, England. (M.1941)
Piper, Richard L. Engrg. Devlpt. Dept., Imperial Oil Ltd., Sarnia, Ont. For mail: 146 Cecil St. (M.1946)
Pippy, G. A. Supvr., Fuel Oil & Burner Dept., Imperial Oil Ltd., Halifax, N.S. For mail: 32 Inglis St. (M.1942)
Pippy, Wm. D. Engr., Nova Scotia Light & Power Co., Halifax, N.S. For mail: 105 LeMarchant St. (M.1943)
Pirnie, Malcolm Partner, Malcolm Pirnie, Engrs., 25 W. 43rd St., New York 18, U.S.A. (M.1945)
Pitcairn, John Engr. i/c Strl. Design, Aluminum Co. of Can., Montreal. For mail: 158-24th Ave., Lachine, Que. (M.1944)
Pitfield, Barclay W. Gen. Supt., Northwestern Utilities Ltd., Edmonton, Alta. For mail: 96 St. Georges Cres. (S.1933. Jr.1938. M.1940)
Pitman, D. L. 3926 W. 19th St., Vancouver, B.C. (S.1946)
Pittis, Ralph C. A. 18 Balmy Ave., Toronto. (Jr.1940)
Pitts, Clarence McL. Pres. & Gen. Mgr., People's Gas Supply Co. & Pitts Constrn. Co., 2 Mill St., Ottawa. (S.1913. A.M.1921. M.1940)
Pitts, Gordon McL. Arch. & Engr., 900 Sherbrooke St. W., Montreal. (S.1908. A.M.1914. M.1939)
Plamondon, Sarto Engr. i/c Divn. of Indust. Hygiene, Quebec Dept. of Health. For mail: 2267 Melrose Ave., Montreal 28. (S.1936. M.1940)
Plant, W. A. Res. Mgr., Abitibi Power & Paper Co., Smooth Rock Falls, Ont. For mail: P.O. Box 199. (A.M.1939. M.1940)
Plante, Walter Suptg. Engr., Massicotte et Fils Ltée., Cap de la Madeleine, Que. For mail: 298 Blvd. Madeleine. (S.1939. M.1945)
Platt, Peter L. W. 240 Cooper St., Ottawa. (S.1936. Jr.1940)
Plow, G. L. P. Divn. Engr., Can. Nat. Rwys., Union Station, Ottawa. (M.1946)
Plow, J. F. Treas. & Mgr., Chas. Warnock & Co., Montreal. For mail: 4870 Côte des Neiges Road. (S.1921. Jr.1928. A.M.1930. M.1940)
Plummer, Alex A. 850 Hastings St. W., Vancouver, B.C. (S.1907. Jr.1916. A.M.1920. M.1940)
Plummer, David K. 4930 Queen Mary Rd., Montreal. (S.1945)
Plummer, Wm. E. Asst. Engr., Dept. Public Works of Can., 36 Adelaide St. E., Toronto. (Jr.1919. A.M.1928. M.1940)
Poe, Alex. S. Asst. to Office Engr., Shawinigan Engrg. Co., 107 Craig St. W., Montreal. (S.1916. A.M.1926 M.1940)
Poirier, Cuthbert, Divn. Engr., Dept. Highways of Que., Ville-Marie Co., Temiskaming, Que. (M.1944)
Poirier, Jean Paul Divn. Engr., Dept. Roads of Que. For mail: 373 Notre-Dame St., Joliette, Que. (M.1946)
Poirier, Leo J. Design & Estimatg., Truscon Steel Co., 1117 St. Catherine St. W., Montreal. (S.1944. Jr.1945)
Poisson, Paul-Emile 1379 Laird Blvd., Town of Mount Royal, Que. (S.1944)
Poitevin, Louis M. 3407 Peel St., Montreal. (S.1942)
Poitras, Guy-A. Sr. Engr., Hydr. Resources, Dept. Lands & Forests, Quebec. For mail: 15 Hamel St. (S.1944. Jr.1946)
Poitras, Paul-E. Dir., Indust. Dept., Quebec Hydro-Elec. Comm., 107 Craig St. W., Montreal. (M.1937)
Poliskin, Jacob Oroya, Peru, South America. (S.1938. Jr.1946)
Pollard, R. Dist. Engr., Water Rights Br., Dept. Lands & Forests of B.C., Box 330, Nelson, B.C. (M.1945)
Pollock, A. R. Prodn. Devlpt. & Engrg., Office Specialty Mfg. Co., Newmarket, Ont. (Affil.1940. Jr.1941)
Pollock, F. J. Engrg. Dept., Can. Bridge Co., Walkerville, Ont. (M.1939)
Pontbriand, Edmond Mech. Engr., Woodlands Section, Price Bros. & Co., Chicoutimi. For mail: 124 George St., Sorel, Que. (S.1942)
Poole, G. E. Constrn. Engr., Poole Constrn. Co., Edmonton, Alta. For mail: 10412-133rd St. (S.1943. Jr.1946)
Poole, John E. Constrn. Engr., Poole Constrn. Co., Tegler Bldg., Edmonton, Alta. (S.1937. Jr.1943)
Poole, Wm. H. 4082 W. 8th Ave., Vancouver, B.C. (S.1946)
Pooler, G. Douglas Dftg. Supvr., Inspection Board of Canada, Ottawa. For mail: 348 Riverdale Ave. (S.1928. Jr.1937. M.1941)
Pope, F. R. Asst. Supt., Western Clock Co., Peterborough, Ont. (S.1933. Jr.1940. M.1945)
Pope, J. M. Elec Supt, Baie Comeau Mill, Quebec North Shore Paper Co. For mail: Baie Comeau, Que. (S.1927. Jr.1937. M.1941)
Porcheron, Alphonse D. 3675 Ste. Famille St., Montreal. (S.1904. A.M.1912. M.1940)
Portas, John Overseas. (A.M.1927 M.1933)
Porteous, J. W. Assoc. Prof. Elec. Engrg., University of Alberta, Edmonton, Alta. (S.1929. Jr.1934. M.1944)
Porter, A. D. A. D. Porter Assoc., 39 Duchess St., Toronto 2. (A.M.1910. M.1940)
Porter, C. J. Elec. Engr., Steel Co. of Can., Hamilton, Ont. (M.1944)
Porter, Earle F. Radio Divn., Dept. of Transport, Hunter Bldg., Ottawa. (S.1939. Jr.1946)
Porter, John W. 339 Academy Road, Winnipeg, Man. (S.1902. A.M.1910. M.1918)
Porter, Sam G. Chairman, Advisory Cte., Dept. Natural Resources, Can. Pacific Rwy. For mail. 2729 Wolfe St., Calgary, Alta. (M.1914)
Porter, Wm. C. Test Studt., Can. Gen. Elec. Co., Peterborough. (S.1943)
Porter, Wm. D. A. D. Porter Assoc., Toronto. For mail: 39 Duchess St. (S.1942)
Porter, Wm. Thompson Mech. Engrg. & Devlpt., Provincial Engrg. Ltd., Niagara Falls, Ont. For mail: 1557 Byng Ave. (A.M.1930. M.1940)
Portugais, J. Maurice Mgr., Delorimier Constrn. Ltd., 3074 Lacombe Ave., Montreal. (M.1946)
Porter, Russell E. City Engr., City Hall, New Westminster, B.C. (M.1940)
Pottinger, Alexander Engr., Can. Westinghouse Co., Hamilton, Ont. For mail: 281 Park Row S. (Jr.1930. M.1940)
Pottruff, Walter A. Jr. Engr., Hydro Elec. Power Comm., Toronto. For mail: 67 Lowther Ave. (S.1946)
Potts, Gerald A. Foreman, Tape Prodn., Canadian Durex Abrasives Ltd., Brantford. For mail: 420 Colborne St., Brantford, Ont. (Jr.1945)
Potts, W. H. 286 York St., Kingston, Ont. (S.1946)
Poudrier, L. P. Res. Engr., Sherbrooke Dist., Dept. Public Works, Parliament Bldg., Quebec. (A.M.1936. M.1940)
Pouliot, Adrien Dean, Faculty of Science, Laval University, Blvd. de l'Entente, Quebec. (M.1942)
Pouliot, G. A. 4270 St. Hubert St., Montreal. (S.1942)
Pouliot, Jean (S.1944)
Pouliot, Jean-Louis Village Montmorency, Que. (S.1944. Jr.1946)
Pouliot, P. L. Teaching, Ecole Polytechnique, Montreal. For mail: 58 Sherbrooke W. (S.1936. Jr.1940)
Pounder, John A. Gen. Exec. Asst., Surveys & Engrg. Br., Dept. Mines & Resources, Cartier Bldg., Ottawa. (A.M.1923. M.1940)
Pounder, T. J. Flintcote Co. of Canada, Toronto. For mail: 159 Burnhamthorpe Rd., Islington, Ont. (A.M.1931. M.1940)
Powell, D. A. 806-8th Ave. N., Saskatoon, Sask. (S.1946)
Powell, George G. Commr. of Works & City Engr., City Hall, Toronto. (A.M. 1907. M.1913)
Powell, J. G. Asst. Engr., Gore & Storrie, Cons. Engrs., Toronto. For mail: 62 Fairlawn Ave. (S.1932. Jr.1936. M.1942)
Powell, Morley V. Mech. Design of Elec. Motors, Can. Gen. Elec. Co., Peterborough, Ont. For mail: 370 London St. (S.1921. Jr.1925. A.M.1930. M.1940)
Powell, Robt. M. Tech. Sales Rep., Can. Industries Ltd., P.O. Box 10, Montreal. (S.1935. Jr.1946)
Powell, Wm. Hall Engr., Greater Vancouver Water Dist. & Joint Sewerage & Drainage Board, Sun Bldg., Vancouver, B.C. (S.1907. A.M.1913. M.1918)
Power, Donald J. 136 Quinpool Road, Halifax, N.S. (S.1946)
Power, H. E. 117 Kline St., Halifax, N.S. (S.1944)
Powers, John W. Jr. Engr., Mech. Mtce., Consolidated Paper Corp., Laurentide Inn, Grand'Mère, Que. (S.1944)
Pradl, George Asst. to Works Mgr., Can. Copper Refineries Ltd., Montreal. For mail: 4396 Coolbrooke Ave. (M.1942)
Pratley, P. L. Cons. Engr., 1117 St. Catherine St. W., Montreal. (S.1907. A.M.1909. M.1917)
Pratt, F. M. Mill Engr., Anglo-Newfoundland Development Co., Grand Falls, Nfld. (A.M.1919. M.1927)
Pratt, James C. Man. Rep., Resch. & Devlpt., Dept. of Reconstruction, Winnipeg, Man. For mail: 177 Waverly St. (S.1942. Jr.1944)
Preboy, Jos. Wm. Chief Surveyor, Eldorado Mining & Refining Ltd., Magee Bldg., Edmonton, Alta. (S.1942. Jr.1945)
Préfontaine, Rolland Pres. Solex Co. Ltd., 4060 St. Lawrence Blvd., Montreal. (S.1903. A.M.1911. M.1940)
Prendergast, R. M. Mgr., Appar. Divn., Can. Gen. Elec. Co., Ottawa. For mail: 205 Faraday St. (A.M.1930. M.1940)
Prénoveau, J. J. 2261 Panet St., Montreal 24. (S.1945)
Presky, Albert G. 492 Powers St., Winnipeg, Man. (S.1945)
Presner, Jos. Sales Engr., Consolidated Engines & Machinery Co., Montreal. For mail: 4727 Maplewood Ave. (M.1945)
Preston, Wm. Walford Head, Engr. Drawg. & Descript. Geom., University of Alberta, Edmonton, Alta. (S.1935. Jr.1938)
Prévost, J. Edouard Devlpt. & Design. Engr., Beauharnois Power Co., Beauharnois, Que (S.1920. Jr.1924. A.M.1932. M.1940)
Price, Chas. A. Chief, Precise Water Levels Divn., Hydrog. Service, Dept. Mines & Resources, Ottawa. (A.M.1921. M.1940)
Price, Douglas A. Jr. Engr., Abitibi Power & Paper Co., The Inn, Smooth Rock Falls, Ont. (S.1946)
Price, Frank O. University of New Brunswick, Fredericton, N.B. (S.1945)
Price, G. J. Works Mgr., Shaw St. Plant, Dominion Bridge Co., Toronto. For mail: 30 Haddon St. (M.1942)
Price, Jacques, Lunenburg, N.S. (M.1942)
Price, J. L. E. Pres. & Gen. Mgr., J. L. E. Price & Co., 680 Sherbrooke St. W., Montreal. (M 1932)

Price, Malcolm M. Divn. Engr., Can. National Rwys., Edmonton, Alta. For mail: 8621-117th Ave. (M.1942)
Price, Paul S. Constrn. Supvr., Housing Enterprises Ltd., Brockville, Ont. (S.1946)
Price, Stanley R. 65 Spruce St., Sault Ste. Marie, Ont. (S.1946)
Price, T. E. Engr., Mtce. of Way, Westn. Lines, Can. Pacific Rwy., Winnipeg, Man. For mail: 587 Stradbrooke Ave. (S.1906. A.M.1912. M.1940)
Prieur, Henri Engr. i/c West Sec., Waterworks & Sewerage, City of Montreal. For mail: 5634 Canterbury Ave. (S.1911. Jr.1916. A.M.1926. M.1940)
Prifogle, J. S. 620 S. W. "A" St., Richmond, Ind., U.S.A. (S.1946)
Pringle, Geo. H. Chief Engr. of Pulp & Paper Mill, Chillicothe Divn. of The Mead Corp. For mail: 244 Caldwell St., Chillicothe, Ohio, U.S.A. (S.1923. Jr.1927. A.M.1936. M.1940)
Pringle, John Pres., John E. Pringle Co., 475 Fifth Ave., New York 17, U.S.A. (S.1915. Jr.1919. A.M.1920. M.1940)
Printz, Carl J. 127 Delaware Ave., Toronto 4. (A.M.1925. M.1940)
Pritchard, Geoffrey R. Engr., Mining Dept., Candn. Allis-Chalmers Ltd., 212 King St. W., Toronto. (S.1937. M.1943)
Pritchard, Wm. R. Dist. Plant Supt., Bell Telephone Co., 1050 Beaver Hall Hill, Montreal. (M.1941)
Proctor, E. M. Cons. Engr., Proctor, Redfern & Laughlin, Toronto. For mail: 177 Inglewood Drive. (A.M.1916. M.1928)
Proctor, G. E. M. Jr. Engr., Proctor, Redfern & Laughlin, 36 Toronto St., Toronto. (S.1944)
Proctor, J. B. C. Proj. Engr., Canadian Gypsum Co., Windsor, N.S. (M.1944)
Proctor, R. Peter Armdale, Halifax Co., N.S. (S.1946)
Prokopy, Peter J. Water Resources of Alta., Edmonton, Alta. (S.1937. Jr.1946)
Proudfoot, Chas. A. Supvr. Airways Engrg., Trans-Canada Air Lines, Stevenson Airport, Winnipeg, Man. (M.1940)
Proudfoot, Robt. G. Demonstrator, University of Alberta, Edmonton. For mail: Chinook, Alta. (S.1946)
Proudfoot, W. B. Elec. Engr., Railway & Power Engrg. Corp., Montreal. For mail: 4535 Coolbrooke Ave. (A.M.1939. M.1940)
Proulx, Gilbert Supt., Saguenay Electric Co., Chicoutimi, Que. (S.1938. Jr.1942)
Proulx, J. N. 105 Calixa Lavallee, Quebec. (S.1941. Jr.1946)
Provan, James T. Mech. Engr., Aluminum Co. of Can., Kingston, Ont. For mail: 115 Collingwood St. (S.1946)
Provencher, Léo-Paul Dist. Engr., Que. Drainage Bureau, Rimouski, Que. For mail: P.O. Box 629. (S.1944. Jr.1946)
Provias, Peter J. 8 St. Joseph St., Toronto 5. (S.1942)
Provost, Roger 4027 Harvard Ave., Montreal. (S.1938. Jr.1946)
Prud'homme, L. A. Elec. Engr., Beauharnois Light, Heat & Power Co., P.O. Box 100, Beauharnois, Que. (S.1939. M.1945)
Prud'homme, Michael A. Mech. Engr., Dominion Dump Car Co., Montreal. For mail: 777 Bloomfield Ave. (M.1945)
Pruneau, Amédée Asst. to Sec. Engr., Waterworks & Sewerage, City of Montreal. For mail: 82 St. Joseph Blvd. W. (S.1943)
Pryde, J. Morrison 1721-13th St. W., Calgary, Alta. (S.1945)
Publicover, Lloyd David Field Engr., Candn. Stebbins Engrg. & Mfg. Co., Drummond Bldg., Montreal. (M.1946)
Puddester, Robt. P. Asst. Engr., Mtce. of Way, Newfoundland Railway. For mail: 306 LeMarchant Rd. W., St. John's, Nfld. (Affil.1940)
Pue-Gilchrist, A. C. 375 Alfred St., Kingston, Ont. (S.1941. Jr.1946)
Pugh, Wm. L. Asst. Chief Engr., Aluminum Co. of Canada, Sun Life Bldg., Montreal. (M.1945)
Pullar, Jas. Asst. Engr. of Bldgs., Can. National Rlwys., Moncton, N.B. (M.1942)
Pumple, F. G. 76 Kennedy St., Saint John, N.B. (S.1940. Jr.1946)
Purdie, Wm. McLeod 94 Cedar Ave., Shawinigan Falls, Que. (S.1944)
Purdy, Clayton C. Jr. Engr., Dominion Engrg. Works, Lachine, Que. For mail: 705-3rd Ave. (S.1943. Jr.1946)
Purdy, Harold C. Supt. Engr., Maritime National Fish, Divn. of National Sea Prod. Ltd., Halifax. For mail: Bedford, N.S. (S.1945)
Purser, Ralph B. 159 Collingwood St., Kingston, Ont. (S.1946)
Purser, Ralph Clinton 211-5th Ave., Ottawa, Ont. (A.M.1919. M.1940)
Purves, Wm. F. Electric Tamper & Equipment Co., 1440 St. Catherine St. W., Montreal. (S.1935. M.1941)
Putnam, James M. Mtce. & Repairs, Canada Packers Ltd., St. Boniface. For mail: 42 Claremont Ave., Norwood, Man. (S.1946)
Pybus, Ralph C. West. Mgr., Commonwealth Constrn. Co., 700 Taylor St., Vancouver, B.C. (S.1920. Jr.1923. A.M.1930. M.1940)

Q

Quance, Richard A. Asst. Foreman, Instmt. & Elec. Dept., Canadian Synthetic Rubber Ltd., Sarnia, Ont. For mail: 138 Crawford St. (S.1944)
Quevillon, Olivier R. L. A. Plant Engr., Aircraft Divn., Can. Car & Foundry, Montreal. For mail: 4740 Adam St. (M.1945)
Quintal, Robt. Engr., Soils Dept., Que. Dept. of Highways, Govt. House, Quebec. (S.1938. M.1945)
Quinn, O. C. Bergerville, Que. (Jr.1937)
Quirk, E. T. 3992 W. 13th St., Vancouver, B.C. (S.1946)
Quirk, Raymond W. Mfg. Methods Engr., Northern Electric Co., Montreal. For mail: 1107-4th Ave., Verdun, Que. (S.1943. Jr.1946)
Quist, Jack Ernest Elec. Dftg., Candn. Comstock Co., Montreal. For mail: 11301 Patricia Ave., Ville St. Laurent, Montreal. (S.1942. Jr.1945)

R

Rabb, Arthur H. Asst. Highways Engr., Ont. Dept. of Highways, Kenora, Ont. (A.M.1940. M.1940)
Rabut, Jacques Charles Rabut & Cie., 27 rue Cambacéres, Paris 5e, France (Hon.M.1937)
Racey, H. John Gen. Mgr., Cresswell Roll Forming Co. & Cresswell Pomeroy Ltd., 2150 Oxford Ave., Montreal. (S.1928. Jr.1931. A.M.1938. M.1940)
Racicot, Félix Saint-Roch Co., Richelieu, Que. (M.1946)
Racicot, Jacques Tech. Dept., City of Montreal. For mail: 2699 Joliette St. (S.1938. Jr.1941. M.1945)
Racine, Réjean, W. 1522 Comox St., Vancouver, B.C. (S.1946)
Radley, P. E. Mgr., Smelter Divn., Aluminum Co. of Can., Sun Life Bldg., Montreal. (M.1943)
Rae, Wm. Chief Inspr. of Equipt., Dept. Rlys. of B.C., Vancouver, B.C. For mail: 5838 Churchill St. (M.1936)
Rahilly, Thos. F. Jr. Asst. Supt., Mech. Dept. Algoma Steel Corp., Sault Ste. Marie, Ont. For mail: 174 Pim St. (Jr.1941)
Raidel, Isaac S. Personnel Engr., Robinson St. Divn., MacDonald Bros. Aircraft, Winnipeg, Man. For mail: 76 Lusted St. (M.1945)
Rainville, Guy 274 de l'Epée Ave., Outremont, Que. (S.1944)
Raley, Charles 704 Raycide Ave., Burnaby, New Westminster, B.C. (A.M.1921. M.1940)
Ralph, Harold D. R.R. No. 4, Kemptville, Ont. (S.1943. Jr.1946)
Ramore, Wm. D. Overseas. (S.1941. Jr.1946)
Ramsay, Donald A. Jr. Engr., Hdryo Elec. Power Comm. of Ont. For mail: 118 Maple St., S., Timmins, Ont. (S.1946)
Ramsay, Wm. Dist. Engr., Dept. Public Works of B.C. For mail: 157 Nicola St. W., Kamloops, B.C. (A.M. 1920. M.1940)
Ramsay, W. Beattie, Contr. & Engr., Box 86, Regina, Sask. (M.1941)
Ramsay, Wm. Wallace Hydraul. Engr., Water Resources Br., Dept. Mines & Resources of Manitoba. For mail: 4 Lovat Apts., Winnipeg, Man. (Jr.1937. M.1941)
Ramsdale, Donald O. D. Dist. Mgr., English Elec. Co. of Canada, 22 Lebel St., Kirkland Lake, Ont. (S.1933. M.1943)
Ramsey, T. A. Field Engr., Foundation Co. of Ont., Thorold. For mail: 367 Indian Grove, Toronto 9. (S.1945)
Randall, Norman 132 Ossington St., Ottawa. (S.1944)
Randle, Harold Elec. & Waterworks Engr., Calgary Power Co., Insurance Exchange Bldg., Calgary, Atla. (M.1941)
Randlesome, H. G. Constrn. Mgr. & Chief Engr., Dept. of Reconstruction of Sask., Normal School Bldg., Regina, Sask. (M.1946)
Range, G. N. Works & Bldg. Mgr., Dept. Veterans Affairs, Portage La Prairie. For mail: Inglis Apts., Winnipeg, Man. (M.1944)
Rankin, Garnet Strl. Engr., Engrg. & Constrn. Serv., Dept. Mines & Resources, Ottawa. (S. 1914. A.M.1921. M.1940)
Rankin, Orla J. F. 101 College St., Kingston, Ont. (S.1939)
Rankin, Robt. A. Partner, Robt. A. Rankin & Co., Cons. Indus. Engrs., 1420 Sherbrooke St. W., Montreal (M.1941)
Rankine, D. F. Box 224, University Residence, Fort Garry, Winnipeg, Man. (S.1946)
Rannie, J. Leslie Geodetic Survg., Dept. Mines & Resources, Ottawa. (A.M.1918. M.1922)
Ransom, G. Edgar Jr. Elec. Engr., Beauharnois Light, Heat & Power Co For mail: 74 Leduc St., Beauharnois, Que. (Jr.1946)
Rapley, B. P. Res. Engr., Imperial Oil Ltd., Montreal East. For mail: 21 Marien Ave. (S.1922. Jr.1927. A.M.1934. M.1940)
Raskin, Franz J. M. Pres., F. J. Raskin Inc., 370 Rachel E., Montreal. (M.1945)
Rattenbury, D. J. Chief Dftsmn., Can. Sumner Iron Works. Vancouver, B.C. For mail: 3576 W. 3rd Ave. (Jr.1946)
Ravary, L. Robert Constrn. & Mtce. Engr., Brown Corp., LaTuque, Que. For mail: 102 Real St. (S.1938. Jr.1946)
Ravenor, M. A. Res. Engr., Air Ministry, Hullavington Aerodrome, Wilts., Eng. For mail: Hardenhuish, Chippenham, Wilts., England. (M.1929)
Rawlins, J. W. 27 Ava Road, Toronto. (M.1941)
Ray, Louis Wm. Hydraul. Design, Can. & General Finance Co., Toronto. For mail: 273 Danforth Ave. (S.1943. Jr. 1946)
Ray, W. R. Sales Engr., Can. Fairbanks Morse Co., Quebec. For mail: 62 Preston Ave. (A.M.1932. M.1940)
Rayment, Arthur Chas. Cons. Engr., 133 Westminster Place, Montreal West 28. (M.1938)
Raymond, A. Vice-Pres. & Gen. Mgr., Intnl. Braid Co. of Canada, Ste. Rose de Laval, Que. (M.1946)
Raymond, James D. 4877 Lacombe Ave., Montreal. (S.1946)
Raymond, Jean M. Pres., Raymond Hardware Ltd., 658 Craig St. W., Montreal. (M.1945)
Rayner, Geo. W. Pres., Rayner Constrn. Ltd., Toronto. For mail: 92 MacLennan Ave. (M.1920)
Raynor, Warren S. Cons. Engrg., Brian R. Perry, Cons. Engr., Montreal. For mail: 1270 Regent Rd., Town of Mount Royal, Que. (Jr.1941)
Read, F. C. 11 Bernard Ave., Toronto 5. (S.1938. Jr.1942)
Read, H. E. Design & Engrg., City of Montreal, and W. S. Lea, Cons. Engr., 1226 University St., Montreal. (M.1945)
Read, H. W. Sackville, N.B. (S.1907. A.M.1913. M.1940)
Rebin, P. M. Design Engr., Vulcan Iron Works Ltd, Winnipeg, Man. For mail: 115 Kennedy St. (S.1939. Jr.1946)
Redding, J. Malcolm Elec. Engr., New Brunswick Power Co., Saint John, N.B. For mail: 37 Leinster St. (M.1944)
Redfern, C. R. Pres., Redfern Constrn. Co., Excelsior Life Bldg., Toronto. (M.1931)
Redfern, W. B. Proctor, Redfern & Laughlin, Cons. Engrs., Toronto. For Mail: 458 Russell Hill Rd. (A.M.1920. M.1930)
Redman, W. B. Asst. Engr., Can. National Rwys., Toronto. For mail: 25 Harding Blvd. (S.1914. Jr.1919. A.M.1921. M.1940)
Reed, John Chief Engr., Strl. Steel Dept., St. John Dry Dock & Shipbuilding Co. For mail: 31 Waterloo St., Saint John, N.B. (M.1942)
Reed, W. A. Teaching, University of Saskatchewan. For mail: 439 Ave. C. South, Saskatoon, Sask. (S.1946)
Reeder, W. F. Demonstrator, University of Saskatchewan, Saskatoon. For mail: Alsask, Sask. (S.1944)
Reekie, W. G. Asst. Chief Engr., Abitibi Power & Paper Co., 408 University Ave., Toronto. (S.1924. Jr.1927. A.M.1936. M.1940)
Rees, D. B. 10706-81st Ave., Edmonton, Alta. (M.1941)
Rees, Frederick Mining Engr. & Rep., Dominion Steel & Coal Corp., Bathurst Iron Mine. For mail: Wabana, Nfld. (S.1935. Jr.1944)
Rees, Howard S. Resch. Aero. Engr., Air Transport Board, Ottawa. For mail: 391 Ashbury Place, Rockcliffe Park. (S.1928. A.M.1938. M.1940)
Reeve, David D. Asst. Chief Dftsmn., Aluminum Co. of Canada, Montreal. For mail: P.O. Box 33, Beauharnois, Que. (Jr.1940. M.1943)
Reevely, F. R. Prodn. Supt., Power Tube Divn., Rogers Radio Tubes Ltd., Toronto. For mail: 21 Murrie St., Mimico, Ont. (Jr 1932. A.M.1939. M.1940)
Regan, Francis E. Ont. Br. Mgr., Bepco Canada Ltd., 45 Niagara St., Toronto 2. (Jr.1930. A.M.1939. M.1940)
Regimald, Gilles 6282 St. Vallier St., Montreal 10. (S 1944)
Reid, Alexander MacLaren Dist. Engr., Dept Public Works of Alta., Parliament Bldgs., Edmonton, Alta. (A.M.1939. M.1940)
Reid, Anthony M. Gen. Supvr., Job Evaluation, Bell Telephone Co., Beaver Hall Bldg., Montreal. (S.1919 Jr.1925. A.M.1927. M.1940)
Reid, Edwin C. Plant Engr., Canadian Gypsum Co., Hillsboro, Albert Co., N.B. (S.1944)
Reid, Frederick Blair Geodetic Survey, Dept. Mines & Resources, Ottawa. (M.1919)
Reid, Fraser Daniel. (M.1919)
Reid, G. C. Res. Engr., Dept. Highways of N.S., Halifax, N.S. For mail: 328 Gottingen St. (A.M.1919. M.1940)
Reid, George G. Sales & Service, Priv. Prac., Halifax, N.S. For mail: 34 Regina Terrace (M.1942)
Reid, John A. Cons. Mining Engr., 60 Front St. W., Toronto. (M.1919)
Reid, John H. Gen. Mgr., Trinidad & Tobago Elec. Comm., P.O. Box 121, Port-of-Spain, Trinidad. B W.I. (Jr.1919. A.M.1924. M.1936)
Reid, James M. Mech. Engr., Ford Motor Co. of Can., Windsor, Ont. For mail: 1589 Hall Ave. (S.1944)
Reid, J. M. Res. Engr., Dept. Public Works of Que. For mail: 405 St. Cyrille St., Quebec. (A M.1936. M.1940)
Reid, Kenneth Elec. Engr. & Supt. Street Lighting, City Hall, Victoria, B.C. (S.1924 Jr.1929. A.M.1940. M.1940)

Reid, Robt. Arthur Mech. Design., Dominion Bridge Co, Lachine. For mail: 5546 Decelles Ave., Montreal 26. (S.1942. Jr.1946)

Reid, W. J. W. Vice-Pres., Otis-Fensom Elevator Co., Victoria Ave. N., Hamilton, Ont. (S.1920. A.M.1929. M.1940)

Reid, Wm. Murray 559 Grosvenor Ave., Westmount, Que. (S.1887. A.M.1895. M.1940)

Reid, W. T. Pres., Crude Oil Engine & Engrg. Co., University Tower, Montreal. (M.1937)

Reikie, M. K. T. Supt. of Resch., Hudson Bay Mining & Smelting Co., Flin Flon, Man. (S.1932. A.M.1939. M.1940)

Reikie, W. T. T. (S.1936. Jr.1946)

Reinhardt, G. V. Dftsmn., Aluminum Co. of Canada, Arvida, Que. For mail: 827 First St. (S.1932. Jr.1937. M.1942)

Relyea, J. D. Overseas. (M.1937)

Remine, Harold H. Supt. Elec. Distrbn., Quebec Hydro-Elec. Comm., 107 Craig W., Montreal. (M.1945)

Rempel, Cornelius Jr. Engr., Manitoba Paper Co., Pine Falls, Man. (S.1944)

Remus, F. R. 542 Miller St., Pembroke, Ont. (S.1941. Jr.1946)

Renaud, Robt. 5035 des Sorbiers St., Montreal. (S.1942)

Rennie, Robt. Marine Surveyor, Lloyd's. Register of Shipping, Marine Bldg., Vancouver, B.C. (M.1942)

Renouf, Eric R. Office Engr., Foundation Co. of Ont., Toronto. For mail: 78 Banff Rd. (S.1946)

Renouf, E. T. 36 Upper Bellevue Ave., Westmount, Que. (S.1923. A.M.1936. M.1940)

Reside, J. W. Dept. Highways of N.S., P.O. Box 828, Yarmouth, N.S. (M.1940)

Rettie, James R. Proj. Engr., Manitoba Dept. Mines & Resources, Winnipeg, Man. For mail: 1220 Strathcona St. (Jr.1938. M.1943)

Reynaud, Julien Claude Jr. Engr., Mtce. Dept., Dominion Industries Ltd., Chalk River. For mail: Staff Hotel, Deep River, Ont. (S.1946)

Reynolds, G. K. Engr., Wire & Cable Mfg., Northern Electric Co., Montreal. For mail: 1321 Graham Blvd. (S.1935. Jr.1946)

Reynolds, J. A. Aluminum Co. of Canada, Montreal. For mail: 3-11th Ave., St. Eustache sur le Lac, Que. (M.1941)

Reynolds, J. Russell Mtce. Engr., Imperial Oil Ltd., Halifax, N.S. For mail: 68 Connaught Ave. (M.1945)

Reynolds, John W. Engr., Consolidated Mining & Smelting Co., Kimberley, B.C. (Jr.1943)

Reynolds, Theo. Chief Examiner & Inspector of Boilers, Quebec Dept. of Labour, 88 St. James St. E., Montreal. (Affil.1943)

Reynolds, W. M. Asst. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 106 Laird Drive S. (S.1920. A.M.1926. M.1940)

Rhodes, Donald Dist. Plant Supt., East. Dist., Bell Telephone Co., 87 Ontario St. W., Montreal. (S.1926. A.M.1935. M.1940)

Rhodes, Edward L. Insptg. Engr. i/c Demolition, Surplus Property Divn., War Assets Corp., Nobel, Ont. (S.1940. Jr.1946)

Rhodes, Ernest S. Mech. Engr., Heaps Engrg. Ltd., New Westminster, B.C. For mail: 120-7th Ave. (S.1946)

Rhodes, F. N. Chief Instructor in Elec., Alberta Institute of Technology & Art. For mail: 912-19th Ave. N.W., Calgary, Alta. (A.M.1928. M.1940)

Rhodes, Brig. Gen. Sir Godfrey Dean Cons. Engr., Sir Alexander Gibb & Partners, London, S.W.1. For mail: Summer Hill, Crowborough, Sussex, England. (M.1922)

Ricard, Julien 2018 Champlain St., Montreal. (S.1942. M.1945)

Rice, J. Donald International Petroleum Co., Negrittos, Peru, South America. (S.1935. Jr.1940)

Rice, Robt. MacNeill Indust. Serv. Engr., Imperial Oil Ltd., Halifax, N.S. For mail: 16 Kent St. (S.1944. Jr.1946)

Rice, Wm. B. Materials Handling, Northern Electric Co., Montreal. For mail: 7654 Broadway Ave., Ville LaSalle, Que. (S.1943. Jr.1946)

Rice, Walter L. Asst. Engr. of Water Distbn., Toronto Dept. of Works, 511 Richmond St. W., Toronto. (Jr.1933. A.M.1938. M.1940)

Richard, Adrien Roquet & Richard, Montreal. For mail: 5801 Ave. des Epinettes, Cité Jardin. (S.1939. M.1944)

Richards, Carl Price Asst. Resch. Engr., Bridge Dept., Oregon State Highways, Salem, Ore., U.S.A. (A.M.1917. M.1940)

Richards, Edward Green (A.M.1919. M.1940)

Richards, G. H. City Engr., Brantford, Ont. (M.1941)

Richards, H. J. B. Plant Engr., Chatco Steel Products Ltd., Chatham, Ont. (Jr.1936)

Richards, J. L. 303 University Ave., Kingston, Ont. (S.1943. Jr.1946)

Richards, Vincent Llewellyn, 508 Markham St., Toronto 4. (S.1946)

Richardson, Frank C. Metlgl. Engr., Aluminum of Canada, Shawinigan Falls, Que. (M.1944)

Richardson, Geo. W. Chassis Engr., Ford Motor Co. of Canada, Windsor, Ont. For mail: 1262 Chilver Road. (S.1940. Jr.1943)

Richardson, John M. Elec. Engr., Southern Canada Power Co., 355 St. James St. W., Montreal. (M.1942)

Richardson, K. Grant Jr. Engr., Trng. Course, Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 67 Lowther Ave. (S.1944)

Richardson, Kent N. 3460 Rosedale Ave., Montreal 28. (S.1945)

Richardson, Roderick M. Gen. Plant Mgr., New Brunswick Telephone Co., Saint John, N.B. (S.1922. Jr.1926. A.M.1930. M.1940)

Richer, Jean H. Lieut. (E), R.C.N.V.R., Asst. Staff Officer, Appointments & Records. For mail: 708 Victoria Ave., Westmount, Que. (Jr.1946)

Richman, Harold 524 Mountain Ave., Winnipeg, Man. (S.1946)

Ricker, Herbert A. Mech. Engr., Can. Westinghouse Co., Hamilton, Ont. For mail: 81 Victoria Ave. N. (M.1928)

Riddell, Arthur G. Cons. Engr., 73 Proctor Blvd., Hamilton, Ont. (S.1907. A.M.1913. M.1940)

Riddell, John Morrison Dist. Supvr. of Triangulation, Geodetic Survey of Canada, Dept. Mines & Resources, Ottawa. For mail: 21 Findlay Ave. (M.1942)

Riddell, W. F. Asst. Prof., Dept. of Engrg., University of Manitoba, Winnipeg, Man. For mail: 42 Dundurn Place. (S.1922. Jr.1928. M.1936)

Rider, Ezra B. Engr., Metropolitan Water Dist. of Southn. Calif., 306 West Third St., Los Angeles B., Calif., U.S.A. (S.1907. A.M.1913. M.1940)

Ridgers, A. C. Chief Dftsmn., Consolidated Mining & Smelting Co., Trail. For mail: Box 176, Rossland, B.C. (Jr.1929. A.M.1935. M.1940)

Ridler, Arthur A., Jr. 20 Browside Ave., Toronto. (S.1946)

Ridley, Edmund N. Supt. Opern. & Mtce., West. Sec., Irrigation Project, Can. Pacific Rly. For mail: 1986 West 35th Ave., Vancouver, B.C. (S.1905. A.M.1909. M.1929)

Ridout, G. S. Bell Telephone Co., Beaver Hall Hill, Montreal. (A.M.1931. M.1940)

Ridout-Evans, G. W. F. Engr., Public Projects Br., Dept. Reconstruction, Ottawa. For mail: 66 Grove Ave. (S.1905. A.M.1912. M.1940)

Riehl, Wm. H. City Engr., City Hall, Stratford, Ont. (S.1919. A.M.1925. M.1940)

Riesen, Herman G. Hyd. Engr., P.F.R.A., Dom. Dept. Agric., McCallum Hill Bldg., Regina, Sask. (A.M.1939. M.1940)

Rigby, George P. Insptg. Highway Engr., N.B. Dept. Public Works, Fredericton. For mail: St. Croix Ave., St. Stephen, N.B. (M.1942)

Riggs, Henry Earle North Shore Hotel, Evanston, Ill., U.S.A. (M.1935)

Rigg-Story, Leslie Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 790 Eglinton Ave. W. (M.1943)

Rigsby, D. L. Interm. Engr., Aluminum Co. of Canada, Kingston, Ont. For mail: 85 Centre St. (S.1938. Jr.1946)

Riley, Thos. McDonald Engrg. Apptce., Can. Westinghouse Co., Hamilton, Ont. For mail: 163 Jackson St. W. (S.1945)

Rimmer, R. H. Mgr., Tech. Dept., Aluminum Co. of Canada, Sun Life Bldg., Montreal. (A.M.1935. M.1940)

Rindal, Harald Safety Dept., Workmen's Compensation Board of B.C., Vancouver. For mail: 1178 Nanton Ave. (M.1918)

Rinfret, Guy R. Gen. Supt., Shawinigan Engrg. Co. of Montreal. For mail: 426 Berwick Ave., Town of Mt. Royal, Que. S.1924. Jr.1927. A.M.1932. M.1940)

Ring, A. J. Strl. Design, H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S.1940. Jr.1943)

Ring, R. P. Engr., Devlpt. & Inspn., Moore Business Forms Ltd., Toronto. For mail: 157 Arlington Ave. (M.1946)

Riopelle, Robert 7086 St. Denis St., Montreal 10. (S.1944)

Rioux, Jean Gaston 3666 St. Hubert St., Montreal 24. (S.1944)

Rioux, J. H. René Asst. Dist. Engr., Quebec Dept. of Roads. For mail: 66 Blvd. Benoit XV, Quebec. (S.1936. Jr.1942)

Ripley, Blair Cons. Engr., 592 Sherbourne St., Toronto. (A.M.1907. M.1913)

Ripley, Chas. F. Hyd. Engr., P.F.R.A., Dom. Dept. of Agric., Soil Mechanics Lab., University of Saskatchewan, Saskatoon, Sask. (S.1943. Jr.1946)

Ripley, H. A. Davis Ripley & Associates, Williamson Bl., Edmonton, Alta. (S.1938. Jr.1941. M.1944)

Ripley, Howard A. Pres., Industrial Engineering Co., Halifax, N.S. For mail: 4 Armview Drive, Armadale P.O. (S.1930. M.1940)

Ripley, Wilfred J. Master Mech of Smelters, Intern. Nickel Co., Box 260, Copper Cliff, Ont. (A.M.1923. M.1926)

Risley, Wilfred C. Pres., Rico Engineering Ltd., Halifax. For mail: 180 Pleasant St., Dartmouth, N.S. (M.1944)

Rispin, W. E. A. 448 King St. W., Chatham, Ont. (S.1943)

Ritchie, Chris Elec. Engr., Montreal Engineering Co., 244 St. James St. W., Montreal. (Jr.1940)

Ritchie, D. W. Dist. Engr. of Highways, Dept. Public Works, Edmonton, Alta. For mail: 10958-80th Ave. (M.1941)

Ritchie, Hugh C. Town Engr., P.O. Box 398, Macleod, Alta. (S.1910. A.M.1913. M.1936)

Ritchie, J. N. Robb Engineering Works, Amherst, N.S. (M.1940)

Ritchie, Ross A. Asst. Chief Engr., Canada & Dominion Sugar Co., 1410 Montmorency St., Montreal. (S.1942. Jr.1946)

Ritchie, W. P. Engr., Foundation Co. of Canada. For mail: 145 George St., Fredericton, N.B. (S.1945)

Riva, R. H. 1922 Blodgett St., Houston, Texas, U.S.A. (S.1923. Jr.1928. A.M.1939. M.1940)

Rivest, Guy P. 6277 Christophe Colomb, Montreal 10. (S.1944)

Roach, R. B. Chief Operator, St. Margaret System, N.S. Power Comm., Upper Tantallon, Halifax Co., N.S. (M.1940)

Roast, Harold J. Vice-Pres. i/c Tech. Operations, Canadian Bronze Co., 999 Delorimier Ave., Montreal. (M.1932)

Robb, Chas. A. Prof. Mech. Engrg., McGill University, Montreal. (S.1908. A.M.1913. M.1923)

Robb, M. D. 42-20th St. W., Prince Albert, Sask. (S.1946)

Robert, André System Comn. Engr., Aluminum Co. of Canada, Shipshaw. For mail: 803-2nd St., Arvida, Que. (S.1938. M.1943)

Robert, René A. Lecturer Maths., Ecole Polytechnique, 1430 St. Denis St., Montreal. (M.1943)

Roberts, Alexander Mech. Engr., Can. & General Finance Co., 25 King St. W., Toronto. (A.M.1921. M.1940)

Roberts, Chas. Drury Jr. Engr. & Designer, Dept. Works of Toronto. For mail: 184 Albertus Ave., Toronto 12. (A.M.1921. M.1940)

Roberts, John D. Sales Engr., Farand & Delorme Ltd., Montreal. For mail: 817 Desmarchais Blvd., Verdun, Que. (Affil.1942)

Roberts, J. Frank Mgr. Hyd. Turbine Dept., Allis Chalmers Mfg. Co., West Allis, Wis., U.S.A. (A.M.1927. M.1940)

Roberts, P. B. 19 Everest Road, Eltham, S.E.9, England (M.1919)

Roberts, Wm. R. Supvr. Test Dept., Davenport Works, Can. General Electric Co., Toronto. For mail: 29 Robina St. (S.1945)

Robertson, Alex. K. Cons. Engr., Struan Lodge, Kaleden, B.C. (M.1914)

Robertson, Edward A. 984 W. 20th Ave., Vancouver, B.C. (S.1944)

Robertson, E. D. 3605 Cadboro Bay Rd., Victoria, B.C. (M.1941)

Robertson, E. E. 148 Hanna Road, Leaside, Ont. (M.1946)

Robertson, Gordon G. D. Dftsmn. & Designr., Surveys & Engrg. Br. Dept. Mines & Resources, Banff. For mail: 205-2nd St. W., Calgary, Alta. (S.1928. Jr.1936)

Robertson, Hugh c/o C. A. Robbins, Dist. Engr., Dept. Highways, Toronto. (A.M.1916. M.1940)

Robertson, James Mgr., Strl. Plant, Pacific Divn., Dominion Bridge Co., Vancouver, B.C. For mail: 5888 Adera St. (S.1913. A.M.1916. M.1935)

Robertson, James D. 940 Chestnut Road, Ladner, B.C. (S.1946)

Robertson, John F. P.O. Box 502, Copper Cliff, Ont. (S.1904. A.M.1912. M.1914)

Robertson, Randal K. Mgr., Laprairie Co. Inc., 660 St. Catherine W., Montreal. (A.M.1923. M.1940)

Robertson, R. M. i/c Shipbldg., Dominion Bridge Co., Lachine, Que. For mail: 3890 St. Joseph St. (Jr.1920. A.M.1927. M.1940)

Robertson, W. C. Morrison Knudsen Deo Brazil, Avenida Upiranga 795, Caixa Postal 245-8, Sao Paulo, Brazil, S.A. (S.1945)

Robertson, Wallace W. Alsask, Sask. (S.1945)

Robichaud, Fernand H. Technical Dept., City of Montreal. For mail: 3500 Durocher Ave. (S.1945)

Robillard, Louis Alfred Gen. Master Mech., Shawinigan Chemicals Ltd., Shawinigan Falls, Que. (M.1945)

Robillard, Richard F. Mgr. for Canada, H. G. Vogel Co. (Canada) Ltd., 1440 St. Catherine W., Montreal. (S.1930)

Robinson, A. 621A College St., Toronto. (S.1946)

Robinson, A. H. (S.1937. Jr.1946)

Robinson, C. T. M. Groundwood Supt., Consolidated Paper Corp., Shawinigan Falls, Que. For mail: 41 Maple Ave. (M.1941)

Robinson, D. O. Sales Engr., Tech. Dept., Canada Cement Co., Northern Ontario Bldg., Toronto. (A.M.1932. M.1940)

Robinson, Gordon Milford Asst. Engr., Canadian Bridge Co., Walkerville, Ont. (Jr.1938)

Robinson, J. A. L. Instr., University of Saskatchewan, Saskatoon. For mail: Cabri, Sask. (S.1946)

Robinson, Leonard H. 8th Line, Oakville, Ont. (A.M.1909. M.1927)

Robinson, M. C. 221-5th Ave., New Westminster, B.C. (S.1946)

Robinson, Paul G. Instrmn., Highway Divn., Dept. Public Works, Fredericton. For mail: R.R. No. 4, Woodstock, N.B. (S.1944)

Robinson, P. J. 1209 Ninth St .W., Calgary, Alta. (S.1945)

Robinson, Roy Clifton Divn. Engr., Can. National Rlys., P.O. Box 501, Dauphin, Man. (A.M.1919. M.1940)

Robinson, Wm. Cecil Elwood Asst. Dist. Engr., Ontario Dist., Can Pacific Rly., Toronto. For mail: 40 High Park Blvd. (Jr.1922. A.M.1926. M.1940)
Robinson, Wm. E. Waterworks Engr., Utility Bldg., Calgary, Alta. (M.1941)
Robinson, Wm. George 828 W. 69th Ave., Vancouver, B.C. (S.1945)
Roblin, H. L. Divn. Engr., Can. National Rwys., Union Station, Regina, Sask. (A.M.1919. M.1940)
Robson, J. A. Creswell-Pomeroy Ltd., Montreal. For mail: 7312 Sherbrooke St. W. (S.1944)
Robson, Richard Christopher Chief Dftsmn., Arthur Pearson, Cons. Engr., Vancouver. For mail: 152 11th St. E., North Vancouver, B.C. (Jr.1932)
Roby, Marcus A. Oregon-Washington Rwy. & Navig. Co., Union Pacific System, Portland, Ore., U.S.A. For mail: 853 Pittock Block. (A.M.1909. M.1940)
Roche, Ivor F. Vipond-Tolhurst Co., Montreal. For mail: 64 Columbia Ave. (S.1913. A.M.1920. M.1940)
Roche, Maurice J. 175 Pearson Ave., Toronto. (S 1942. Jr.1946)
Rochester, Lloyd B. Mining Engr., Exploration, 529 Richmond Road, Ottawa. (S.1914. A.M.1925. M.1940)
Rochon, André Asst. to Chief Elec. Engr., Marine Industries Ltd., Sorel, Que. (S.1941. Jr.1945)
Rochon, H. P. 4404 Delormier Ave., Montreal 34. (S.1944)
Rockwell, D. J. Boiler Engr., Robb Engrg. Works Ltd., Amherst, N.S. For mail: 10 Melrose St. (M.1940)
Roden, B. A. V. Roe Co. of Canada, Malton, Ont. For mail: 275 Oriole Parkway, Toronto 12. (M.1946)
Roddick, J. O. Pres. & Gen. Mgr., Russell Constrn. Co., Harbour Commission Bldg., Toronto. (M.1944)
Rodger, N. Elliot Maj. Gen., Quartermaster, Canadian Army, Dept. Nat. Def., New Army Bldg., Ottawa. (S.1930. Jr.1935)
Rodger, Wm. Chief Dftsmn., Dept. Mines of N.S., Halifax. For mail: 270 Portland St., Dartmouth, N.S.
Rodman, M. Floyd Jr. Engr., Field Party Head, Hydro-Elec. Power Comm. of Ont., St. Catharines, Ont. For mail: 153 Thorold Rd. (S.1943. Jr.1946)
Rodwin, Stefan Chief Engr., Aircraft Divn., Can. Car & Foundry Co., Montreal. For mail: 2097 St. Luke St. (M.1945)
Roger, W. H. G. Elec. Cdr., R.C.N.V.R., Mgr. Elec. Engrg., H.M.C. Dockyard, Halifax, N.S. (M.1942)
Rogers, Alvah B. Elec. Engr. i/c Design & Instaln., Shawingan Engineering Co., Montreal. For mail: 4199 Hingston Ave. (A.M.1924. M.1940)
Rogers, C. H. 926 West Moreland St., Phoenix, Ariz., U.S.A. (S.1907. A.M.1909. M.1919)
Rogers, C.S.G. 164 Park St., Moncton, N.B. (A.M.1910. M.1940)
Rogers, Frank K. Dept. Chem. Devlpt., Shawinigan Chemicals Ltd., Craig St. W., Montreal. (S.1942. Jr.1946)
Rogers, Geo. H. Bell Telephone Co., Beaver Hall Hill, Montreal. (A.M.1927. M.1940)
Rogers, Hubert D. Asst. in Mtce. Dept., Aluminum Co. of Canada, Gananoque, Ont. For mail: P.O. Box 23. (S.1913. Jr.1922. M.1943)
Rogers, Howard W. Sales Engr., Can. Blower & Forge Co. & Canada Pumps Ltd., 630 Dorchester St. W., Montreal. (S.1931. M.1942)
Rogers, J. Douglas P.O. Box 185, St. Stephen, N.B. (S.1943. Jr.1946)
Rogers, John H. Engrg. Design, Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (Jr.1940)
Rogers, J. Victor Supt. Constrn. & Mtce., Consolidated Mining & Smelting Co., Trail, B.C. (Jr.1936. A.M.1939. M.1940)
Rogers, Patrick Frank 5916-20th Ave., Rosemount, Montreal. (S.1946)
Rogers, R. G. Overseas. (S.1940)
Roland, J. W. Steel & Concrete Design., Stadler, Hurter & Co., Montreal. For mail: 5258 Byron Ave. (M.1918)
Roles, Clemence Understudy to Foreman, Wm. Kennedy & Sons Ltd., Owen Sound, Ont. For mail: 288-4th Ave. E. (S.1946)
Rolfson, Orville Civil Engr. & Ont. Land Surveyor, Priv. Prac., Bartlett Bldg., Windsor, Ont. (S.1907. A.M.1912. M.1940)
Rolland, Lucien G. Engr. & Asst. Mgr., Rolland Paper Co., Mont-Rolland, Que. (S.1941. Jr.1944. M.1945)
Rolland, P. A. Lubricn. Engr., McColl-Frontenac Oil Co., Montreal. For mail: 5470 Notre Dame de Grace Ave. (S.1942)
Rollefson, M. O. Overseas. (Jr.1941)
Rolph, F. B. Supvg. Engr., Atlas Construction Co., Montreal. For mail: 4305 Broadway, Lachine, Que. (A.M.1937. M.1940)
Rome, Robert Deputy City Engr., Vancouver, B.C. For mail: 5891 Alma Road. (A.M.1918. M.1940)
Ronalds, I. F. Jr. Engr., Hydro Elec. Power Comm. of Ont., 620 University Ave., Toronto. (S.1941. Jr.1946)
Roncarelli, J. Angelo Major, D.E.M.E., M.D. No. 5, Quebec. For mail: 30 Street East, Charlesbourg, Que. (S.1938. Jr.1946)
Rondeau, Jean-Jacques Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1945)
Roney, G. V. Gen. Mgr., Farand & Delorme Ltd., 433 St. Martin St., Montreal. (S.1925. A.M.1935. M.1940)
Ronson, James K. Engrg. Dept., Ford Motor Co. of Canada, Windsor, Ont. For mail: 780 Chilver Road. (Jr.1939)
Roos, Albert E. Motor Design, Can. Gen. Elec. Co., Peterborough, Ont. For mail: 467 Downie St. (S.1946)
Roper, Chas. P. Priv. Prac., Civil Engr., Halifax, N.S. For mail: 16 Poplar St. (M.1940)
Rorvik, O. J. Roald pr. Aalesund, Norway. (A.M.1929. M.1940)
Rosborough, J. M. Asst. Chem., Can. International Paper Co., Kipewa Inn, Temiskaming, Que. (S.1946)
Rose, D. C. Chief Supt., Can. Armament Resch. & Devlpt. Establishment, Valcartier, Que. (M.1946)
Rose, Hugh G. Toll Engr., Central Divn., Bell Telephone Co., Toronto. For mail: 81 Castle Knock Road. (S.1921. Jr.1924. A.M.1928. M.1940)
Rose, Harold T. Design. Dftsmn., H. G. Acres & Co., Niagara Falls, Ont. For mail: 1902 Drummond Road. (Jr.1945)
Rose, John Thoburn 383 Beaverbrook St., Winnipeg, Man. (S.1914. Jr.1920. A.M.1928. M.1940)
Rose, L. B. 144 Main St., Newmarket, Ont. (S.1946)
Rose, Paul Emile Indust. Appar. Engr., Can. Gen. Elec. Co., Montreal. For mail: 4600 Hingston Ave. (S.1936. Jr.1940. M.1945)
Rosenberg, David J. Sec. Leader, Stadler, Hurter & Co., Montreal. For mail: 230 Mt. Royal Ave. E. (M.1945)
Rosenthal, Gordon Jr. Resch. Engr., Aerodynam. Lab., National Research Council, Ottawa. For mail: 255 Somerset E. (S.1946)
Roshko, Anatol Guggenheim Aero. Lab., California Institute of Technology, Pasadena, Calif, U.S.A. (S.1945)
Rosier, C. H. Supt. of Quarries, Can. Gypsum Co., Windsor, N.S. For mail: Box 43, Newport, N.S. (M.1942)
Ross, A. C. Pres., Ross & Meagher Ltd., 7 Echo Drive, Ottawa. (M.1933)
Ross, Alexander D. Pres. A. D. Ross & Co., 680 Sherbrooke St. W., Montreal. (A.M.1926. M.1940)
Ross, A. LeB. Works Mgr., Mueller Ltd., Sarnia, Ont. (S.1930. Jr.1939. M.1945)
Ross, A. M. 1025 Nelson St., Vancouver, B.C. (A.M.1919. M.1940)
Ross, C. W. 12 Waterloo Row, Fredericton, N.B. (S.1944)
Ross, Donald, Asst. to Chief Engr., Paper Divn., Price Bros. & Co., Kenogami, Que. (S.1935. Jr.1938. A.M.1939. M.1940)
Ross, Don Res. Engr. Underwood & McLellan, Cons. Engrs., Edmonton, Alta. For mail: 11013-98th Ave. (S.1939. Jr.1941. M.1945)
Ross, D. G. Chief Engr., Mtce. of Way, Newfoundland Railway, St. John's, Nfld. (Jr.1924. A.M.1931. M.1940)
Ross, D. Kenneth Vice-Pres., Cushing Ross Ltd., Westmount, Que. For mail: 12355 Dion St., Montreal. (A.M.1938. M.1940)
Ross, George Sales Engr., Hamilton Bridge Co. For mail: Athabasca Hotel, Jasper, Alta. (S.1937. Jr.1939)
Ross, George Victor Engr., Engineering Ser-Canada, Edmunston, N.B. For mail: 75 Archibald St., Moncton, N.B. (S.1944)
Ross, George Victor Engr., Engineering Service Co., Halifax, N.S. For mail: 88 Chebucto Road. (S.1930. A.M.1937. M.1940)
Ross, Gordon W. Sales, Can. General Electric Co., Box 310, Sydney, N.B. (S.1942. Jr.1944)
Ross, Hugh C. Supvg. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 137 Dunn Ave. (Jr.1931. M.1942)
Ross, Hugh G. Cons. Engr., 356 Hamilton Ave., Ottawa. (S.1925. A.M.1930. M.1940)
Ross, Herrick H. Elec. Engr., Purity Flour Mills Ltd., East Calgary, Alta. (M.1946)
Ross, Henry James Jr. Engr. & Designer, Dept. of Works, City of Toronto. For mail: 269 Strathmore Blvd. (A.M.1921. M.1940)
Ross, H. U. Lieut.Cdr. (E) R.C.N. (R), Royal Canadian Naval College, Royal Roads, B.C. (S.1936. Jr.1939)
Ross, John B. 23 Cote St. Catherine Road, Montreal. (S.1946)
Ross, Jos. H. Dir. Youth Training, Govt. of Alta, Calgary, Alta. For mail: 204-27th Ave. N.W. (A.M.1922. M.1940)
Ross, John H. Cons. Engr., 102 Charles St. W., Toronto. (M.1944)
Ross, J. H. Design & Sales Engr., McGruer, Fortier, Myers Ltd., 1971 Tansley St., Montreal. (M.1946)
Ross, Kenneth G. 17 Summit Ave., Sault Ste. Marie, Ont. (A.M.1919. M.1932)
Ross, J. M. Strl. Steel Engr., Can. Structural Steel Works, Montreal. For mail: 4178 Decarie Blvd. (S.1941. Jr.1946)
Ross, Oakland Kenneth Vice-Pres., i/c Operations, Continental Can. Co. of Canada, Montreal. For mail: 204 Cote St. Antoine Road. (S.1934. M.1943)
Ross, Robt. W. Engr. of Mtce., Can. Nat. Rlys., Union Station, Winnipeg, Man. (S.1909. Jr.1911. A.M.1918. M.1940)
Ross, Stirling, Equipt. & Bldg. Engr., British Columbia Telephone Co., 1955 Wylie St. Vancouver ,B.C. (M.1946)
Ross, Thomas W. Mill Engr., Can. International Paper Co., Three Rivers, Que. For mail: P.O. Box 547. (S.1935. Jr.1940)
Ross, W. Bruce Asst. Prof. Maths., McGill University, Montreal. For mail: 3514 Hutchison St. (S.1929. A.M.1935. M.1940)
Ross, W. E. Mgr., Apparatus Sales, Can. Gen. Elec. Co., Toronto. For mail: 169 Golfdale Road. (Jr.1920. A.M.1924. M.1940)
Rossetti, Anthony Bruce Mtce. Sched. Engr., Can. Industries Ltd., Shawinigan Falls, Que. For mail: 17-b Tamarac St. (S.1941. Jr.1946)
Rossi, Ernest Joseph 5838 McLynn Ave., Montreal. (S.1946)
Rossiter, Vincent P. 150 Patrick St., St. John's, Nfld. (S.1944)
Ross-Ross, Donald Chief Indust. Engr., Howard Smith Paper Mills Ltd., Cornwall, Ont. For mail: 516 Sydney St. (S.1916. Jr.1918. A.M.1921. M.1933)
Ross-Ross, Philip, 516 Sydney St., Cornwall, Ont. (S.1946)
Rothschild, K. Bédard-Girard Ltd., Montreal. For mail: 249 St. Joseph Blvd. W. (S.1946)
Roué, J. E. A/Lt.Cdr. (L), R.C.N. (R), Chief Radio Engr. Officer, H.M.C. Dockyard, Halifax, N.S. For mail: 244 Spring Garden Road. (S.1939. Jr.1944. M.1946)
Rounthwaite, C. Frederic T. Instr. in Arch., Univ. of Toronto and Priv. Prac., Toronto. For mail: 69 Howland Ave. (Jr.1942)
Rounthwaite, F. George Merchant Exporter, Rounthwaite Ltd., Montreal. For mail: 655 Murray Hill, Westmount, Que. (S.1916. Jr.1920. A.M.1922. M.1933)
Rousseau, Antoine Res. Engr., Quebec Dept. of Roads, Box 187, Chicoutimi, Que. (S.1940. M.1945)
Rousseau, François Paul Angus Robertson Ltd., Montreal. For mail: 4171 Old Orchard Ave. (M.1940)
Rousseau, Gabriel Tech. Advisor, Que. Dept. of Labour, Montreal. For mail: 4780 Roslyn Ave. (A.M.1935. M.1940)
Rousseau, Gérard, 5209 Descelles Ave., Montreal 26. (S.1944)
Rousseau, Jean Melville Interm. Engr., Can. Marconi Co., Montreal. For mail: 3489 Addington Ave. (S.1938. Jr.1946)
Rousselle, J. R. Asst. Supt. Engr., Elec. Divn., Dept. Public Works of Montreal. For mail: 953 St. Joseph Blvd. E. (M.1945)
Routledge, G. G. The Glen, R.R No. 3, King, Ont. (A.M.1921. M.1940)
Routly, Wm. James Boiler Design & Estim., Can. Vickers Ltd., Montreal. For mail: 4956 St. Catherine St. E. (S.1942. M.1945)
Row, Ronald V. Beloeil Station, Que. (S.1946)
Rowan, John J. Chief Engr., Mtl. Refinery, Imperial Oil Ltd. For mail: 4460 Lafontaine St., Montreal 4. (S.1935. Jr.1940)
Rowan, Russell G. Asst. Engr., East. Divn., Bell Telephone Co., Montreal. For mail: 356-40th Ave., Lachine, Que. (S.1939. Jr.1942)
Rowbotham, Brian H. Dominion Engineering Works, Lachine, Que. For mail: 83-17th Ave. (S.1944)
Rowbotham, Wm. R. Mach. Design, Internl. Harvester Co., Hamilton, Ont. For mail: 58 Jackson St. W. (S.1943. Jr.1946)
Rowe, G. W. S/L, C-3654, R.C.A.F. Station, Dartmouth, N.S. (S.1926. Jr.1931. A.M.1937. M.1940)
Rowe, H. M. Dept. Veterans Affairs, Daly Bldg., Ottawa. (A.M.1939. M.1940)
Rowell, Lorne A. Asst. Chief Mech. Engr., Imperial Tobacco Co., Montreal. For mail: 265-51st Ave., Lachine, Que. (S.1935. Jr.1946)
Rowley, H. W. Watermaster, P.O. Box 20, Coaldale, Alta. (A.M.1922. M.1940)
Rowntree, A. K. 54 Glenwood Ave., Toronto 9. (S.1945)
Roxburgh, Gerald S. Reg. Rep., Wartime Bureau of Tech. Personnel, Paris Bldg., Winnipeg, Man. (M.1944)
Roy, D. J. Bureau of Geology & Topography, Ottawa. For mail: 129 Broadway Ave. (S.1944. Jr.1946)
Roy, Eugène Asst. Engr., City Hall, Outremont, Que. (Jr.1920. A.M.1926. M.1940)
Roy, H. Georges Adhesives Techn., Commonwealth Plywood Co., Ste. Therese, Que. For mail: P.O. Box 302. (S.1942. Jr.1946)
Roy, J. E. Engr., Bridge Divn., Que. Dept. of Roads, Quebec. For mail: 324 Laurier Ave. (A.M.1919. M.1940)
Roy, Jacques Geo. Demers, Cons. Engr., Quebec. For mail: 253 Richelieu St. (S.1942)
Roy, Léo Asst. Supt., Elec. Distbn. Divn., Quebec Hydro Elec. Comm., Craig St. W., Montreal. (S.1931. Jr.1936. M.1942)
Roy, Léo Paul Papineau & Frigon, Montreal. For mail: 5517-4th Ave., Rosemount, Montreal. (S.1944. Jr.1946)
Roy, Maurice Engr., Archer & Dufresne, Cons. Engrs., Quebec. For mail: 234 Fraser St. (S.1937. M.1944)

Roy, Phil Plant Engr., Can. Locomotive Co., Kingston, Ont. For mail: 242 Frontenac St. (S.1928. M.1944)
Royer, Maurice Cons. Engr. & Prof. Faculty of Science, Laval University, Quebec. For mail: 239 Laurier Ave. (M.1944)
Rubush, Jas. P. Vice-Pres., Goslin Birmingham Mfg. Co., Birmingham, Ala. For mail: 350 Madison Ave., New York 17, U.S.A. (M.1943)
Ruddick, James Cons. Engr., Power Bldg., Quebec. (M.1916)
Rudge, F. W. Woodstock, N.B. (M.1944)
Ruggles, E. L. Asst. Gen. Mgr., Bird-Archer Co., 485 McGill St., Montreal. (Jr.1936. M.1942)
Rukavina, Matt K. 520 Princess St., Kingston, Ont. (S.1946)
Rule, Peter L. Rule, Wynn & Rule, Edmonton. For mail: 337-8th Ave. W., Calgary, Alta. (Jr.1943)
Rule, Russell A. Constrn. Supt., A. E. Rule Ltd., Toronto. For mail: 100 Humbercrest Blvd. (S.1939. M.1945)
Runciman, A. S. Supt., Transmn. & Commn. Divn., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (A.M.1919. M.1939)
Rundle, L. P. Elec. Engr., Welland Ship Canal, St. Catharines, Ont. For mail: 28 Academy St. (M.1932)
Runge, John F. Sales Engr., Armco Drainage & Metal Products of Canada, Guelph, Ont. (S.1946)
Runge, Walter Sales Engr., McColl-Frontenac Oil Co., 30 Kent Ave., Kitchener, Ont. (S.1943. Jr.1946)
Rush, C. Kenneth Jr. Resch. Engr., National Research Council, Ottawa. For mail: 102 Research Row, Quarries P.O., Ont. (S.1943. Jr.1946)
Rush, Walter A. 200 Rideau Terrace, Ottawa. (A.M.1921. M.1940)
Russell, Andrew Welding Engrg., Imperial Oil Ltd., Sarnia, Ont. For mail: 394 London Road. (M.1945)
Russell, Alan H. Civil Engr., Algoma Steel Corp., Sault Ste. Marie, Ont. For mail: 21 Lansdowne Ave. (Jr.1922. A.M.1925. M.1940)
Russell, Benjamin Dir., Water Resources, and Member, Power Comm. of Alta., Water Resources Office, Edmonton, Alta. (S.1907. A.M.1913. M.1924)
Russell, Bruce H. Design Engr., Fairchild Aircraft Ltd., Longueuil, Que. (M.1945)
Russell, Earl A. Supt., Mech. & Power Serv. Dept., Defence Industries Ltd., Chalk River, Ont. (Jr.1939)
Russell, Edna Georgia Mary 112 Brock St., Winnipeg, Man. (S.1945)
Russell, Gordon D. 135 Pleasant St., Arlington, Mass., U.S.A. (S.1940. Jr.1946)
Russell, Harold Geo. Petroleum Engr., Bahrein Petroleum Co., Awali, Bahrein Island, Persian Gulf. For mail: 2358 Grand Blvd., Montreal. (S.1940. Jr.1945)
Russell, John A. Chief Mech. Engr., Dominion Coal Co., Sydney, N.S. For Mail: 178 Royal Ave. (Jr.1930. A.M.1937. M.1940)
Russell, J. H. (Jr.1920. A.M.1925. M.1940)
Russell, Leonard J. Field Engr., Horton Steel Works Ltd., Fort Erie, Ont. For mail: 69 Niagara Blvd. (Jr.1938)
Rust, F. C. 26 St. Joseph St., Toronto. (S.1909. Jr.1913. A.M.1922. M.1940)
Rust, Henry P. (S.1899. A.M.1905. M.1914)
Rutherford, Andrew S. Vice-Pres. i/c Constrn., J. L. E. Price Co., 680 Sherbrooke St. W., Montreal. (S.1920. A.M.1928. M.1940)
Rutherford, James Forest Prodn. Supt., Johnson & Johnson Ltd., Montreal. For mail: 3469 Addington Ave. (S.1924. A.M.1933. M.1940)
Rutherford, Stewart F. Commr., Quebec Streams Comm., Montreal. For mail: 465 Mount Pleasant Ave., Westmount, Que. (A.M.1899. M.1940)
Rutledge, M. J. City Mgr., City Hall, St. Lambert, Que. (Jr.1916. A.M.1919. M.1923)
Rutledge, Stanley E. Jr. Engr., Calgary Power Co., Insurance Exchange Bldg., Calgary. (S.1945)
Rutley, Frederick G. Vice-Pres., Foundation Co. of Canada, 1538 Sherbrooke St. W., Montreal. (A.M.1921. M.1940)
Ruttan, John D. Mng. Dir., Chipman Chemicals Ltd., 1040 Lynn Ave., Winnipeg, Man. (A.M.1921. M.1940)
Ryan, Bernard K. Jr. Engr., Can. Tube & Steel Products Ltd., Montreal. For mail: 5435 Angers St. (S.1944. Jr.1946)
Ryan, C. C. Res. Engr., B.C. Pulp & Paper Co., Port Alice, B.C. (S.1913. A.M.1924. M.1936)
Ryan, Chas. Wilbert Pres., Ryan Contracting Corp. 341 E. 79 St., New York, N.Y. (S1915. Jr.1920. A.M.1927. M.1940)
Ryan, D.L. 3292 Notre Dame St., Lachine, Que. (S.1945)
Ryan, Ed. 232 Sydenham St., Kingston, Ont. (Jr.1937)
Ryan, Edward A. Cons. Engr., Canada Cement Bldg., Montreal. A.M.1919. M.1927)
Ryan, H. Franklin Transpn. Divn., Can. Gen. Elec. Co., 212 King St. W., Toronto. (A.M.1928. M.1940)
Ryan, James L. Asst. Prof. of Engrg., Univ. of Saint Mary's College, Halifax, N.S. For mail: 75 Macara St. (AM.1939. M.1940)
Rybka, Karel R. Cons. Engr., 989 Bay St., Toronto. (A.M.1931. M1938)
Ryder, F. J. Asst. Supt., Can. Bridge Co., Windsor, Ont. For mail: 220 Erie St. W. (S1928. Jr.1935. M.1942)
Ryley, A. St. C. Gen. Mgr., Can. Bridge Co., Walkerville, Ont. (M 1941)
Ryley, Edmund G. Field Engr., Dinsmore-McIntire Ltd., Security Bldg., Windsor, Ont. (A.M.1921. M.1940)

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Saari, R. A. 267 Waterloo St., Winnipeg, Man. (S.1945)
Saba, R. N. 163 Cambridge Ave., Toronto 6. (S.1946)
Sabiston, M. R. 7 Ansley St., Toronto 12. (S.1946)
Sabourin, Jean Robert 6790 Louis-Hébert Ave., Montreal 36. (S.1945)
Sadler, R. F. Asst. Engr., Can. Nat. Rwys., Montreal. For mail: 1245 St. Mark St. (S.1935. Jr.1946)
Sadler, W. R. Mgr., Alberta Transit Mix Concrete Co., 618-3rd St. W., Calgary, Alta. (S.1937)
Safran, N. Head of Science Dept., Provincial Institute of Technology, Calgary, Alta. (Jr.1943)
Sagar, W. L. Overseas. (A.M.1926. M.1940)
Saint-Arnaud, Hervé T. Chem. Engr., French Supply Council, Montreal. For mail: 10943 Esplanade Ave. (M.1946)
Saint-Denis Marcel 4852 Rivard Ave., Montreal 34. (S.1944)
Saint-Jacques, Jean Dir. of Sales, Quebec Power Co., 229 St. Joseph St., Quebec. (S.1931. A.M.1937. M.1940)
Saint-Jacques, Maurice. Elec. Distbn., Engr., Hydro-Quebec Power Comm., Montreal. For mail: 386 St. Catherine Road.. (S.1942 Jr.1944)
Saint-Louis, Renel 6550 1st Ave., Rosemont, Montreal. (S.1944)
Saintonge, Jérôme Asst. Engr., Aluminum Co. of Canada, Arvida, Que. For mail: 485 Hunt St. (Jr.1943)
Saintonge, Rosaire Woodlands Logging Engr., Consolidated Paper Corp., Grand'Mère, Que. (S.1936. M.1942)
Saint-Pierre, Roland Valcourt, Shefford Co., Que. (A.M.1939. M.1940)
Saldat, John Hans Dftsmn., H. G. Acres & Co., 2135 Culp St., Niagara Falls, Ont. (S1946)
Salisbury, Ernest A. Design Engr., Gordon L. Wallace, Cons. Engr., Toronto. For mail: 61 Kingsmount Park Road. (M.1943)
Salmon, K. W. Commrl. Tel. Engrg., New Brunswick Telephone Co., Saint John, N.B. (Jr.1946)
Saltman, Fred E. Res. Engr., Dept. Highways of N.S., Halifax. For mail: Mahone Bay, N.S. (A.M.1925. M.1940)
Salvas, Paul E. Inspr. and Rep. for Prefab. Shipbldg., French Supply Council in Canada, Montreal. For mail: 468 Cherrier St. (S1940. M.1945)
Saltzman, Otto 4021 Grey Ave., Montreal. (S.1946)
Samis, G. R. Estimr. & Designer, Dominion Bridge Co., Lachine. For mail: 3800 Decarie Blvd., Montreal. (Jr.1937. M.1943)
Sampson, C. D. Engr., Intercolonial Coal Co., Westville, N.S. (Jr.1923. A.M. 1934. M.1940)
Sampson, Wm. T. Mine Supt., Wright Hargreaves Mines, Kirkland Lake, Ont. (M.1932)
Samson, Jean J. City Hall, Coaticook, Que. (S.1939. M.1945)
Samuel, A. B. Field Engr., City of Edmonton, Alta. For mail: 10828-108th St. (S.1941. Jr.1943)
Samuel, Myron Owner, Empire Engineering Co., 11 Wellington St. E., Toronto. (Affil.1931. A.M.1935. M.1940)
Sancton, Geo. E. Gen. Mgr., Fraser & Chalmers of Can., 1411 Crescent St., Montreal. (M.1934)
Sanden, Emil J. Mfg. & Indust. Engr., Consolidated Mining & Smelting Co., Trail, B.C. For mail: 15 Aldridge Ave. (S.1945)
Sanders, Geo. O. (S.1937. Jr.1940)
Sanders, Geo. S. 26 Oakview St., East Kildonan, Man. (S.1943)
Sanders, L. J. R. (M.1942)
Sanders, Robt. Lewis East Kootenay Power Co., Coleman, Alta. (S.1938. Jr.1946)
Sanderson, A. U. Waterworks Engr., Toronto Dept. of Works, 511 Richmond St. W., Toronto. (A.M.1921. M.1940)
Sanderson, C. J. L. Res. Engr., Northern Alberta Rwys., Edmonton. (A.M.1921. M.1940)
Sanderson, D. R. Jr. Strl. Design., Gordon L. Wallace, Cons. Engr., Toronto. For mail: 488 Windermere Ave. (S.1944. Jr.1945)
Sanderson, R. M. 160 Linden Ave., Winnipeg, Man. (S.1945)
Sandilands, Adam Sales Engr., Automatic Electric (Canada) Ltd., 156 Lombard St., Winnipeg, Man. (S.1931. A.M.1938. M.1940)
Sands, D.H. Jr. Mech. Engr., Northern Electric Co., Montreal. For mail: 2149 Rosemont Blvd. (S.1943)
Sandwell, P. R. Chief Engr., Powell River Co., Standard Bank Bldg., Vancouver, B.C. (Jr.1935. A.M.1940. M.1940)
Sanger, J. W. Gen. Mgr., City of Winnipeg Hydro-Elec. System, 55 Princess St., Winnipeg, Man. (A.M.1921. M.1936)
Sankoff, A. Indust. Engrg. Dept., Canadian Vickers Ltd., Montreal. For mail: 2515 Maplewood Ave. (M.1944)
Sansfacon, Jacques Engr., Dept. Public Works of Can., Montreal. For mail: P.O. Box 129, Station "H". (S.1941. M.1945)
Sansom, Ralph T. Asst. Engr., Signal Dept., Can. Nat. Rlys., Moncton, N.B. For mail: 39½ Bonaccord St. (S.1935. M.1946)
Santerre, G. A. 146 rue De Longueuil, Quebec. (S.1945)
Sara, Richard Allan Aladdin Homes Co. Ltd., Winnipeg, Man. For mail: 366 Yale Ave. (Jr.1914. A.M.1920. M.1940)
Sarault, Gilles E. Cons. Engr. and Prof. Dept. of Elec. Engrg., Laval University, Quebec. (M.1942)
Sarchuk, Leon A. Aircraft Inspr., MacDonald Bros. Aircraft, Winnipeg, Man. For mail: 720 Nassan St. (S.1940. Jr.1942)
Sargent, A. E. Dir. of Engrg., National Breweries Ltd., Montreal. For mail: 4675 Victoria Ave. (M.1939)
Sargent, Kenneth S. 3 Erb St., Elmira, Ont. (S.1945)
Sauder, Frederick James Liaison Engr., Aircraft Divn., St. Laurent Plant, Can. Car & Foundry Co. For mail: 4331 Draper Ave., Montreal. (M.1945)
Sauder, Penrose Melvin Gen. Mgr., Western Irrigation Dist. & St. Mary Milk Rivers Devlpt., Strathmore, Alta. (A.M.1908. M.1914)
Sauer, C. Douglas Constrn. Engr.'s Asst., American Gas & Electric Service Corp., New York. For mail: 118 Midvale Road, Mountain Lakes, N.J., U.S.A. (S.1930. A.M.1934. M.1940)
Sauer, Maxwell V. Hyd. Engr. & Gen. Supt. of Generating Stations, Quebec Hydro-Elec. Comm., 107 Craig St. W., Montreal. (S.1904. M.1913)
Saunders, Harold L. Prodn. Engr., W. C. Wood Co., Guelph, Ont. For mail: 15 Victoria Road. (S.1944. Jr.1946)
Saunders, J. Bruce Rural Supt., Hydro-Elec. Power Comm. of Ont., Box 265, Stayner, Ont. (S.1922. M.1944)
Saunders, M. G. Plant Engr., Aluminum Co. of Can., Kingston Ont. For mail: 345 Willingdon Ave. (A.M.1933. M.1940)
Saunders, M. S. Internl. Petroleum Co., Lima, Peru, S.A. (M.1941)
Saunders, Reginald Geo. Beamsville, Ont. (S.1907. Jr.1911. A.M.1913. M.1919)
Saunders, W. A. B. 1010-4th Ave., N.W., Calgary, Alta. (S.1940. Jr.1944)
Saunders, Walter L. Res. Engr., Dept. Highways of Ont., 295 Albert St., Ottawa. (S.1910. Jr.1913. A.M.1920. M.1940)
Sauvage, Robert Sr Engr., Quebec Dept. Public Works, Parliament Bldgs., Quebec. Jr.1925. A.M.1934. M.1940)
Savage, P. E. Dominion Bridge Co., Lachine. For mail: 152 Ballantyne Ave. N., Montreal West. (S.1930. A.M. 1937. M.1940)
Savard, Guy S.O.A.E.O. (The Far East Oxygene Co.), 851 Passir Panjang Road, Singapore, Strait Settlements. (S.1935. Jr.1946)
Savary, Roméo J. L. 1278 Ste. Foye Rd., Sainte Foye, Que. (S.1913. Jr. 1916. A.M.1917. M.1940)
Savoie, Jean-Louis 5165 Decelles Ave., Montreal 26. (S.1944)
Savory, John A. Mech. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 10 Lumsden Ave., Hamilton, Ont. (S.1941. Jr.1946)
Sawle, Ross T. A. C. Designer, English Electric Co. of Canada, St. Catharines, Ont. (S.1934. Jr.1940)
Sawyer, John E. B. Jr. Engr., Brown Corp., La Tuque, Que. (S.1943. Jr.1946)
Scales, Wm. 3727 West 12th Ave., Vancouver, B.C. (M.1936)
Scanlan, J. R. Design Engr., Foundation Co. of Can., Montreal. For mail: 2054 Claremont Ave. (S.1925. A.M.1935. M.1940)
Scarabelli, R. J. 3592 University St., Montreal. (S.1946)
Scarisbrick, R. G. Demonstrator, Dept. Civil Engrg., Univ. of British Columbia, Vancouver, B.C. For mail: 980 Denman St., (S.1944. Jr.1946)
Scarlett, Arthur A. Vice-Pres. i/c Engrg., Internl. Harvester Co. of Canada, 208 Hillyard St., Hamilton, Ont. (M.1943)
Scarlett, I. C. Lieut., Experimental Station, Suffield, Alta. (S.1944. Jr.1946)
Scarth, R. Lloyd Asst. Engr., Bell Telephone Co. of Can., Montreal. For mail: Box 268, Macdonald College, Que. (S.1944. Jr.1946)
Schaeffer, J. G. Dir., Divn. of Sanitation, Prov. Health Dept., Regina, Sask. (S.1922. A.M.1927. M.1940)
Schafheitlin, Frederick B. Mech. Dftsmn., H. G. Acres & Co., Culp St., Niagara Falls, Ont. (S.1942. Jr.1946)
Scharry, Léo Engr., Leblanc & Montpetit, Cons. Engrs., Montreal. For mail: 4743 Berri St. (S.1942)
Scheen, Marcel 1228 St. Hubert St., Montreal 24. (S.1937. Jr.1940. M.1945)

Schermerhorn, H. L. County Engr., Co. of Lennox & Addington, Box 230, Napanee, Ont. (A.M.1937. M.1940)
Scheunert, Hans Designer, Canadair Ltd., Cartierville. For mail: 5265 Côte St. Catherine Road, Montreal. (M.1941)
Schippel, W. H. Lecturer, Dept. Elec. Engrg., McGill Univ., Montreal. For mail: 117 Graham Blvd. (M.1945)
Schmeltzer, Hans Mech. Engr., Robt. A. Rankin & Co., Montreal. For mail: 3232 Tremblay St. (M.1942)
Schmidt, Curtis O. J. 476 Aikins St., Winnipeg, Man. (S.1946)
Schmidt, Donald V. Chem. Engr., Engrg. & Devlpt. Dept., Imperial Oil Ltd., Sarnia, Ont. (Jr.1946)
Schneider, R. J. 163 Glendonwynne Rd., Toronto 9. (S.1946)
Schnyder, Max. (S.1934. Jr.1938)
Schofield, Robt. J. G. Demonstrator, Calco Chemical Divn., American Cyanamid Co., Bound Brook, N.J. For mail: Pearl St., Somerville, N.J., U.S.A. (S.1935, Jr.1940, M.1946)
Schofield, Stewart M. Res. Engr., Dept. Public Works of B.C., Essondale. For mail: Whyte St., Port Coquitlam, B.C. (S.1941. Jr.1946)
Schofield, Wm. Plant Engr., Alliance Paper Mills Ltd., Merritton, Ont. (S.1931. Jr.1936)
Schofield, W. D. Gen. Constrn. & Plant Mtce., Slack Bros., Waterloo, Que. For mail: 9 MacDonald Ave. (S.1939. M.1946)
Schreiber, John W. Chief Constrn. Engr., Aluminum Co. of America, Gulf Bldg., Pittsburgh 19, Pa., U.S.A. (M.1926)
Schroter, Bernard H. Partner, Engr., Schroter Bros. Ltd., P.O. Box 760, Vernon, B.C. (M.1945)
Schuett, George H. Constrn. Supt., L. G. Ogilvie & Co., Montreal. For mail: 306 University Ave., Kingston, Ont. (Jr.1946)
Schulte, Theodore Supt., Teleph. & Elec. Equipt., Can. Pac. Rly., Calgary, Alta. For mail: 1037-16th Ave. W. (A.M.1923. M.1940)
Schulte, T. M. Engr., Prodn. Dept., Calgary Power Co., Insurance Exchange Bldg., Calgary, Alta. (S.1939. Jr.1941)
Schultz, Charles Davies Cons. Forest Engr., C. G. Schultz & Co. Ltd., 475 Howe St., Vancouver, B.C. (S.1928. Jr.1932. A.M.1939. M.1940)
Schurman, Peter Plant Engr., Elec., Dayton Rubber Mfg. Co., P.O. Box 1004, Dayton, Ohio, U.S.A. (S.1946)
Schwartz, Hyman Tool & Jig Designer, Can. Power Boat Co., Montreal. For mail: 230 Clarke St. (S.1943)
Schwartz, Harry H. Chief Engr., Dee Electronics Ltd., Montreal. For mail: 2210 Dorchester St. W. (S.1937. Jr.1944)
Schwieder, F. M. Design. Dept., Intrnl. Harvester Co., Hamilton, Ont. For mail: 3112 Yonge St., Toronto (S.1939. Jr.1946)
Scott, A. Divn. Engr., Can. National Rlys., Halifax, N.S. For mail: 1 Owen St. (A.M.1921. M.1940)
Scott, Ainsworth David Asst. Engr., Jamaica Govt. Rly., Kingston, Jamaica, B.W.I. (S.1941. M.1945)
Scott, A. Gordon Vice-Pres. & Gen. Treas., Footwear Findings of Canada, Cowansville, Que. (A.M.1920. M.1940)
Scott, Allen Nye Suptg. Engr., Electrical Comm. of Montreal. For mail: 326 Brock Ave. N., Montreal West. (S.1911. A.M.1921. M.1940)
Scott, A. V. F. Overseas. (M.1942)
Scott, C. A. Lt. Col., Commr., B.C., Divn., Canadian Red Cross Society, Marine Bldg., Vancouver, B.C. (A.M.1920. M.1940)
Scott, C. E. Univ. of New Brunswick, Fredericton, N.B. (S.1945)
Scott, Daniel S. 190 Fraser St., Quebec. (S.1907. A.M.1910. M.1940)
Scott, E. M. 805 Alverstone St., Winnipeg, Man. (S.1945)
Scott, Frederic B. B. Aero. Engr., Stress Analyst, A. V. Roe Canada Ltd., Malton, Ont. For mail: 30 Bald St., Welland, Ont. (S.1946)
Scott, Hew M. Toronto Mgr. & Dir., Atlas Constrn. Co. For mail: 88 Wells Hill, Toronto 10. (M.1920)
Scott, H. M. Vice-Pres., Capo Polishes Ltd., 58 Catharine St. N., Hamilton, Ont. (Jr.1944)
Scott, Ivy! 1140-7th St., Santa Monica, Calif., U.S.A. (S.1946)
Scott, J. Blair Jr. Mech. Engr., Dominion Engrg. Works Ltd. For mail: 2382 Grand Blvd., Montreal. (S.1944)
Scott, J. M. Works Mgr., Aluminum Co. of Canada, Beauharnois, Que. For mail: P.O. Box 496 (M.1945)
Scott, James M. Asst. Engr., Montreal Harbour, National Harbours Board, 357 Common St., Montreal. (S.1937. Jr.1939)
Scott, Lloyd G. Cons. Engr., Greenlaw & Trott, Cons. Engrs., Winnipeg. For mail: 109 Kingston Row, St. Vital, Man. (S.1930. Jr.1936. M.1940)
Scott, L. J. Dir. Planning Methods, National Breweries Ltd., 990, Notre Dame St. W. Montreal. (A.M.1936. M.1940)
Scott, Richard Instr., Massachusetts Institute of Technology, Cambridge, Mass. For mail: 601A Graduate House. (S.1942. Jr.1944)
Scott, Robt. Asst. Chief Inspr. of Boilers, Alta. Govt., Edmonton, Alta. For mail: 10521-80th Ave. (M.1941)
Scott, Robt. C. Overseas. (Jr.1940)
Scott, Ronald E. 10 Peter St. N., Orillia, Ont. (S.1943. Jr.1946)
Scott, Robt. G. Asst. Dir., Lighting & Residentl. Serv., B.C. Electric Rly Co., 600 Granville St., Vancouver, B.C. (M.1942).
Scott, Tom F. Jr. Engr., Can. Industries Ltd., Beaver Hall Square, Montreal. (S.1946).
Scott, Wm. A. 68 Edith Drive, Toronto 12. (S.1946)
Scott, W. B. Survey Party Chief, Woods Engrg., Dept., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1944. Jr.1946)
Scott, Wm. B. 4653 W. 7th Ave., Vancouver, B.C. (S.1943)
Scott, W. G. Engr., Howard Smith Paper Mills, Montreal. For mail: 3610 Durocher St. (A.M.1922. M.1940)
Scott, Walter Kingston Dftsmn., Dominion Bridge Co., Lachine. For mail: 6715 Sherbrooke St. W., Montreal. (A.M.1919. M.1940)
Scott, Wm. L. 1320 Kingston Road, Toronto 13. (S.1946)
Scott, W. M. Chairman of Commrs., Greater Winnipeg Water District, Winnipeg Man. For mail: 188 Montrose St. (S.1896. A.M.1902. M.1906)
Scott, Wm. O. Asst. Supt., Dominion Bridge Co., Vancouver, B.C. For mail: 3808 Slocan St. (S.1922. Jr.1926. AM.1931. M.1936)
Scott, W. S. 320 Oakwood Ave., Winnipeg, Man. (S.1946)
Scoular, W. B. Devlpt. Engr., Ontario Paper Co., Thorold, Ont. (A.M.1930. M.1940)
Scovil, John H. Beaverbrook Residence, Fredericton, N.B. (S.1946)
Scovil, S. S. Cons. Hyd. Engr., 492 Driveway, Ottawa, (M1921)
Scowcroft, G. C. Sales Engr., Dominion Tar & Chemical Co., Calgary, Alta. For mail: 2017-24th St. S.W. (S.1942. Jr.1946)
Scrivener, Richard H. 57 Bloor St. W., Toronto 5. (Jr.1937)
Scrivener, R. M. Gen. Mgr., Toronto Shipbuilding Co. For mail: 88 Livingstone Ave., Grimsby, Ont. (M.1942)
Scroggie, George N. Asst. Engr., Dept. Public Works of Can., Box 668, London, Ont. (Jr.1939. M.1943)
Scrymgeour, Charles Supt., Montreal East Refinery, Imperial Oil Ltd. For mail: 11310 Notre Dame St. E., Montreal East. (A.M.1931. M.1940)
Scull, B. P. Assoc. Dir.-Gen., Resch. & Devlpt., Dept. Reconstruction & Supply, 3 Temporary Bldg., Ottawa. (A.M.1938. M.1940).
Seaborne, Rolfe L. Mgr., Woodlands, Mersey Paper Co., Liverpool, N.S. (S.1914. A.M.1920. M.1940)
Searle, Campbell L. 1011 Wellington Cres., Winnipeg, Man. (S.1946)
Sears, John Edgar Demoltn. Engr., War Assets Corp., Toronto. For mail: 64 Roxborough St. (A.M.1921. M.1940)
Sears, J. Joseph Engr., Street Rly. Dept., Nova Scotia Light & Power Co., Halifax, N.S. For mail: 87 Birmingham St. (A.M.1924. M.1940)
Secord, Lloyd G. Design Engr., A. V. Roe Canada Ltd., Toronto. For mail: 22 Albermarle Ave. (S.1944)
Seddon, James Harry, Jr. 557 Dovercourt Road, Toronto. (S.1946)
Seely, H. Chipman Mech. Supt., Can. International Paper Co., Noranda, Que. (A.M.1937. M.1940)
Seely, Hubert E. 229 Aberdeen St., Fredericton, N.B. (S.1944)
Seely, W. E. Cons. Engr., 2365 Clifton Ave., Montreal. (S.1929. Jr.1935. M.1941)
Sefton, F. Hugh C. i/c Public Util. Subways Design, Rapid Transit Dept., Toronto Transportation Comm., 35 Yonge St., Toronto. A.M.1921. M.1940)
Segal, Perry 6211 Lennox Ave., Montreal. (S.1944)
Segalowitz, Kalman 6541 Park Ave., Montreal. (Jr.1945)
Segsworth, R. Sidney Resch. Engr., General Engrg. Co. of Can., Toronto. For mail: 82 Cliveden Ave. (M.1943)
Séguin, Bernard 8190 Henri Julien St., Montreal 10. (S.1941)
Seibert, Fred V. Indust. Commr., Can. National Rlys., Depot, Winnipeg, Man. (A.M.1920. M.1922)
Seifert, Harold L. B. Chem. Engr., Spruce Falls Power & Paper Co., Kapuskasing, Ont. For mail: 1 Dominion St. (S.1936. Jr.1946)
Selchen, Zalman 396 Charles St., Winnipeg, Man. (S.1946)
Self, R. Harvey Constrn. Engrg., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 53 Kenilworth Ave. (A.M.1939. M.1940)
Seline, Walter G. 57 Station Ave., Shawinigan Falls, Que. (S.1944)
Semmens, G. C. Caribbean Petroleum Co., Maracaibo, Venezuela, S.A. (M.1943)
Senkler, Edmund J. (S.1938. Jr.1940)
Senneville, Claude Ecole Polytechnique, 1430 St. Denis St., Montreal 18. (S.1944)
Sentance, Alan P. 20 Allanburg Road, Thorold South, Ont. (S.1946)
Sentance, L. C. Dir. of Mfg. Methods, Can. Westinghouse Co., Hamilton, Ont. (S.1936. (M.1942)
Sentance, R. C. Gen. Foreman, B. Greening Wire Co., Hamilton, Ont. For mail: 53 Cameron Ave. S. (S.1940. Jr.1946)
Senyshyn, E. 565 Anderson Ave., Winnipeg, Man. (S.1946)
Sergi, Frank J. Lieut., R.C.E.M.E. Depot, Esquimalt, B.C. (S.1941. Jr.1946)
Serson, Harold V. Engr. i/c Constrn., Foundation Co. of Can., Marathon, Ont. (A.M.1909. M1940)
Sexton, Frederic H. Reg. Dir. for N.S. Dept. of Education, and Pres., Nova Scotia Technical College, Halifax, N.S. (M.1940)
Sexton, J. K. Montreal Engineering Co. For mail: 1537 Graham Blvd., Town of Mount Royal, Que. (S.1927. Jr.1929. A.M.1934. M.1940)
Seybold, Hugh G. Dept. Mgr., Drummond McCall & Co., 930 Wellington St., Montreal. (S.1933. Jr.1946)
Seymour, David L. San. Engr., Engrg. Divn., Dept. National Health & Welfare, Ottawa. For mail: 87 Cartier St. (S.1941. Jr.1946)
Shabago, Wm. 33 Brookmount Road, Toronto 8. (S.1945)
Shakotko, Léon Methods Engr., Internl. Harvester Co., 61 East Ave. S., Hamilton, Ont. (S.1946)
Shama, Arthur J. 21 Weymouth St., Charlottetown, P.E.I. (S.1945)
Shamess, A. C. Espanola, Ont. (S.1946)
Shane, Walter R. Sales Engr., Strong-Scott Mfg. Co., Winnipeg, Man. For mail: 894 McMillan Ave. (S.1943. Jr.1946)
Shanks, G. Lawson Prof. and Head, Agric. Engrg. Dept., University of Manitoba, Winnipeg, Man. (A.M.1925. M.1940)
Shanks, Victor, Lab. Asst., Sangamo Ltd., Toronto. For mail: 15 Lonsdale Road. (S.1932. Jr.1937)
Shannon, Harold Cecil 10214-124th St., Edmonton, Alta. (S.1945)
Shannon, John Agent & Engr., Sir Wm. Arrol & Co., Glasgow. For mail: 11 Glencairn Drive, Pollokshields, Glasgow, Scotland. (A.M.1913. M.1940)
Shapcotte, R. F. Lynden Young McIntosh, Arch., 118 S. Syndicate Ave., Fort William, Ont. (Jr.1940)
Shapiro, Sydney L. 3935 Colonial Ave., Montreal 18. (S.1946)
Sharp, W. G. Mgr., Sharp's Theatre Supplies, Calgary, Alta. For mail: 706 Lansdowne Ave. (S.1933. Jr.1938. M.1941)
Sharpe, A. E. 179-8th Ave., Haney, B.C. (A.M.1909. M.1922)
Sharpe, David N. Surveyor & Engr., Dept. Mines & Resources of Man., Winnipeg, Man. For mail: 121 Sherburn St. (S.1907. A.M.1913. M.1927)
Sharpe, F. M. Windsor, N.S. (M.1940)
Sharpe, Russell N. Asst. Dist. Engr., Dept. Public Works of Man., Winnipeg, Man. For mail: 760 Sherburn St. (Jr.1939)
Sharpe, T. A. A. Tool Engr., Vector Engrg. Co., Toronto, on loan to General Motors of Can., Oshawa, Ont. For mail: 337 Arthur St. (Jr.1944)
Sharples, Wm. Engr., Shawinigan Engrg. Co., 107 Craig St. W., Montreal. (A.M.1939. M.1940)
Shatford, R. Grant Mtce. Engr., Imperial Oil Ltd., P.O. Box 490, Dartmouth, N.S. (S.1932. Jr.1941)
Shattuck, A. W. Dept. Public Works, Regina, Sask. (A.M.1938)
Shaughnessy, J. O. 525 Parnell St., Peterborough, Ont. (S.1946)
Shaw, Douglas T. Capt., Commns. Engr., N.D.H.Q., Ottawa. For mail: 7097 DeNormanville St., Montreal. (S.1942. Jr.1945)
Shaw, F. W. B. Elec. Engr., Can. International Paper Co., Hawkesbury, Ont. For mail: 11 Allen St. (Jr.1937)
Shaw, G. E. Engr. of Bridges, Can. Pac. Rly., Windsor Station, Montreal. (S.1921. Jr.1928. A.M.1929. M.1940)
Shaw, George Randolph Devlpt. on Mining Prop., Malartic, Que. For mail: 4 Nesbitt Drive, Toronto. (S.1946)
Shaw, J. A. Hudson Heights, Que. (S.1899. A.M.1907. M.1917)
Shaw, Robt. F. Asst. to Pres., Foundation Co. of Can., 1538 Sherbrooke St. W., Montreal. (M.1943)
Shearer, John A. Roadmaster, Can. Pac. Rly., Aroostook, N.B. (S.1941. Jr.1942)
Shearer, J. L. Engr., Ottawa Suburban Roads Comm. For mail: 328 Clemow Ave., Ottawa. (S.1928. A.M.1936. M.1940)
Shearer, Wm. Overseas. (S.1942. Jr.1946)
Shears, J. Wilson Gen. Engrg., Russel Bros., Owen Sound, Ont. For mail: 1244 Third Ave. E. (S.1946)
Shearwood, Alex. P. Mech. Asst. to Pres., National Steel Car Corp., 437 St. James St. W., Montreal (S.1929. A.M.1935. M.1940)
Shearwood, F. P. Cons. Engr., Dominion Bridge Co., Montreal. For mail: 120 Aberdeen Ave., Westmount, Que. (A.M.1892. M.1904)
Shector, L. Strl. Engr., Barott, Marshall, Montgomery & Merrett, Archs., Montreal. For mail: 2241 Maplewood Ave. (S.1937. M.1943)

Sheets, Wm. E. Tech. Adviser, Canada Life Assurance Co., 330 University Ave., Toronto. (M.1943)
Sheffield, Harvey C. F. T. Fisher's Sons Ltd., 6202 Somerled Ave., Montreal. (S.1944)
Sheinberg, Sydney Dftsmn., Can. International Paper Co., Hawkesbury, Ont. (S.1940. M.1945)
Shelden, Wm. Leslie Engr., Can. & General Finance Co., Toronto. For mail: 1920 Bloor St. W. (A.M.1935. M.1940)
Shelson, Wm. Dept. Engrg. Mechanics, Pennsylvania State College, State College, Pa., U.S.A. (S.1945. Jr.1946)
Shelton, J. Frederick, Dftsmn., Engrg. Dept., Welland Canals, Dept. of Transport, Box 384, St. Catharines, Ont. (Jr.1922. A.M.1936. M.1940)
Shepherd, David Cons. Engr., 57 Bloor St. W., Toronto. (A.M.1921. M.1940)
Shepherd, H. L. Asst. Prof. of General Studies, University of Toronto, Ajax, Ont. (M.1946)
Shepherd, Hugh W. R. Rawdon, Que. (S.1909. Jr.1914. A.M.1926. M.1940)
Sheppard, Norman E. D. Can. Engineering Publications Ltd., 1253 McGill College Ave., Montreal. (S.1914. A.M.1916. M.1940)
Sherman, Harry B. Operating Supt., Calgary Power Co., Insurance Exchange Bldg., Calgary, Alta. (A.M.1919. M.1940)
Sherman, N. C. Indust. Cons. Engr., 2050 Barclay St., Vancouver, B.C. (Jr.1911. A.M.1914. M.1927)
Sherrin, Philip W. Dept. of Mines, Victoria Museum, Ottawa. For mail: The Kelso, 17 McDonald St. (A.M.1919. M.1940)
Sherwood, Ben. H. Dftsmn., Imperial Oil Ltd., Sarnia, Ont. For mail: 186 Capel St. (Jr.1937)
Sherwood, Henry L. 713 Mount Joy Ave., Victoria, B.C. (S.1903. A.M.1907. M.1940)
Sherwood, Harris M. Works Mgr., Dom. Ammun. Divn., Can. Industries Ltd., Brownsburg, Que. (S.1935. Jr.1939)
Sherwood, Luman 4 Regent St., Ottawa. (S.1900. A.M.1902. M.1908)
Sherwood, M. L. Dist. Plant Engr., Barrett Co., 5551 St. Hubert St., Montreal (Jr.1938. M.1946)
Shields, Stanley O. Supvr., Winding & Insulation Dept., Can. General Electric Co., Peterborough, Ont. For mail: 9 Anne St. (S.1920. Jr.1927. A.M.1936. M.1940)
Shields, W. F. 72 Cardinal St., St. Laurent, Que. (A.M.1938. M.1940)
Shienfield, Irvine Jr. Hyd. Engr., P.F.R.A., Dept. of Agriculture, Regina, Sask. For mail: 246 Ominica St. W., Moose Jaw, Sask. (Jr.1946)
Shier, Bruce B. Sales Engr., Automatic Electric (Canada) Ltd., 284 King St. W., Toronto. (S.1921. A.M.1928. M.1940)
Shillinglaw, W. H. 302 Russell St., Brandon, Man. (S.1887. A.M.1900. M.1908)
Shipley, Kenneth R. Asst. Refinery Supt., Tropical Oil Co., Barranca-Bermeja, Colombia, S.A. (M.1944)
Shirley, E. R. Elec. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 319 Frederick Ave. (M.1919)
Shisko, N. Constrn. Engr., Thunder Bay Paper Co., Port Arthur, Ont. For mail: Ansonville, Ont. (S.1938. Jr.1943)
Shooner, Jacques Shooner & Co., Pierreville, Que. (S.1943. M.1945)
Shore, Robt. E. Brancepeth, Sask. (S.1946)
Short, Howard W. Contracting Engr., Ont. Divn., Dominion Bridge Co., 1139 Shaw St., Toronto. (M.1942)
Short, Kenneth Wills 2082 Gerrard St. E., Toronto. (S.1946)
Shupe, Stanley City Engr., City Hall, Kitchener, Ont. (A.M.1920. M.1923)
Shuttleworth, Wilbur L. Reg. Mtce. Officer, War Assets Corp., Winnipeg, Man. For mail: 308 Waterloo St. (Jr.1932. A.M.1935. M.1940)
Sibbald, S. W. 177 Indian Road, Toronto. (Jr.1938)
Sick, Arthur E. Sound Engr., Sharp's Theatre Supplies, Calgary, Alta. For mail: 2306-7th Ave. N.W. (Jr.1945)
Sicotte, Bernard, 526 Sherbrooke St. E., Montreal. (S.1941. Jr.1946)
Sicotte, Guy 1906 Van Horne Ave., Montreal. (S.1944)
Sicotte, Jean Asst. Mgr., Armand Sicotte & Sons, 1906 Van Horne Ave., Montreal. (S.1939. Jr.1942)
Siddall, J. N. Jr. Resch. Engr., National Research Council, Ottawa. For mail: 108 Fourth Ave. (S.1943. Jr.1946)
Sidler, Joseph 927 Pratt Ave., Outremont, Que. (S.1946)
Silk, Fred. 225 Lisgar St., Toronto 3. (S.1946)
Sillcox, Lewis Ketcham First Vice-Pres., New York Air Brake Co., Starbuck Ave., Watertown, N.Y. (M.1926)
Silltoe, Sydney Broadcast Radio Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1930. Jr.1936. M.1943)
Sills, Hubert R. Sr. Engr., Synchronous Machines, Can. Gen. Elec. Co., Peterborough, Ont. For mail: 542 Gilmour St. (S.1921. Jr.1926. A.M.1936. M.1940)
Silver, B. L. 719-8th Ave., Brooklyn, N.Y. (A.M.1920. M.1940)
Silver, Ralph C., Protection Engr., Gatineau Power Co., 140 Wellington St., Ottawa. (S.1926. A.M.1937. M.1940)
Silverberg, David M. Engrg. Dftsmn., Civil Aviation Divn., Dept. Transport, Winnipeg, Man. For mail: 291 Manitoba Ave. (S.1938. Jr.1943)
Simard, J. E. 5329 De l'Epée Ave., Montreal 15. (S.1940. M.1945)
Simard, Joseph W. International Water Supply Ltd., 660 St. Catherine St. W., Montreal. (M.1940)
Simard, Laurent Asst. Supvr., Fluoride Plant, Aluminum Co. of Can., Arvida, Que. For mail: 853-5th St. (Jr.1945)
Simard, Roger 405 Mount Royal Ave., Montreal 8. (S.1944)
Simmons, D. S. Petrol. Techn., Imperial Oil Ltd., Sarnia, Ont. (M.1946)
Simmons, H. J. Mgr., Foundry Plant, General Steel Wares Ltd., London, Ont. For mail: 1009 Maitland St. (S.1928. Jr.1936. M.1943)
Simmons, Wm. Raymond Asst. Supt., Power Dept., Montreal Tramways Co., 159 Craig St. W., Montreal (M.1945)
Simms, Cliff E. Bldgs. Engr., Maritime Telegraph & Telephone Co., Halifax, N.S. For mail: 26 Fraser St. (M.1942)
Simon, Robt. C. Engrg. Dept., Imperial Oil Ltd., Montreal East. For mail: 2070 Peel St., Montreal. (S.1925. Jr.1931. A.M.1936. M.1940)
Simons, S. J. Field Engr., Ontario Paper Co., Thorold, Ont. (S.1940. Jr.1946)
Simpkin, D. B. Designer, Hamilton Bridge Co. For mail: 322 Brant St., Burlington, Ont. (S.1919. Jr.1927. A.M. 1933. M.1940)
Simpkins, A. C. Mgr., Mech. Dept., Can. Comstock Co., Leaside, Ont. For mail: 80 Sherwood Ave., Toronto. (S.1941. Jr.1946)
Simpson, C. Cecil Sales Engr., Power Appar., Northern Electric Co., Montreal. (For mail: 2301 Beaconsfield Ave. (S.1938. M.1945)
Simpson, C. N. Asst. Engr., H. G. Acres & Co., Cons. Engrs., Niagara Falls, Ont. (S1939. Jr.1943)
Simpson, D. B. Can. Comstock Co., Outarde Camp, Baie Comeau, Que. (S.1944. Jr.1946)
Simpson, Fred C. Chief Constrn. Engr., Herbert Morris Crane & Hoist Co., Niagara Falls, Ont. For mail: 1011 Armoury St. (A.M.1938. M.1940)
Simpson, Frederick John Instructor, Engrg. Drawing, T. J. Trapp Technical High School, New Westminster, B.C. For mail: Carlton Court, 317 Third Ave. (A.M.1936. M.1940)
Simpson, F. W. 41 Union St., Ottawa. (S.1942. Jr.1946)
Simpson, John H. Assoc. Resch. Engr., National Research Council, Ottawa. For mail: 41 Union St. (S.1937. Jr.1943)
Simpson, Jack Lloyd Mgr., Insulation Industries (Man.) Ltd., 760 Wall St., Winnipeg, Man. (S.1943. Jr.1945)
Simpson, John Raymond Strl. Engr., Arch. Br., Dept. Public Works of B.C., Victoria, B.C. For mail: 44 Simcoe St. (M.1946)
Simpson, Leslie C. 1173 Wolseley Ave., Winnipeg, Man. (S.1943. Jr.1946)
Simpson, Philip Handley Page Ltd., London, Eng. For mail: 32 Crundale Ave., Kingsbury, London N.W.9, England. (A.M.1923. M.1940)
Simpson, R. E. White Motor Co. of Can., Montreal. For mail: 7 Lazard Ave., Town of Mount Royal, Que. (M.1946)
Simpson, W. F. Constrn. Engr., Can. Johns-Manville Co., Asbestos, Que. For mail: Box 306. (M.1945)
Simpson, W. T. Sound System Engr., Northern Electric Co., Montreal. For mail: 5207 Trans Island Ave. (S.1942. Jr.1946)
Simson, D. C. Unwin Col., Attaché, Canadian Embassy, Paris, France. (A.M.1921. M.1940)
Simson, Fred T. Mech. Engr., Can. & General Finance Co., 25 King St. W., Toronto. (M.1944)
Sinclair, A. B. Supt., Hydro-Elec. Dept., Price Bros. & Co., Kenogami, Que. For mail: 2 Maple Crescent. (S.1927. Jr.1928. A.M.1935. M.1940)
Sinclair, Donald A. 120 Crescent Road, Toronto. (S.1943)
Sinclair, George Resch. Supvr., Ohio State University Research Foundation, Columbus, O. For mail: 171 King Ave. (S.1933. Jr.1942)
Sinclair, G. E. Blake Gen. Exec. Asst., Dept. Mines & Resources, 150 Wellington St., Ottawa. (A.M.1922. M.1940)
Sinclair, S. R. Sessional Instructor, Civil Engrg. Dept., University of Alberta, Edmonton, Alta. (S.1943. Jr.1946)
Singer, Gerald G. Mgr., Atlas Engrg. Works, 4361 de Bullion St., Montreal. (S.1939. Jr.1944)
Singer, Robt. A. 68 Baby Point Cres., Toronto 9. (S.1946)
Sinnamon, A. W. Chief Engr., Brantford Coach & Body Ltd., Paris, Ont. For mail: 123 McNab St., Hamilton, Ont. (M.1920)
Sise, Paul E. Pres., Northern Electric Co., 1050 Beaver Hall Hill, Montreal. (M.1920)
Sisson, C. E. Works Engr., Can. General Electric Co., 940 Lansdowne Ave., Toronto. (M.1919)
Sisson, Heber Percival Asst. Divn. Engr., Dept. Highways of Ont., Fort William. For mail: 11 Crown St., Port Arthur, Ont. (Affil.1936)
Sissons, Thos. A. Elec. Test. Techn., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 196 Reid St. (S.1946)
Skarin, Emil Pres., Crown Paving Co., Edmonton, Alta. For mail: 11115-89th Ave. (M.1936)
Skelton, Cecil Hastings Cons. Engr., Montreal. For mail: 3496 Montclair Ave. (M.1945)
Skelton, Eric T. Capt., R.C.E., Works Officer, Quebec. For mail: 2112 Vendome Ave., Montreal. (S.1942. Jr.1944)
Skelton, P. Edwin Traffic Engr., Bell Telephone Co., Montreal. For mail: 5558 Decelles Ave. (S.1945)
Skerry, Francis S. (Jr.1938)
Skinner, C. M. Can. Gen. Elec. Co., Peterborough, Ont. For mail: 515 Bolivar St. (S.1946)
Skolfield, H. N. Engr., Maine State Highway Comm., 35 Church St., Ellsworth, Me., U.S.A. (A.M.1919. M.1940)
Slader, Geoffrey Yorke Engrg. Dept., Gatineau Power Co., Ottawa. For mail: 205 Flora St. (S.1944)
Slaney, F. F. Campbell River, B.C. (S.1946)
Slater, Arthur E. C. Supvg. Engr., Polymer Corp. Ltd., Sarnia, Ont. For mail: 534 Davis St. (M.1946)
Slater, John S. Asst. Engr., Dept. Public Works of Canada, Post Office Bldg., New Westminster, N.B. (S.1943. Jr.1946)
Slater, Stewart Major, R.C.E., Royal Military College, Kingston, Ont. (S.1938. M.1946)
Slinn, W. Harmon Divn. Plant Engr., Bell Telephone Co., Toronto. For mail: 21 Glenholme Ave. (S.1916. Jr.1918. A.M.1920. M.1940)
Slipp, J. G. 73 Pleasant Blvd., Toronto. (S.1939. M.1945)
Sloan, J. Luxton S/L, R.A.F., 1411-7a St. N.W., Calgary, Alta. (Jr.1946)
Slominski, F. J. Br. Mgr., Poole Construction Co., Regina, Sask. For mail: Bellevue Court. (M.1944)
Slone, Morton R. 643 Bloomfield Ave., Outremont, Que. (S.1945)
Smail, F. H. Insptg. Engr., Dept. Highways of Sask., Regina. For mail: 49 Angus Cres. (A.M.1939. M.1940)
Smaill, Wm. Chief Engr., Northern Construction Co., Vancouver, B.C. For mail: 975 Chilco St. (M.1918)
Small, F. S. Office Engr., Fraser Brace Ltd., 360 St. James St. W., Montreal. (S.1909. A.M.1917. M.1929)
Small, W. H. Vice-Pres. & Chief Engr., Barnett-McQueen Co., Box 39, Fort William, Ont. (M.1939)
Smallhorn, Edward R. Gen. Mgr., Aerocrete Construction Co., Lakefield Ave., Montreal East. (S.1923. A.M.1932. M.1940)
Smallwood, Robt. E. Engr. i/c Transm. & Plastics Machinery, Dominion Engineering Works, P.O. Box 220, Montreal (S.1935. M.1945)
Smedley, Hubert Mill Supt., Malagash Salt Co., New Glasgow, N.S. For mail: Malagash, N.S. (M.1946)
Smiley, D. C. Capt., R.C.E.M.E., N.D.H.Q., Ottawa. For mail: 124 Hamilton Ave. (S.1938. Jr1942)
Smith, A. A. Chief Engr., Dept. Highways of Ont., Toronto. For mail: 160 Stibbard St. (M.1921)
Smith, Allen C. Strl. Engr., C. B. K. Van Norman, Arch., Vancouver, B.C. For mail: 3241 E. 28th Ave. (S.1941. Jr.1945)
Smith, Arthur D. Foster Wheeler Ltd., St. Catharines, Ont. For mail: 40 South Drive. (S.1939. Jr.1943)
Smith, A. G. Illum. Sales Engr., Northern Electric Co., 131 Simcoe St., Toronto. (S.1937. Jr.1942)
Smith, Arthur James Edwin Asst. Town Engr., 5569 Queen Mary Road, Hampstead, Que. (S.1935. M.1942)
Smith, A. T. Eric Vice-Pres., Fraser Brace Engrg. Co., Montreal. For mail: 78 Dufferin Road, Hampstead, Que. (A.M.1929. M.1940)
Smith, Adam W. Simpson Asst. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 46 Old Bridle Path. (S.1921. A.M.1938. M.1940)
Smith, C. A. Asst. Engr., Transm. Sec., Hydro Elec. Power Comm. of Ont., Toronto. For mail: 125 Evelyn Ave. (M.1941)
Smith, Carl C. Circuit Breaker Engr., Can. Westinghouse Co., Hamilton, Ont. For mail: 167 London St. (S.1928. Jr.1935. M.1941)
Smith, Claude H. M. Office of Engr. of Constrn., Can. Nat. Rlys., Toronto. For mail: 2090 Avenue Road. (S.1943. Jr.1946)
Smith, D. A. G. Mine Engr., International Uranium Mining Co., Contact Lake, via Yellowknife, N.W.T. (M.1946)
Smith, Donald Bentley Jr. Engr., Bell Telephone Co., Ottawa. For mail: 471 McLeod St. (S.1945)
Smith, Duncan N. Design Engr., Dominion Bridge Co., Toronto. For mail: 7 Rosehill Ave. (M.1942)
Smith, D. R Dir of Works, City Hall, Saint John, N.B. (Jr.1914. A.M.1920. M.1940)
Smith, Donald Sinclair Power Appar. Sales Engr., Northern Electric Co., Vancouver, B.C. For mail: 4093-13th Ave. W. (A.M.1939. M.1940)

Smith, Ernest Dist. Engr., Dept. Public Works of B.C., Parliament Bldgs., Victoria, B.C. (A.M.1922. M.1940)
Smith, Edgar B. Asst. to Chief Engr., Can. Comstock Co., 1010 St. Catherine St. W., Montreal. (S.1939. Jr.1940)
Smith, E. I. 124 Rosemount Ave., Weston, Ont. (S.1946)
Smith, E. L. Eatonia, Sask. (S.1946)
Smith, Eugene L. Chem. Engr., City of Edmonton Power Plant. For mail: 9760-90th Ave., Edmonton, Alta. (S.1930. A.M.1936. M.1940)
Smith, Edith Muriel Jr. Engr., Calgary Power Co., Calgary. For mail: 11331-72nd St., Edmonton, Alta. (S.1946)
Smith, E. S. 438-6th St., Saskatoon, Sask. (Jr.1945)
Smith Fred G. Supvg. Office Engr., Dept. Public Works of Can., Hunter Bldg., Ottawa. (A.M.1918. M.1940)
Smith, F. L. Asst. to Staff Engr., Maritime Telegraph & Telephone Co., Halifax, N.S. For mail: 71 Chestnut St. (M.1943)
Smith, G. E. Engr., Right of Way, Atlantic Reg., Can. Nat. Rlys., Moncton, N.B. (A.M.1921. M.1940)
Smith, Gordon J. Asst. Treas., Queen's University, Kingston, Ont. (A.M.1920. M.1940)
Smith, G. M. International Nickel Co., Sudbury, Ont. For mail: 291 Elm St. E. (S.1935. Jr.1946)
Smith, Hamilton E. Prodn. Mgr., Silex Co., Hartford, Conn. For mail: East Hill Farm, R.F.D. No. 1, Collinsville, Conn., U.S.A. (S.1925. A.M.1930 M.1940)
Smith, H Leslie Asst. Engr., Western Bridge & Steel Fabricators Ltd., Vancouver, B.C. For mail: 1395 W. 12th Ave. (S.1943. Jr.1946)
Smith, H. M. Maritimes Regional Engr., Can. Broadcasting Corp., Sackville, N.B. (M.1943)
Smith, H. P. 31 Drewry Ave., Newtonbrook, Ont. (S.1940. Jr.1946)
Smith, Ian, 1506-13th Ave. W., Calgary, Alta. (Jr.1946)
Smith, Joseph Asst. Engr., Mech. Dept., Dominion Bridge Co., Montreal. For mail: 3500 Walkley Ave. (A.M.1939. M.1940)
Smith, Jos. A. 4422 Christophe-Colomb St., Montreal. (S.1908. A.M.1910. M.1940)
Smith, J. C. R.R. No. 4, Crysler, Ont. (S1946)
Smith, Jack D. (S.1943)
Smith, Jas. E. 4270 Evergreen Ave., Sherman P.O., B.C. (S.1946)
Smith, J. J. Elec. Lt. Cdr., R.C.NVR., Supvr, Elec. Personnel, Naval Service H.Q., Ottawa. (M1942)
Smith, J. Leslie A/Chief Aero Engr., Civil Aviation Br. Dept. of Transport, Ottawa. (A.M.1937. M.1940)
Smith, J. M. Dftsmn., Ont. Dept. of Highways, Toronto. For mail: 796 Carlaw Ave. (M.1942)
Smith, J. Norman Power Supvg. Engr., City of Westmount, Que. (M.1921)
Smith, L. E. Instrmn., Dept. of Transport, Whitecourt, Alta. (S.1942. Jr.1944)
Smith, Maurice H. Insptg. Officer, Inspection Board of Canada, Hamilton. For mail: 500 Romaine St., Peterborough, Ont. (Jr.1939. M.1942)
Smith, M. S. (Jr.1939)
Smith, Norman J. W. Office & Field Engr., McKay-Cocker Constrn. Ltd., 284 Dundas St., London, Ont. (S.1931. M.1944)
Smith, Odric H. Assoc., Karel R. Rybka, Cons. Engr., 989 Bay St., Toronto. (S.1935. Jr.1946)
Smith, Osborne K. Engr., Ont. Sales Divn., Imperial Oil Ltd., Leaside, Toronto. For mail: 122 Divadale Drive. (M.1945)
Smith, Owen L. Elec. Engr., Price Bros. & Co., Riverbend, Que. (S.1935. Jr.1938)
Smith, Owen W. Asst. Dist. Engr., Dept. Public Works of B.C. For mail: 1720 Beach Drive, Victoria, B.C. (S.1895. A.M.1901. M.1910)
Smith, Paul D. Elec. Engr., Can. Westinghouse Co., 286 Sanford North, Hamilton, Ont. (M.1946)
Smith, Paul M. Irrigation Dept., Colombo, Ceylon. (S.1941. Jr.1944. M.1945)
Smith, Paul Moody Constrn. Engr. i/c., Pacific Coast Terminals Co., New Westminster, B.C. For mail: 1504 Hamilton St. (A.M.1920. M.1940)
Smith, Russ 40 Eastgate, Winnipeg, Man. (S.1946)
Smith, R. F. A. Refinery Mgr., British American Oil Co., Montreal East. (M.1945)
Smith, Roy H. Engrg. & Devlpt. Dept., Imperial Oil Ltd., Sarnia, Ont. (M.1946)
Smith, Robt. L. Mfg. Engr., Northern Electric Co., Montreal. For mail: 4890 Maplewood Ave. (S.1941. Jr.1945)
Smith, R. M. 140 Wolfrey Ave., Toronto 6. (A.M.1921. M.1940)
Smith, Robt. Rudolph Asst. Engr., W. G. Ure, Surv. & Cons. Engr., 9 Perry St., Woodstock, Ont. (S.1942. Jr.1946)
Smith, R. Stewart Bishopton, Que. (S.1946)
Smith, Robt. W., Asst. Prof., Dept. Elec. Engrg., University of New Brunswick, Fredericton, N.B. (M.1945)
Smith, Thomas R. Design Engr., John Inglis Co., Toronto. For mail: 175 Pearson Ave. (S.1944)
Smith, Will Elec., National Light & Power Co., Moose Jaw, Sask. For mail: 1211 Wolfe Ave. (S.1941. Jr.1945)
Smith, W. A. Chief Plants Engr., Burns & Co., Calgary, Alta. (M.1944)
Smith, Willard A. (Jr.1939)
Smith, Wm. C. Wire & Cable Sales Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1946)
Smith, Wm. Chester Mgr., Engrg. Divn., Cooksville Co., 46 Bloor St. W., Toronto. (M.1936)
Smith, W. E. Lieut. (L), R.C.N., Elec. Mtce., H.M.C. Dockyard, Halifax, N.S. For mail: 59 Duncan St. (S.1934. M.1945)
Smith, Walter H. Chief Engr. in Toronto, T. Eaton Co. Ltd., 190 Yonge St., Toronto. (M.1941)
Smith, Walter M. Eastern Divn. Plant, Bell Telephone Co. of Canada, Montreal. (S.1942. Jr.1946)
Smith, Wm. Nelson 524 Court St., Reading, Pa., U.S.A. (M.1919)
Smith, W. Raywood County Engr. for Middlesex, County Bldg., London, Ont. (A.M.1918. M.1940)
Smoke, Franklin G. Asst. Engr., Stewart-Warner-Alemite Corp., Belleville, Ont. For mail: 240 William St. (S.1944)
Smuck, F. Harold Jr. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: Caledonia, Ont. (M.1946)
Smyth, C. M. Gen. Supt., Eastern Light & Power Co., Sydney, N.S. (Jr.1920. A.M.1921. M.1931)
Smyth, Wm. C. Supt. Engr., H. J. O'Connell Ltd., Canada Cement Bldg., Montreal. (S.1935. Jr.1940)
Smythies, R. Eric Antigua Beach Hotel, Antigua, B.W.I. (A.M.1924. M.1926)
Snape, John B. Res. Engr., Jasper National Park, Dept. Mines & Resources of Can., Jasper, Alta. (A.M.1937. M.1940)
Snelgrove, Laurence H. Elec Engr., Courtauld's (Canada) Ltd., Cornwall, Ont. For mail: 731-a Amelia St. (S.1944)
Snider, A. Melville Gen. Mgr., Sunshine Waterloo Co. Ltd., Waterloo, Ont. (S.1917. Jr.1918. A.M.1922. M.1940)
Sniezek, Jos. T. Jr. Engr. Logging Divn., Ontario-Minnesota Pulp & Paper Co., Kenora, Ont. For mail: 119 Rupert Road (S.1946)
Snodgrass, J. Roscoe, Young's Cove Road, Queen's Co., N.B. (S.1941. Jr.1946)
Snook, W. A. G. 676 Prince St., Truro, N.S. (S.1946)
Snook, Walter I. Truro, N.S. (M.1940)
Snow, A. H. G. Jr. Hyd. Engr., P.F.R.A., Dept. of Agric., Public Bldg., Calgary, Alta. (S.1944)
Snyder, B W. Engr., Can. Western Natural Gas Light, Heat & Power Co., 215-6th Ave., W., Calgary Alta. (A.M.1937. M.1940)
Snyder, Frederic Antes Constrn. & Safety Engr., 105 Carnegie Ave., East Orange, N.J., U.S.A. (M.1915)
Snyder, Robt. B., Can. Western Natural Gas Heat, Light & Power Co., 215-6th Ave. W., Calgary, Alta. (S.1938. Jr.1946)
Snyder, R. R. Jr. Engr. & Dftsmn., Pacific Mills Ltd., Box 189, Ocean Falls, B.C. (S.1942. Jr.1945)
Snyder, W. G. Plant Mgr., Wettlaufer-Welker Industries Ltd., 32 Queen St., Waterloo, Ont. (S.1937. Jr.1946)
Soden, John W. Job Study Engr., Proctor & Gamble Co. of Can., Hamilton, Ont. For mail: 493 Catherine St. N. (S.1946)
Soicher, Percy Arthur Design & Test., Hyd. Equipt., Dominion Engineering Works, Lachine. For mail: 4629 Hutchison St., Montreal. (Jr.1946)
Soles, Wm. England Mill Mgr., Anglo-Canadian Pulp & Paper Mills Ltd., Quebec. (S.1935. Jr.1938)
Solomon, Julius D. A. V. Roe Canada Ltd., Box 430, Terminal A, Toronto. (S.1942. Jr.1944)
Sokoloski, Steve (S.1941. Jr.1946)
Somers, C. J. Plant Engr., Robin Hood Flour Mills Co., Moose Jaw, Sask. (S.1936. Jr.1937. M.1943)
Somers, J. S. Engr. Supt., Marine Sec., Foundation Maritime Ltd., Halifax, N.S. For mail: 20 Carleton St. (M.1946)
Somerville A. Laurence H. Dist. Airway Engr., Civil Aviation Divn., Dept. of Transport, Post Office Bldg., Lethbridge, Alta. (A.M.1936. M.1940)
Sommerville, Donald B. Vice-Pres. & Gen. Mgr., St. Catharines Steel Products Ltd., 72 Vine St., St. Catharines, Ont. (Jr.1937. M.1946)
Sommerville, L. W. Chief Engr., Air-Lock Log Constrn. Co., Toronto. For mail: 131 DeForest Road. (S.1944. Jr.1946)
Sorby, Walter O. Sales Engr., Can. Westinghouse Co., 1010 St. Catherine St. W., Montreal. (M.1945)
Sorensen, E. E. 384 Earl St., Kingston, Ont. (Jr.1946)
Sorgius, Henry Supt. Woods Operations, Consolidated Paper Corp., Shawinigan Falls, Que. For mail: 45 Maple Ave. (M.1945)
Soucy, C. André L. 2447 Maplewood Ave., Montreal 26. (S.1944)
Soucy, Jacques 6590 Christophe-Colomb St., Montreal 10. (S.1945)
Southmayd, Charles Goodrich Engr., Hyd. Dept., Can. Allis-Chalmers Ltd., 212 King St. W., Toronto. (M.1945)
Spark, H. S. Asst. Chief Engr., National Harbours Board, Montreal. For mail: 223 Melville Ave., Westmount, Que. (A.M.1922. M.1940)
Sparrow, C. W. Transm. & Equipt. Engr., Sask. Govt. Telephones, Regina, Sask. For mail: 1079 Atkinson St. (M.1945)
Spector, M. N. 117-3rd Ave., Yorkton, Sask. (S.1946)
Speed, S. R. 799 St. Mary's Road, St. Vital, Man. (S.1946)
Spence, Allan J. Jr. Engr., Calgary Power Co., Ltd. For mail: 824-13th Ave. West, Calgary, Alta. (S.1944)
Spence, Earl B. Sr. Engr., New Brunswick Internl. Paper Co., Dalhousie, N.B. For mail: St. Croix, Hants Co., N.S. (S.1931. M.1941)
Spence, H. C. Mgr. Calgary Br., Central Mortgage & Housing Corp., 513-8th Ave. W., Calgary, Alta. (A.M.1938. M.1940)
Spence, John James Asst. Prof., Faculty of Applied Science & Engrg., University of Toronto, Toronto. (A.M.1926. M.1940)
Spencer, Brian Roff Cdr. (E), R.C.N., Asst. Engr.-in-Chief, Naval Service H.Q., Ottawa. (A.M.1939. M.1940)
Spencer, George H. Lt.Col., Royal Military College, Kingston, Ont. (S.1938. Jr.1946)
Spencer, Henry A. Jr. Engr., Diesel Dept., Dominion Engrg. Works, Montreal. For mail: 5548 Queen Mary Road. (S.1943. Jr.1946)
Spencer, Henry C. Chief Mach. & Tool Designer, Northern Electric Co., Montreal. For mail: 4321 Beaconsfield Ave. (A.M.1935. M.1940)
Spencer, J. D. Can. Blower & Forge Co., Kitchener, Ont. For mail: 136 Water St. W. (S.1943. Jr.1946)
Spencer, J. G. 407-5th St. W., Calgary, Alta. (S.1946)
Spencer, Roy A. Dean of Engrg., University of Saskatchewan, Saskatoon, Sask. (S.1907. Jr.1913. A.M.1919. M.1940)
Spencer, Walter H. Engr., Elec. Transm. Lines, Quebec-Hydro-Elec. Comm., Montreal. For mail: 646 Belmont Ave., Westmount, Que. (M.1945)
Spicer, B. W. R.R. No. 4, Komoka, Ont. (S.1946)
Spigelman, M. Street Lighting Engr., City of Winnipeg. For mail: 141 Polson Ave., Winnipeg, Man. (M.1946)
Spino, Mario 7793 Henri-Julien St., Montreal. (S.1946)
Spivak, S. G. 115 S. Birney, Bay City, Mich., U.S.A. (S.1946)
Spotton, John G. Mfgr.'s Rep., Toronto. For mail: 26 Princeton Road. (S.1920. Jr.1924. A.M.1934. M.1940)
Spratt, M. J. Chief Engr., Sask. Pool Elevators Ltd., Regina, Sask. For mail: 27 Lorscott Apts. (S.1921. A.M.1927. M.1936)
Sprenger, A. Reginald Wartime Merchant Shipping Ltd., Montreal. For mail: 6957 Terrebonne Ave. (S.1906. A.M.1908. M.1919)
Spriggs, Robt. H. Divn. Plant Engr., Bell Telephone Co., 479 Clarence St., London, Ont. (S.1920. Jr.1929. M.1941)
Spriggs, Wm. Elec. Design Engr., Shawinigan Engineering Co., 107 Craig St. W., Montreal. (M.1941)
Sproule, George Fintona, Milngavie, Dumbartonshire, Scotland. (A.M.1917. M.1940)
Sproule, J. E. Transm. & Distbn. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 48 Douglas Drive. (A.M.1926. M.1940)
Sproule, S. M. Arch., 1420 Sherbrooke St. W., Montreal. (M.1944)
Stacey, Leonard B. Dist. Mgr., Packard Electric Co., 570 Dunsmuir St., Vancouver, B.C. (M.1945)
Stadler, John Indust. Engr., 1117 St. Catherine St. W., Montreal. (M.1921)
Stafford, James Walter Devlpt. Engr., Aluminum Co. of Can., Sun Life Bldg., Montreal. (S.1936. M.1942)
Stairs, Denis Vice-Pres., Montreal Engineering Co. Ltd., 244 St. James St. W., Montreal. (M.1930)
Stairs, Gordon S. Divn. Engr., Constrn., Dept. Highways & Public Works of N.S. For mail: 15 Dalhousie St., Halifax, N.S. (M.1940)
Stairs, H. G. Cons. Engr. & Naval Arch., Mahone Bay, N.S. (M.1945)
Stairs, James A. Mech. Engr., Dominion Engineering Works, Montreal. For mail: 6720 Sherbrooke St. W. (M.1939)
Stamford, G. W. 41 Wellington Ave., Victoria, B.C. (S.1943)
Stamford, W. L. Agent, Dept. of Transport, Victoria, B.C. (A.M.1916. M.1940)
Stanfield, G. D. Pres., Starr Mfg. Works Ltd., Prince Albert Rd., Dartmouth, N.S. (Jr.1940. M.1946)
Stanfield, J. Y. Gen. Mgr., Londonderry of Canada Ltd., Montreal. For mail: 954 MacNaughton Rd., Town of Mt. Royal, Que. (S.1932. Jr.1937. M.1943)
Staniforth, Harold F. Sec. Treas., Staniforth Lumber Co., 437 St. James St. W., Montreal. S.1940. Jr.1944)

Stanley, Donald Russell Prov. Sanitary Engr., Dept. Health of Alta., Administration Bldgs., Edmonton, Alta. (S.1939. Jr.1941. M.1946)
Stanley, J. N. 28 Beechwood Ave., York Mills, Ont. (S.1908. A.M. 1912. M.1940)
Stanley, James P. Indust. Engr., Ronalds Co. Ltd., Montreal. For mail. 559 Lansdowne Ave., Westmount, Que. (S.1938. Jr.1942)
Stanley, T. D. Prodn. Supt., Calgary Power Co., Insurance Exchange Bldg., Calgary, Alta. (S.1932. Jr.1937. M.1941)
Stann, Daniel A. Markinch, Sask. (Jr.1945)
Stanners, J. E. 566 Spadina Ave., Toronto. (S.1943)
Stansfield, Edgar 835 Island Road, Victoria B.C. (M.1918)
Stapells, R. F. Power Plant Design, Canadair Ltd., Cartierville. For mail: 72 Hudson Ave., Town of Mt. Royal, Que. (S.1942. Jr.1946)
Staples, Wm. J. Demarara Bauxite Co., Mackenzie, British Guiana, S.A. (Jr.1945)
Staples, W. R. Instr., Mech. Engrg., University of Saskatchewan, Saskatoon, Sask. (S.1941. Jr.1943)
Stapleton, David O. Lab. Tech., Propellor Divn., Can. Car & Foundry Co., Montreal. For mail: 55 Wolseley Ave., Montreal West. (S.1938. M.1944)
Stapleton, Michael J. Harbour Grace, Nfld. (S.1945)
Stapley, W. H. 76 Tampleton St., Ottawa. (Jr.1940)
Stark, John Edward Engr., Station Constrn., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 63 Wendover Road. (M.1941)
Starkey, J. Leonard 3425 University St., Montreal. (S.1933)
Stavert, R. Ewart Pres., Consolidated Mining & Smelting Co., 215 St. James St. W., Montreal. (Jr.1919. A.M.1926. M.1940)
Stead, Harry G. Pres., E. Leonard & Sons, London, Ont. For mail: 79 Bruce St. (Jr.1938. M.1943)
Stearns, Eugene, Pres. & Mng. Dir., Concrete Engrg. Ltd., Montreal. For mail: 4414 Girouard Ave. (M.1945)
Stedman, Ernest W. Mayfair Apartments, Metcalfe St., Ottawa. (M.1921)
Stee, Thomas R. 404 Glencairn Ave., Toronto. (S.1946)
Steel, Francis M. 2801 Tudor Road, Victoria, B.C. (M.1920)
Steel, H. L. Chief Dftsmn. Strl. Design., Robb Engrg. Works Ltd., Amherst, N.S. (M.1943)
Steele, Owen Hewittie Electric Co., Walton-on-Thames, Surrey, England For mail: 146 Hersham Road. (S.1944. Jr.1946)
Steenbuch, Harald L. Engrg. Dept., Shawinigan Water & Power Co., Craig St. W., Montreal. (A.M.1912. M.1940)
Steeves, Cecil Myron Elec. Engr., Sao Paulo Tramway Light & Power Co., 23 Rue Xavier de Toledo, Sao Paulo, Brazil. (M.1945)
Steeves, J. T. R. Dir. i/c Prodn. & Engrg., Imperial Tobacco Co. of Can., Montreal. For mail: 4151 Hampton Ave. (S.1912. A.M.1917. M.1940)
Steeves, S. M. Topograph. Engr., Mines & Geology Br., Dept. Mines & Resources, Museum, McLeod St., Ottawa. (S.1924. A.M.1930. M.1940)
Stehling, Kurt R. 521 Huron St., Toronto. (S.1943)
Steiman, M. I. Jr. Engr., Dept. Public Works of Can., Winnipeg, Man. For mail: 456 Pritchard Ave. (S.1939. Jr.1946)
Stein, Chas R. S. (A.M.1925. M.1940)
Stein, Mark Asst. Constrn. Mgr., Foundation Maritime Ltd., Halifax, N.S. For mail: 12 Second St. (M.1944)
Stein, Morris A. 259 James St. N., Hamilton, Ont. (S.1946)
Steinman, D. B. Cons. Engr., 117 Liberty St., New York 6, N.Y. (M.1929)
Steinmayer, Otto C. 541 Victoria Ave., Westmount, Que. (M.1925)
Ste-Marie, Gaston P. Examr.-Techn., Que. Dept. of Labour, Montreal. For mail: 5329 Duquette Ave. (Affil.1940)
Ste-Marie, Jean E. Engr., J. A. Lalonde & Co., Cons. Engrs., Montreal. For Mail: 5377 Brodeur St. (S.1942)
Stenbol, Carl Chief Engr., Algoma Steel Corp., Sault Ste. Marie, Ont. (M.1921)
Stenhouse, R. H. Engr., Dominion Atlantic Rly. Co., Kentville, N.S. For mail: P.O. Box 261. (Jr.1920 A.M.1922. M.1940)
Stephen, E. J. Wartime Housing Ltd., Vancouver, B.C. For mail: 2589-41st Ave. W. (M.1941)
Stephen, Gordon R. Gen. Mgr., Fraser-Brace Engrg. Co., 360 St. James St. W., Montreal. (A.M.1933 M.1940)
Stephen, R. Garnett 302-6th Ave., Verdun, Que. (S.1946)
Stephens, D. M. Deputy Minister, Dept. Mines & Resources of Man., Legislative Bldg., Winnipeg, Man. (Jr.1934. A.M.1935. M.1940)
Stephens, George L. Engr. Rear Admiral, R.C.N., N.S.H.Q., Ottawa. For mail: 383 Stewart St. (A.M.1919. M.1926)
Stephens, H. J. Mgr., Gold Medal Feeds Ltd., Calgary, Alta. For mail: 534-21st Ave. W. (M.1943)
Stephens, John Prof. Mech. Engrg., University of New Brunswick, Fredericton, N.B. (M.1924)
Stephenson, D. C. Supt. & Engr., Vancouver Island Br., B.C. Power Comm. For mail: R.R.1, Wellington, Nanaimo, B.C. (A.M.1938. M.1940)
Stephenson, Eric P. Engrg. Dept., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 335 Rubidge St. (S.1939. Jr.1944)
Stephenson, George Mech. Supt., E. B. Eddy Co., Hull, Que. (A.M.1931. M.1940)
Stephenson, George E. County Engr. & Road Supt., Bruce County, Box 398, Walkerton, Ont. (S.1915. Jr.1921. A.M.1923. M.1940)
Stephenson, H. A. Vice-Pres., E. S. Stephenson & Co., 15 Dock St., Saint John, N.B. (M.1942)
Stephenson, John Asst. Plant Engr., National Steel Car Corp., Hamilton, Ont., For mail: 97 Barons Ave. S. (A.M.1921. M.1940)
Stephenson, R. J. Res. Engr., Water & Sewerage, Dept. of Transport, Tegler Bldg., Edmonton, Alta. (M.1946)
Stephenson, S. Lt. Col., R. E., Tech. Staff Officer, British Intelligence Survey in Austria. For mail: Barclay's Bank, West End Foreign Branch, Pall Mall, London, S.W.1, England. (S.1930. Jr.1938. A.M.1940. M.1940)
Sterne, Francis E. Tech. Sales, Dye & Chemical Co., Kingston, Ont. (S.1946)
Sternfeld, Sol. I. 5838 Durocher Ave., Montreal. (Jr.1946)
Sterns, Frank E. Engr., National Harbours Board, Ottawa. (A.M.1907. M.1926)
Sterns, Laurence Constrn. Engr., E. B. Eddy Co., Hull, Que. (S.1923. Jr.1925. A.M.1929. M.1940)
Sterns, Russell W. Res. Engr., Ste. Anne Paper Co., Beaupre, Que. (M.1945)
Steven, James H. A. Locating Engr., Dept. Public Works of B.C., Kamloops, B.C. For mail: 211 Connaught Road. (M.1942)
Stevens, A. M. 448 George St., Fredericton, N.B. (S.1946)
Stevens, Frederick Supvr., Dftg. Office, Canadian Bridge Co., Walkerville, Ont. For mail: 690 Windermere Road. (A.M.1923. M.1940)
Stevens, Hugh E. P.O. Box 360, Ladysmith, B.C. (A.M.1917. M.1940)
Stevens, John C. Engrg. Asst., Bell Telephone Co., Toronto. For mail: 604 Huron St. (S.1943. Jr.1946)
Stevens, Peter D. 58 Brookdale Ave., Toronto. (S.1946)
Stevens, R. H. Municipal Engr., Esquimault, B.C. (A.M.1927. M.1940)
Stevens, R. L. Engr., Can. Industries Ltd., P.O. Box 10, Montreal. S.1935. Jr.1940)
Stevens, Guille, H. LeM. Pres. & Mgr., Madison Natural Gas Co., 231-8th Ave. W., Calgary, Alta. (A.M.1936. M.1940)
Stevenson, David A. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 357 Prince Albert Ave., Westmount, Que. (S.1944)
Stevenson, H. I. Overseas. (S.1938. Jr.1946)
Stevenson, M. H. Dist. Engr., Sask. Dept. of Highways, North Battleford, Sask. (A.M.1938. M.1940)
Stevenson, Wm. Foubister. Vice-Pres. & Gen. Mgr., Sterling Collieries Co., McLeod Bldg., Edmonton, Alta. (A.M.1910. M.1940)
Stevenson, Wm. H. Quality Control, Dunlop Tire & Rubber Goods Co., Toronto. For mail: 39 Beachview Cres. (S.1943)
Steventon, Harry E. Mtce. Supvr., Otis-Fensom Elevator Co., Victoria Ave. N., Hamilton, Ont. (A.M.1937. M.1940)
Stevinson, A. L. Student Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 212 Reid St. (S.1946)
Stewart, A. L. Vice-Pres. & Mgr., Bailey Meter Co., Montreal. For mail: 61 Finchley Road, Hampstead, Que. (M.1945)
Stewart, C. G. Sales & Serv. Engr., Can. Car & Foundry Co., Fort William Ont. (M.1945)
Stewart, Donald. Divn. Equipt. Engr., Bell Telephone Co., Montreal. For mail: 5228 Byron Ave. (M.1945)
Stewart, Donald L. Supvn. & Mtce., East. Area, Bell Telephone Co., Montreal. For mail: 4659 Melrose Ave. (S.1922. A.M.1927. M.1940)
Stewart, Earl. Chemist, Sewage Disposal Works, City Engr.'s Dept., Regina, Sask. For mail: 1315 McTavish St. (M.1943)
Stewart, Fred. C. Cons. Engr., Dominion Bank Bldg., Vancouver, B.C. (M.1934)
Stewart, J. J. 5876 Notre Dame St. E., Montreal. (S.1943. Jr.1946)
Stewart, J. R. 197 Argyle St., Renfrew, Ont. For mail: Box 447. (A.M.1921. M.1940)
Stewart, John R. Asst. Sales Mgr., Can. Liquid Air Co., 1111 Beaver Hall Hill, Montreal. (S.1925. Jr.1934. M.1940)
Stewart, Murray A. Deputy City Engr., Toronto. For mail: 282 Glencairn Ave. (A.M.1912. M.1940)
Stewart, M. D. City Engr., P.O. Box 100, Sudbury, Ont. (S.1919. Jr.1924. A.M.1929. M.1940)
Stewart, M.D. (S.1939. Jr.1946)
Stewart, M. E. 10955-79th Ave., Edmonton, Alta. (S.1946)
Stewart, R. A. Asst. Design Engr., Winnipeg Hydro-Elec. System, 55 Princess St., Winnipeg, Man. (M.1945)
Stewart, Robt. Bruce. Pres. & Engr., I. Matheson & Co., P.O. Box 620, New Glasgow, N.S. (S.1909. Jr.1913. A.M.1916. M.1918)
Stewart, R. Meldrum. Dominion Astronomer, Dept. of Mines & Resources, Observatory House, Ottawa. (M.1924)
Stewart, Ross O. Engr. of Bridges, Can. Nat. Rlys., McGill St., Montreal. (A.M.1920. M.1940)
Stewart, R. W. 329 Earl St., Kingston, Ont. (S.1944)
Stewart, Walter D. White Motor Co. of Canada, 967 Seymour St., Vancouver, B.C. (S.1933. Jr.1946)
Stewart, Wm. F. Field Engr., A. C. Wickman (Canada) Ltd., Montreal. For mail: 4855 Harvard Ave. (S.1923. Jr.1929)
Stewart, W. M. Mtce. Engr., Dept. of Highways of Sask., Legislative Bldgs., Regina, Sask. (A.M.1917. M.1940)
Stickney, W. Ralph. Welding Engr., Can. Vickers Ltd., P.O. Box 550, Place d'Armes Station, Montreal. (M.1941)
Stiles, Douglas D. Design Strl. Engr., E. A. Cross, Cons. Engr., Toronto. For mail: 293 St. Clements Ave. (Jr.1940)
Stiles, Edwin M. Chief Engr., Consolidated Mining & Smelting Co., Trail, B.C. (M.1945)
Stiles, John A. 498 Piccadilly Ave., Ottawa. (A.M.1913. M.1916)
Stinson, John N. Supvg. Engr., Engrg. & Constrn. Serv., Dept. Mines & Resources, Ottawa. (S.1912. Jr.1917. A.M.1919. M.1940)
Stinson, Wm. G. Lecturer, Dftg. Dept., Queen's University, Kingston, Ont. (S.1944. Jr.1946)
Stirling, Grote The Honourable. For mail: Kelowna, B.C. (M.1927. Hon.M.1937)
Stirling, John B. Vice-Pres., E. G. M. Cape &Co., New Birks Bldg., Montreal. (M.1934)
Stirling, L. Brodie. Supt., Generating Divn., Shawinigan Water & Power Co., P.O. Box 70, Shawinigan Falls, Que. (S.1921. Jr.1929. M.1943)
Stirrett, Gordon. Pres., General Appraisal Co., 553 Granville St., Vancouver, B.C. (M.1940)
St-Jacques, Gustave F. Transptn. Engr., Quebec Provincial Transportation & Communication Board, 89 Notre Dame St. E., Montreal. (S.1935. Jr.1938. A.M.1939. M.1940)
St-Laurent, Aurèle. Dftsmn., Intrnl. Nickel Co. of Can., Copper Cliff, Ont. For mail: 190 Whittaker St., Sudbury, Ont. (S.1941. Jr.1944)
St-Laurent, Joseph-Emile. Vice-Chairman, National Harbours Board, West Block, Wellington St., Ottawa. (M.1922)
St-Martin, Maurice. Engr., Waterworks & Sewerage Divn., City of Montreal. For mail: 982 Montcalm St. (S.1943)
Stobbart, Wm. M. Mgr. Ordnance Plant, Dominion Bridge Co., Vancouver, B.C. (A.M.1935. M.1940)
Stober, Julius L. Asst. Engr., Louis Pickard & Co., Montreal. For mail: 15 Ainslie Ave., Outremont, Que. (S.1946)
Stock, Leonard W. 18 Farley Place, St. Thomas, Ont. (S.1946)
Stocker, W. A. Jr. Engr., Northern Electric Co., Montreal. For mail: 393 Kensington Ave., Westmount, Que. (S.1945)
Stockton, Robt. Summers. Cons. Engr., Craigantler Ranch, Thompson Falls, Montana, U.S.A. (M.1918)
Stockwell, Henry P. Jr. Asst. Waterworks Engr., City of Ottawa, Transportation Bldg., Ottawa. (M.1944)
Stodart, James. Design Engr., City Engr.'s Office, Hamilton, Ont. For mail: 10 Stanley Ave. (A.M.1924. M.1929)
Stokes, H. Aldred C. 226-4th Ave., New Westminster, B.C. (S.1943)
Stokes, P. F. Chief Dftsmn., Indust. Dept., Can. Vickers Ltd., Montreal. For mail: 5006 Mira Rd. (A.M.1925. M.1940)
Stollery, Chas. Alex. Bldg. Constrn. Supt., Poole Constrn. Co., Tegler Bldg., Edmonton, Alta. (S.1941. M.1945)
Stone, Daniel. 4 Avenue Road, Toronto. (S.1942)
Stone, E. A. 23 Park Road, Toronto. (S.1888. A.M.1895. M.1906)
Stone, J. G. Asst. Mtce. Supt., Quebec North Shore Paper Co., Baie Comeau, Que. (S.1940. Jr.1946)
Stone, Rodney E. Post-Grad., Physics Dept., University of Western Ontario, London, Ont. (S.1943. Jr.1946)
Stonehewer, John. Design Engr., Proctor, Redfern & Laughlin, 36 Toronto St., Toronto. (S.1943)
Stonehouse, Donald H. Mount Allison University, Sackville, N.B. (S.1944)
Stopps, F. S. Mech. Designer, Somerville Ltd., London, Ont. (S.1941. Jr.1945)
Stopps, Reginald E. Asst. Radio Engr., Radio Divn., Dept. of Transport, Ottawa. (S.1942. Jr.1946)
Storey, Thos. E. Gen. Supt. i/c Prodn., City of Winnipeg Hydro-Elec. System, 55 Princess St., Winnipeg, Man. (S.1926. Jr.1933. A.M.1935. M.1940)
Storrie, Wm. Gore & Storrie, Cons. Engrs., 1130 Bay St., Toronto. (A.M.1910. M.1917

Stothert, Winston D. Prov. Elec. Inspr., Dept. Public Works of Alta., Old Court House Bldg., Calgary, Alta. (Jr.1946)

Stott, J. D. Engr., Power Engineering Co., Craig St. W., Montreal. (A.M.1921. M.1940)

Stowe, G. N. 1080 Burris St., Burnaby via New Westminster, B.C. (A.M.1920. M.1940)

St-Pierre, Fernand Omer. Engr., Laurentide Divn., Consolidated Paper Corp., Grand'Mère, Que. (S.1942)

St-Pierre, J. C. d'Arcy. 5055 Turcot St., Montreal. (S.1944)

St-Pierre, Robert. Trainee, Ville La Salle Plant, Standard Brands Ltd., Montreal. For mail: 6665 DeNormanville St. (S.1943)

Strachan, Jack L. Mtce. Engr., Defence Industries Ltd., Chalk River, Ont. (S.1939. Jr.1945)

Strathy, R. L. A. 481 Prince Albert Ave., Westmount, Que. (Jr.1921. A.M.1922. M.1940)

Stratton, D. H. Gen. Mgr., Stratton Engrg. Co., Winnipeg, Man. For mail: 174 Yale Ave. (M.1945)

Stratton, F. S. Sales & Serv. Engr., Exide Batteries of Can. Ltd., 153 Dufferin St., Toronto. (S.1928. A.M.1937. M.1940)

Stratton, L. R. Strl. Engr., National Harbours Board Ottawa. For mail: 335 Metcalfe St. (S.1930. Jr.1936. M.1943)

Stratton, W. D. G. Res. Engr., Civil Aviation Br., Dept. of Transport, P.O. Box 38, Moncton, N.B. (S.1929. Jr. 1936. M.1940)

Street, Alfred E. Transptn. Engr., Can. National Rlys., Union Depot, Winnipeg, Man. (S.1940. Jr.1946)

Street, J. C. Mgr., Board of Water Commrs., Welland, Ont. For mail: 181 Niagara St. (S.1909. Jr.1913. A.M.1914. M.1921)

Street, J. J. A. Mgr., Concrete Products Ltd., Regina, Sask. For mail: 2639 Angus Blvd. (A.M.1938. M.1940)

Strickland, Robt. Ste Anne de Bellevue, Que. (A.M.1906. M.1940)

Strickland, T. P. Priv. Prac., 84-88 William St., Melbourne, C.I., Australia. (S.1898. M.1910)

Stringer, Douglas Melville Chemist, Fabrikoid Divn., Can. Industries Ltd., Toronto. For mail: 54 Alhambra Ave. (S.1946)

Striowski, J. B. Engr. of Design, Engrg. Dept., City of Winnipeg. For mail: 84 Lenore St. (S.1927. Jr.1935. A.M.1939. M.1940)

Strong, B. J. O. 1576 Retallack St., Regina, Sask. (A.M.1938. M.1940)

Strong, J. I. Asst. City Engr., City Hall, Calgary, Alta. (A.M. 1938. M.1940)

Strong, Robt. L. Engr., Associated Factory Mutual Fire Insurance Co's., Boston, Mass. For mail: 45 Washburn Ave., Wellesley Hills, Mass., U.S.A. (S.1932. M.1941)

Stroyan, Philip B. Supt. & Engr., Board of Park Commrs., Vancouver, B.C. For mail: 2099 Beach Ave. (A.M.1938. M.1940)

Stuart, H. Black Cons. Engr., 4205 Dorchester St. W., Westmount, Que. (S.1888. A.M.1898. M.1940)

Stuart, Wm. Grey Mining & Hyd. Engr., Swan River Power Project, Yellowknife, N.W.T. (A.M.1927. M.1937)

Stuart, Wm. Henry Deputy Minister, Dept. of Industry & Publicity, Provincial Bldg., Halifax, N.S. (A.M.1919. M.1932)

Stubbs, J. C. 3647 University St., Montreal. (S.1946)

Stuewe, Wm. L. Mech. Supt. of Coal Mines, Dominion Steel & Coal Corp., Sydney, N.S. For mail: 62 Charlotte St. (M.1946)

Stuppel, I. Gen. Supt., Northern Foundry Ltd., Montreal. For mail: 5620 Decarie Blvd. (M.1944)

Sturdee, Chas. P. Devlpt. Engr., Imperial Oil Ltd., Sarnia, Ont. For mail: R.R. No. 1. (M.1946)

Sturdy, F. D. Instructor, Regina College, Sask. For mail: 175 Leopold Crescent. (S.1941. Jr.1946)

Sudden, Edwin A. Asst. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 9 Raymond Ave. (S.1926. Jr.1928. M.1942)

Sugiyama, J. S. 517 Furby St., Winnipeg, Man. (S.1944)

Suitor, W. D. Imperial Oil Co., Calgary, Alta. For mail: 1315-6th St. N.W. (Jr.1936. M.1941)

Sullivan, Arthur W. Priv. Prac., & City Engr., Valleyfield, Que. For mail: 244 Salaberry St. (S.1909. Jr.1914. A.M.1920. M.1940)

Sullivan, Harry Morton Chemist, Dept. Public Works, Ottawa. For mail: 18 Findlay Ave. (S.1945)

Sullivan, T. E. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 4465 Sherbrooke St. W. (S.1946)

Surtees, Russell C. 80 St. Vital Road, St. Vital, Man. (S.1945)

Surveyer, Arthur Cons. Engr., Arthur Surveyer & Co., Dominion Square Bldg., Montreal. (S.1899. A.M.1907. M.1912)

Sutcliffe, H. W. Cons. Engr., Sutcliffe Co. Ltd., New Liskeard, Ont. (S.1908. A.M.1913. M.1940)

Sutherland, Donald B. Asst. Supt., Dept. of Bldgs., Montreal Protestant Central School Board, 3460 McTavish St., Montreal. (S.1932. M.1943)

Sutherland, Duncan G. Investment Agent, Winnipeg Electric Co., Winnipeg, Man. For mail: 1012 Jessie Ave. (A.M.1922. M.1940)

Sutherland, Donald H. 43 Esher St., Charlottetown, P.E.I. (S.1938. M.1943)

Sutherland, Eric S. 1012 Jessie Ave., Winnipeg, Man. (S.1939. Jr.1946)

Sutherland, G. A. Exec. Asst., Elec. Engrg. & Radio Br., National Research Council, Sussex St., Ottawa. (Jr.1938)

Sutherland, George M. Engr., Compressor Divn., Can. Ingersoll-Rand Co., Sherbrooke, Que. For mail: 15 Main St., Lennoxville, Que. (S.1924. A.M.1931. M.1940)

Sutherland, John G. Asst. Engr. of Bldgs., Can. Pacific Rly., Windsor Station, Montreal. (M.1944)

Sutherland, J. R. S. (A.M.1911. M.1940)

Sutherland, L. H. D. Pres., Sutherland Constrn. Co., Montreal. For mail: 11 Richelieu Place. (M.1926)

Sutherland, R. D. Dist. Mgr., Rogers Majestic Ltd., 760 St. Antoine St., Montreal. (A.M.1920. M.1940)

Sutherland, W. M. 29 York St., Glace Bay, N.S. (A.M.1922. M.1940)

Suthren, Jos. W. Comphanhia Brasileira Do., Cartuahos, Caixa Postal 1937, Sao Paulo, Brazil, S.A. (S.1936. M.1945)

Suttie, E. R. Can. Cottons Ltd., 760 Victoria Square, Montreal. (M.1946)

Sutton, Arthur L. Plant Engr., John Inglis Co., Toronto. For mail: 12 Malcolm Road, Leaside, Ont. (S.1939. Jr.1944)

Sutton, E. E. Port Credit, Ont. (S.1946)

Svarich, John P. Engrg. Divn., Consolidated Mining & Smelting Co., Trail, B.C. (S.1927. Jr.1934. M.1941)

Swabey, H. W. B. Consultant, Dept. of Reconstruction, Ottawa. For mail: 336 Chapel St. (A.M.1910. M.1919)

Swallow, M. G. Dftsmn., Gaspesia Sulphite Co., Chandler, Que. For mail: P.O. Box 10. (S.1941. Jr.1945)

Swan, Andrew Munro. Engr., Industrial Devlopt. Bank Toronto. For mail: 143a Cedric St. (S.1939. M.1944)

Swan, David. Chief Engr., Kipp-Kelly Ltd., 68 Higgins Ave., Winnipeg, Man. (M.1946)

Swan, N. Stanley S. Designer & Dftsmn., Brian R. Perry, Cons. Engr., 680 Sherbrooke St. W., Montreal. A.M.1936. M.1940)

Swan, Russell G. 8004 Western Ave., Montreal West, Que. (S.1907. A.M.1913. M.1940)

Swan, Wm. George. Cons. Engr., Birks Bldg., Vancouver. B.C. (S.1906. A.M.1910. M.1919)

Swanson, Alfred Lawrence. Engr. & Prodn. Mgr., International Plywoods Ltd., Gatineau, Que. For mail: Box 157. (M.1944)

Swarek, Martin. Jr. Engr., Winnipeg Hydro Elec. System, 55 Princess St., Winnipeg, Man. (S.1943. Jr.1946)

Swartz, J. N. Tech. Supt., Howard Smith Paper Mills, Cornwall, Ont. (S.1934. Jr.1939)

Sweeney, Jack B. Asst. to Divn. Engr., Laurentide Divn., Consolidated Paper Corp., Grand'Mère, Que. (S.1941. Jr.1943)

Sweet, F. A. Asst. Secy., Can. Standards Assn., National Research Bldg., Ottawa. (M.1943)

Sweet, Wm. H. Northern Electric Co., 1261 Shearer St., Montreal. (S.1943. Jr.1946)

Sweezey, Robt. Oliver. Pres., R. O. Sweezey & Co., 132 St. James St. W., Montreal. S.1907. A.M.1909. M.1916)

Swenson, Orville. Naicam, Sask. (S.1943)

Swerdfeger, John H. Strl. Designer & Dftsmn., E. F. Carter, Cons. Engr., Vancouver, B.C. For mail: 2083 E. 37th Ave. (S.1941. Jr.1946)

Swift, Chas. E. Elec. Engr., Shawinigan Water & Power Co. For mail: 101 Cascades Ave., Shawinigan Falls, Que. (S.1945)

Swift, J. W. 5142 Notre Dame de Grace Ave., Montreal. (S.1933. Jr. 1946)

Swift, Lionel D. Asst. Supt., Power Divn., Quebec Power Co. For mail: 511 St. Cyrille St., Quebec. (Jr.1941. M.1945)

Swinnerton, Aylmer A. Engr., Fuel Research Labs., Bureau of Mines, 562 Booth St., Ottawa. (A.M.1924. M.1940)

Swinton, K. R. Mgr., Electronics Divn., R.C.A. Victor Co., Montreal. For mail: 5267 Westbury Ave. (M.1942)

Swyers, Harry Bonavista, Newfoundland. (S.1946)

Swystun, August Dftsmn., Consolidated Mining& Smelting Co., Tadanac, B.C. For mail: 15 Aldridge Ave., Trail, B.C. (S.1945)

Sylvester, Jack D. Asst. Engr., Can. National Rlys., Montreal. For mail: 3575 Durocher St. (S.1938. Jr.1940)

Symes, Donald C. Student Engr., Spruce Falls Power & Paper Co., Kapuskasing Inn, Kapuskasing, Ont. (S.1946)

Symons, Lloyd G. Dominion Foils (Canada) Ltd., Three Rivers, Que. For mail: 2133-5th Ave. (S.1941. Jr.1944)

Szkolnicki, T. J. Engr., Motor Coach, Winnipeg, Man. For mail: 553 St. Johns Ave. (S.1945)

Szymanski, Michal Bernard Stress Engr., Fairchild Aviation, Montreal. For mail: 3210 Maplewood Ave. (M.1946)

T

Tackaberry, Stanley G. Air Commodore, R.C.A.F., 11 Inglewood Place, Ottawa. (A.M.1920. M.1940)

Tait, Eric Strl. Design Engr., G. Lorne Wiggs & Co., Indust. Engrs. 1411 Crescent St., Montreal. (S.1938. M.1945)

Tait, I. J. Cons. Engr. & Marine Surveyor, Montreal. For mail: 9790 LaSalle Blvd., Ville LaSalle, Que. (A.M.1918. M.1923)

Tait, Irving R. Chief Engr., Canadian Industries Ltd., Montreal. For mail: 4034 Oxford Ave. (A.M.1921. M.1940)

Tait, J. L. M. Dominion Bridge Co., Lachine. For mail: 473 Birch St., St. Lambert, Que. (A.M.1922. M.1940)

Takeshige, Maurice 3649 Park Ave., Montreal 18. (S.1944)

Talbot, Chas. 26 Cynthia St., London, Ont. (A.M.1921. M.1940)

Tallman, E. Gordon Engr., Hyd. Design, Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (M.1944)

Talman, Stephen G. Dftsmn., City of Toronto. For mail: 88 Delaware Ave. (A.M.1914. M.1937)

Tamblyn, R. T. Sales & Design. Engr., Canadian Ice Machinery Co., Toronto. For mail: 83 Prince Arthur St. (S.1942. Jr.1946)

Tames, John Alex. Appar. Sales Engr., Can. Westinghouse Co., Marine Bldg., Vancouver, B.C. (S.1924. Jr.1928. M.1943)

Tanguay, Pierre 10600 Waverley St., Montreal 12. (S.1944)

Tannenbaum, J. Canadian Vickers Ltd., Montreal. For mail: 5346 Jeanne Mance St. (S.1934. Jr.1940)

Tanner, Chas. J. Sr. Engr., Montreal Dist., Dominion Sound Equipments Ltd. For mail: 39 Cardinal Ave., St. Laurent, Que. (M.1945)

Tanner, Chas. J. Asst. Supvr., Ore Plant No. 1, Aluminum Co. of Can., Arvida, Que. For mail: 824 Second St. (Jr.1945)

Tanner, Wm. John 133 Longueuil St., Longueuil, Que. (S.1938. Jr.1943. M.1945)

Tansey, Peter James 2307 Melrose Ave., Montreal. (S.1946)

Tant, V. E. Chairman, Specif. Panel, Committee on Electronics Standards, Dept. National Defence, Ottawa. For mail: 250 Cooper St. (S.1944. Jr.1946)

Tanton, Fred W. Southern Canada Power Co., Montreal. For mail: 546 Mercile Ave., St. Lambert, Que. (A.M.1939. M.1940)

Tanton, Roy Fraser 88 Cedar St., Halifax, N.S. (S.1945)

Tapay, Harold Martin Design. & Dftg., Heaps Engrg. Ltd., New Westminster, B.C. For mail: 175 View St., Nanaimo, B.C. (S.1946)

Tapley, Alexander G. Sr. Asst. Engr., Dept. Public Works of Can., Federal Bldg., Halifax, N.S. (S.1904. A.M.1909. M.1940)

Tapley, D. G. i/c Sales Engrg., Supply Dept., Can. Gen. Elec. Co., 4th St. W. & 11th Ave., Calgary, Alta. (S.1934. Jr.1936. A.M.1940. M.1940)

Tapley, Frederick B. Wiltshire Apts., Winnipeg, Man. (A.M.1910. M.1919)

Tarbox, John W. Jr. Resch. Engr., Dept. Elec. Engrg. & Radio, National Research Council, Ottawa. For mail: 410 Hinton Ave. (M.1946)

Tarr, F. G. A. Asst. Switchgr. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 615 Gilmour St. (S.1926. A.M.1937. M.1940)

Taschereau, Chas. Contract Mgr., Commrl. & Distbn. Dept., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (A.M.1938. M.1940)

Tassé, Y. R. Appar. Engr., Can. Gen. Elec. Co., Quebec. For mail: 14 Bois Joli. (S.1934. M.1941)

Tassie, R. W. Ebasco Intrnl. Corp., 2 Rector St., New York, N.Y. (M.1929)

Tate, G. H. Chief Engr., Can. Kodak Co., Toronto. For mail: 1200 Avenue Road. (A.M.1938. M.1940)

Tate, Harry Wm. Asst. Gen. Mgr., Toronto Transportation Comm., 35 Yonge St., Toronto. (S.1909. A.M.1913. M.1936)

Tate, W. Hunter Sales Engr., Can Gen. Elec. Co., Calgary, Alta. For mail: 211-27th Ave., S.E. (S.1942. Jr.1946)

Taunton, A. J. S. Deputy City Engr., 223 James Ave., Winnipeg, Man. (S.1909. A.M.1914. M1936)

Taylor, Bert, Asst Geol. Quemont Mining Corp., Noranda, Que. For mail: Box 158. (S.1941. Jr.1946)

Taylor, Bruce S. Overseas (S.1929. Jr.1936)

Taylor, Chester Calvin, 4542 Pender St., Vancouver, B.C. (S.1946)

Taylor, Chas G. Partner, Beatty & Taylor, Mun. Engrs. & Land Surveyors, Pembroke, Ont. For mail: 112 William St., Arnprior, Ont. (S.1940. Jr.1942)

Taylor, Clive Gilbert Jr. Engr., Hydro-Elec. Power Comm. of Ont. For mail: 78 Selkirk St., Chatham, Ont. (S.1945)

Taylor, Dudley R. Supvr., Radio & Elec. Engrg., Trans-Canada Air Lines, Winnipeg, Man. For mail: 371 Winchester St. (S.1936. Jr.1942)

Taylor, E. Geo. T. Pres., Taylor Engrg. & Constrn. Co., 80 Richmond St. W., Toronto. (M.1936)
Taylor, Frank 599 Roslyn Ave., Westmount, Que. (S.1898. A.M.1903. M.1910)
Taylor, F. B. Marine & Indust. Engr., Vancouver, B.C. For mail: 3303 Marine Drive. (A.M.1938. M.1940)
Taylor, Frank H. Design. Engr., Lehigh Strl. Steel Co., New York. For mail: 3532-163th St., Flushing, N.Y., U.S.A. (S.1920. A.M.1925. M.1940)
Taylor, Franklin T. Chief Engr., Consumer Products Divn., John Inglis Co. Ltd., Toronto. For mail: 5 Donnybrook Lane. (Jr.1939. M.1941)
Taylor, F. W. Heating Engr., C. B. Taylor, Accts. & Auditors, Toronto. For mail: 27 Cranbrook Ave. (S.1936. Jr.1938)
Taylor, Gilbert Ferguson, Strl. Engr., 4468 W. 13th Ave., Vancouver, B.C. (A.M.1924. M.1940)
Taylor, G. O. Asst. Engr., Marine Br., Dept. of Transport, Halifax. For mail: 31 Smith Ave., Truro, N.S. (S.1945)
Taylor, Gordon R. Grafton, Ont. (Jr.1912. A.M.1919. M.1940)
Taylor, Harry Serv. Engr., Aluminate Chemicals Ltd., Box 353, Moncton, N.B. (S.1939. M.1946)
Taylor, John John Taylor & Co., Engrs. & Contractors, Hamilton, Ont. For mail: 21 Mount Royal Ave. (A.M.1908. M.1940)
Taylor, Jas. L. Asst. Shift Charge Engr., Willesden Generating Station London Power Co. For mail: 94 Dartmouth Rd., Cricklewood, London, N.W.2, England. (S.1934. M.1942)
Taylor, J. M. City Elec. Engr., Saskatoon. For mail: 112 Saskatchewan Crescent. (A.M.1938. M.1940)
Taylor, J. R. 346 Home St., Winnipeg ,Man. (S.1946)
Taylor, J. Ross Prodn. Mgr., Stuart Bros. Ltd., 3470 St. Antoine St., Montreal. (M.1945)
Taylor, Leonard H. American Can. Co., Vancouver, B.C. For mail: 4498 West 14th Ave. S.1945)
Taylor, M. G. C. A. Energia Electrica de Venezuela, Apartado 146, Maracaibo, Venezuela, S.A. (S.1927. Jr.1929. A.M.1938. M.1940)
Taylor, Newton P. Asst. Chief Engr., Aluminum Co. of Canada, Sun Life Bldg., Montreal. (M.1945)
Taylor, Thos. A. I. C. Overseas. (Jr.1937)
Taylor, W. D. Sales Engr., Railway & Power Engrg. Corp., Montreal. For mail: 4570 Melrose Ave. (A.M.1939. M.1940)
Taylor, W. E. Project Engr., Polymer Corp. Ltd., Sarnia, Ont. For mail: 115 Cecil St. (Jr.1939)
Taylor, Wm. R. C. Aircraft Radio Engr., Trans-Canada Air Lines, Winnipeg, Man. For mail: 95 Niagara St. (S.1928. Jr.1934. M.1943)
Taylor-Bailey, F. W. Vice-Pres. & Gen. Mgr., Dominion Bridge Co., P.O. Box 280, Montreal. (S.1915. A.M.1919. M.1930)
Teagle, Robt. Wills Teagle & Son, General Contrs., 4 New St., Toronto. (A.M.1937. M.1940)
Teaze, Moses Hay Partner, Hardy S. Ferguson & Co., New York. For mail: 31 Clarenden Place, Bloomfield, N.J., U.S.A. (M.1926)
Teevan, James T. 1785 West 12th Ave., Vancouver, B.C. (S.1944)
Telford, Robt. B. (S.1943)
Telmosse, Paul G. Res. Engr., Shawinigan Water & Power Co., Shawinigan Falls, Que. For mail: P.O. Box 40. (M.1940)
Tempest, Frank Mech. Supt., Imperial Oil Ltd., Calgary, Alta. For mail: 2610-10th St. W. (Jr.1920. A.M.1926. M.1940)
Temple, P. B. 167 St. Germain Ave., Toronto. (S.1946)
Templeman, G. E. Chief Engr., Elec. Comm. of the City of Montreal, Tramway Bldg., Montreal. (A.M.1919. M.1927)
Tennant, David Cowan Dominion Bridge Co., 1139 Shaw St., Toronto. (A.M.1906. M.1911)
Termuende, J. E. Aluminum Co. of Can., Sun Life Bldg., Montreal. (S.1941. Jr.1946)
Ternan, Jas. B. (S.1939. Jr.1946)
Teskey, Arthur G. Sales Engr., Can. Westinghouse Co., 2408-11th Ave., Regina, Sask. (Jr.1941)
Teskey, R. H. Chem. Engr., Madison Natural Gas Co., Black Diamond, Alta. (Jr.1946)
Tessier, Joachim desR. Real Estate & Ins Broker, 71 St. Peter St., Quebec. (M.1946)
Tessier, Jos. L. (S.1944)
Tessier, J. Paul 5750-16th Ave., Rosemount, Montreal. (S.1944)
Tessier, Laurent 6253 De Laroche St., Montreal. (S.1942)
Tessier, René 360 St. Just St., Montreal 5. (S.1944)
Tétreault, Armand J. Engr., G. Lorne Wiggs & Co., Montreal. For mail: 1322 Sherbrooke St. E. (S.1938. Jr.1944)
Tétreault, Jacques Welding Dept. Engr., Marine Industries Ltd., Sorel, Que. (S.1938. Jr.1944. M.1945)
Tétreault, Rolland Engr. on Mun. Works, Léon Desrochers, Cons. Engr., Granby, Que. For mail: 96 Drummond St. (S.1943)
Thauvette, Laurent Town Mgr., P.O. Box 251, Malartic, Que. (S.1941)
Theakston, Harold R. Prof. Engrg. & i/c Bldgs. & Grounds, Dalhousie University, Halifax, N.S. For mail: 27 Oakland Road. (Jr.1921. A.M.1925. M.1940)
Théault, Robert C. 3156 Tremblay St., Montreal. (S.1944)
Théberge, Gabriel 6283-25th Ave., Montreal 36. (S.1945)
Theobalds, T. R. Water Engr., Govt. of Antigua, Newgate St., St. John's, Antigua, B.W.I. (A.M.1937. M.1940)
Thériault, A. Brig., Chief Supt. of Arsenals, Dominion Arsenal, Artillery Park, Quebec. (M.1944)
Theriault, L. Leon Registrar of Motor Vehicles of N.B., Fredericton, N.B. For mail: 650 Brunswick St. (M.1942)
Thexton, R. D. Harbour Engrg., Dept. Public Works of Can., Dom. Public Bldg., Halifax, N.S. (M.1940)
Thian, Prosper E. 93 N. Lexington Ave., St. Paul, Minn., U.S.A. (M.1906)
Thibaudeau, Jean 2144 Roberval St., Montreal 20. (S.1944)
Thibaudeau, J. Raymond 2461 Duvernay St., Montreal 3. (S.1945)
Thibault, Bernard Asst. Res. Engr. for Matane County, Que. Dept. of Roads, Matane, Que. (S.1942. Jr. 1946)
Thibault, Jos. G. Operating Dept., Southern Canada Power Co., Drummondville, Que. (S.1937. Jr.1941)
Thibault, Robert 293-18th St., Quebec. (S.1946)
Thibault, Sylvain Engr., Quebec Provincial Electricity Board, Montreal. For mail: 4080 St. Hubert St. (S.1941)
Thibodeau, H. R. 8541 Ontario St. E., Montreal 5. (M.1946)
Thicke, J. E. Gen. Supt., Saguenay Power Co. Ltd., Isle Maligne, Que. (S.1926. Jr.1931. A.M.1936. M.1940)
Thierman, V. Douglas Rodman, P.F.R.A., Dom. Dept. of Agric., Cardston, Alta. For mail: Swift Current, Sask. (S.1946)
Thierman, V. E. City Engr., Swift Current, Sask. For mail: 150-2nd Ave. E. (A.M.1939. M.1940)
Thistlethwaite, Robt. Surveys & Engrg. Br., Dept. Mines & Resources, Labelle Bldg., Ottawa. (M.1940)
Thom, J. Edwin Res. Engr., Constrn. Dept., Can. Industries Ltd., Kingston, Ont. For mail: 19 George St. (S.1932. Jr.1936. M.1944)
Thoman, Russell K. Works Mgr., Can. Vickers Ltd., Montreal. For mail: 4382 Van Horne Ave., Montreal. (S.1936. Jr.1938. M.1944)
Thomas C. Oldreive Designg. Dftsmn., W. H. A. Robertson & Co., Bedford, Eng. For mail: 125 Wendover Drive, Bedford, England. (A.M.1922. M.1940)
Thomas, David R. 30 High Park Blvd., Toronto 3. (A.M.1904. M.1913)
Thomas, E. C. Res. Engr., Standard Paving Maritime Ltd., Halifax, N.S. For mail: 293 Oxford St. (M.1943)
Thomas, G. E. 5834 Third Ave., Rosemount, Que. (S.1943)
Thomas, G. N. Engrg. & Contract Section, Can. Gen. Elec. Co., Toronto. For mail: 231 Wychwood Ave. (M.1924)
Thomas, J. M. Foundation Co. of Can., 1538 Sherbrooke St. W., Montreal. (S.1935. Jr.1938. M.1945)
Thomas, Jean-Marie 386 Ave. de LaSalle, Montreal. (S.1942)
Thomas, J. W. McColl-Frontenac Oil Co., Montreal. For mail: 608 Victoria Ave., Westmount, Que. (M.1945)
Thomas, Sydney Cons. Engr., 213 Inglis St., Halifax, N.S. (M.1944)
Thomasson, H. Metalurg. Engr., Can. Westinghouse Co., Hamilton, Ont. (M.1943)
Thomlinson, Leonard Engrg. Dept., Babcock-Wilcox & Goldie, McCulloch Ltd., Galt, Ont. (S.1937. Jr.1946)
Thompson, Alvin H. Engr., Dftg. Dept., Foundation Co. of Can., Montreal. For mail: 3436 Prudhomme Ave. (S.1942. M.1944)
Thompson, Arthur M. Elec. Sales Engr., Can. Gen. Elec. Co., 265 Notre Dame Ave., Winnipeg, Man. (S.1937. Jr.1941)
Thompson, C. M. Transitman, Can. Pacific Rly., Moose Jaw, Sask. For mail: 1225-5th Ave. N.W. (S.1942. Jr.1943. M.1945)
Thompson, D. Mount Allison University, Sackville, N.B. (S.1946)
Thompson, E. J. R.R. No. 4, Aylmer West, Ont. (S.1946)
Thompson, F. Gerard Dist. Highway Engr., Dept. Public Works of N.B., Sussex, N.B. (Jr.1929. M.1942)
Thompson, Frank L. Indust. Engr., Lub. Dept., Imperial Oil Ltd., 56 Church St., Toronto. (S.1930. Jr.1935. A.M.1937. M.1940)
Thompson, Francis R. Mathews Conveyer Co., Port Hope, Ont. (S.1946)
Thompson, Geo. A. Engr., Spruce Falls Power & Paper Co., Kapuskasing, Ont. For mail: Box 678. (M.1944)
Thompson, G. H. Montreal Engineering Co., 244 St. James St. W., Montreal. (A.M.1921. M.1940)
Thompson, G. W. Major, R.C.E.M.E., D.M.E., N.D.H.Q., Ottawa. (S.1941)
Thompson, Howard B. Mech. & Elec. Engr., Imperial Oil Ltd., Sarnia, Ont. (M.1945)
Thompson, H. G. Mgr., Aluminate Chemicals Ltd., 555 Eastern Ave., Toronto. (S.1920. Jr.1923. A.M.1928. M.1940)
Thompson, J. I. Overseas. (Jr.1940)
Thompson, J. W. J. Res. Engr., Dept. Highways & Public Works of N.B. For mail: 7 Payzant Ave., Halifax, N.S. (S.1937. M.1940)
Thompson, Murray O. Vice-Pres. & Gen. Mgr., Cargo Dockers Ltd., 320 Bay St., Toronto. (M.1944)
Thompson, N. A. Hyd. Engr., Dom. Govt., Ottawa. For mail: 18 Downing St., (A.M.1921. M.1940)
Thompson, Philip M. Deputy Commr. of Bldgs., City Hall, Queen St., Toronto. (A.M.1921. M.1940)
Thompson, Trevor C. Mgr., Gen. Service Bureau, Bell Telephone Co., 1050 Beaver Hall Hill, Montreal. (Jr. 1921. A.M.1931. M.1940)
Thompson, V. S. Chief Design Engr., Dept. Reconstruction & Supply, No. 3 Temporary Bldg., Ottawa. (A.M.1931. M.1940)
Thompson, W. L. Mgr., Toronto Office, Bailey Meter Co. For mail: 115 Chatsworth Drive, Toronto 12. (S.1923. Jr.1929. A.M.1935. M.1940)
Thompstone, R. E. (S.1938. Jr.1946)
Thomson, A. Findlay 818 Valour Road, Winnipeg, Man. (S.1946)
Thomson, Clarence Pres., Thomson Electrical Works Ltd., 915 St. Genevieve St., Montreal. (A.M.1899. M.1931)
Thomson, C. A. Tech. Supt., R. Campbell Brown & Co., Montreal. For mail: 3491 Belmore Ave. (Affil.1943)
Thomson, Lesslie R. Manotick, Ont. A.M.1911. M.1919)
Thomson, Reginald H. Cons. Engr., 2404-42nd Ave. N., Seattle 2, Wash., U.S.A. (M.1913)
Thomson, T. Kennard Cons. Engr., New York. For mail: 30 Madeline Parkway, Lowerre Summmit, Yonkers, N.Y., U.S.A. (M.1905)
Thomson, Thos. M. (S.1945)
Thomson, W. B. Asst. Hyd. Engr., P.F.R.A., Dom. Dept. of Agric., Regina, Sask. For mail: 2850 Robinson St. (S.1941. Jr.1944)
Thomson, W. Chase Sr. Engr., Que. Dept. of Public Works, Parliament Bldgs., Quebec. (S.1887. A.M.1894. M.1900)
Thomson, W. J. Mng. Dir., Abrasive Co. of Can., Arvida, Que. For mail: 926 Coulomb St. (Jr.1913. A.M.1936. M.1940)
Thomson, W. J. Asst. Engr., Dept. Highways of Ont., Ottawa. For mail: 585 O'Connor St. (A.M.1938. M.1940)
Thorn, Richard Mech. Engr., T. Pringle & Son Ltd., 485 McGill St., Montreal. (S.1930. Jr.1936. A.M.1939. M.1940)
Thornber, Wm. Forest Prod. Engr., Dept. Mines & Resources, Isabella & Metcalfe Sts., Ottawa. (M.1946)
Thorne, Edward C. Col., R.C.E. For mail: Bank of Montreal, Knowlton, Que. (M.1942)
Thorne, E. L. 36 Larch St., Halifax, N.S. (M.1945)
Thorne, Harvey 17 Waegwoltic Ave., Halifax, N.S. (A.M.1914. M.1919)
Thorne, H. L. Overseas. (S.1928. Jr.1946)
Thornton, Louis Augustus 2244 Smith St., Regina, Sask. (M.1915)
Thorssen, LeRoy A. Asst. Prof. Civil Engrg., University of Alberta, Edmonton, Alta. (S.1937. Jr.1940. M.1941)
Thorsteinson, S. Baldwin 621 Maryland St., Winnipeg, Man. (S.1946)
Throop, Robt. S. 142 King St. E., Kingston, Ont. (S.1946)
Thrupp, Edgar Chas. Cons. Engr., 2547 Wallace Crescent, Vancouver, B.C. (A.M.1913. M.1935)
Thrupp, F. E. M. Dir., Indust. Rehab. for Balkans, U.N.R.R.A. For mail: British Council, 1/10 Kazim Ozalp Caddes 1, Yenisehir, Ankara. (M.1938)
Thurber, G. H. Engr., Dept. Public Works, Hunter Bldg., Ottawa. (Jr.1920. A.M.1923. M.1940)
Thwaites, Jos. T. Divn. Engr., Electronics, Can. Westinghouse Co., Hamilton, Ont. For mail: 111 Leinster Ave. S. (S.1924. Jr.1928. A.M.1939. M.1940)
Tibbitts, A. G. Mgr., Rope& Binder Twine Mfg., Consumers Cordage Co., Wyse Road, Dartmouth, N.S. (S.1930. A.M.1936. M.1940)
Tibbo, Gordon Tucker Geological Survey of Newfoundland, St. John's, Nfld. (S.1940. Jr.1946)
Tidholm, C. E. Gen. Machine Design, Kipp-Kelly Ltd., Winnipeg, Man. For mail: 54 Noble Ave. (S.1944)
Tiedje, J. L. Resch. Chem. Engr., Imperial Oil Ltd., Sarnia, Ont. For mail: Mallah Park, R.R. No. 3. (Jr.1945)
Tighe, Jas. L. Tighe & Bond, Cons. Engrs., 189 High St., Holyoke, Mass., U.S.A. (S.1890. A.M.1900. M.1906)
Tilbury, Harry C. Elec. Tester, Can. Westinghouse Co., Hamilton, Ont. For mail: 51 Munn St. (Jr.1945)
Tilden, S. F., Jr. Jr. Engr., Canadian Marconi Co., Town of Mount Royal, Que. For mail: 40 Oakland Ave., Westmount, Que. (S.1946)
Timleck, Curtis J. Br. Mgr., Canadian Ingersoll Rand Co., 175 McDermot Ave. E., Winnipeg, Man. (S.1923. Jr.1931. A.M.1939. M.1940)

Timm, C. H. Gen. Plant Engr., Dominion Bridge Co., Montreal. For mail: 343 Lansdowne Ave., Westmount, Que. (A.M.1919. M.1940)

Timm, C. Ritchie, Asst. to Chief Engr., Dominion Rubber Co., Montreal. For mail: 5005 MacDonald Ave. (S.1928. M.1936)

Timmins, W. W. Mfr.'s Agent, W. W. Timmins & Co., 660 St. Catherine St. W., Montreal. (A.M.1935. M.1940)

Timmis, Harold G. Mgr., Wayagamack Divn., Consolidated Paper Corp., Three Rivers, Que. For mail: St. Maurice Terrace, Cap de la Madeleine, Que. (S.1921. A.M.1929. M.1940)

Timms, R. H. Vice-Pres. & Engr., R. Timms Constrn. Ltd., 221 Burgar St., Welland, Ont. (S.1942. Jr.1944. M.1946)

Tindale, W. J. Chief Engr., West Kootenay Power & Light Co., South Slocan, B.C. (M.1946)

Tinkler, Howard H. Combustion Engr., L. Cohen & Son, Montreal. For mail: 6183 Durocher Ave., Montreal.. (S.1933. Jr.1938. M.1945)

Tinney, Edwy Roy 3533 West 5th Ave., Vancouver, B.C. (S.1946)

Tite, W. A. S. 163 Jackson St. W., Hamilton, Ont. (S.1943)

Titus, G. W. Dist. Highway Engr., Dept. Public Works, Edmundston, N.B. (M.1942)

Titus, O. W. Chief Engr., Canada Wire & Cable Co., P.O. Box 340, Toronto. (M.1943)

Tivy, Robt. Harrison Asst. to Operating Engr., Manitoba Power Comm., Winnipeg, Man. For mail: 54 Maryland St. (S.1942. Jr.1945)

Tjonnaas, O. H. Telmark Veikontor, Skien, Norway. (A.M.1931. M.1940)

Tkacz, Wm. Post-grad., University of Michigan, Dorm. 20, West Lodge, Ypsilani, Michigan, U.S.A. (S.1941. Jr.1946)

Tod, Jas. A. Asst. Engr., Bell Telephone Co., London, Ont. For mail: 840 Richmond St. (S.1943. Jr.1946)

Todd, Henry Overseas. (S.1941. Jr.1946)

Todd, Wm. L. Design Engr., R. A. Rankin & Co., Cons. Engrs., at Courtaulds Ltd., Cornwall, Ont. For mail: 447 York St. (M.1946)

Todgham, Herbert H. Design Engr., Edgar A. Cross, Cons. Engr., 991 Bay St., Toronto (S.1945)

Tollington, G. C. Asst. D. C. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 195 Murray St. (S.1932. Jr.1937. M.1940)

Tomkins, R. V. Jr. Resch. Engr., National Research Council, Ottawa. For mail: 130 Eccles St. (S.1944. Jr. 1946)

Tomlinson, C. P. Vice-Pres., McColl-Frontenac Oil Co., Montreal. For mail: 3940 Côte des Neiges Rd. (M.1939)

Tomlinson, J. W. Chief Engr., Manitoba Power Comm., Winnipeg, Man. For mail: 415 Rosedale Ave. (M.1946)

Tomlinson, W. J. Tech. Dir., E. F. Drew & Co., 660 St. Catherine St. W., Montreal. For mail: 6 Morrison Ave., Town of Mount Royal, Que. (M.1946)

Tompkins, Chas. C. Mech. Engr., Can. Hanson & Van Winkle Co., Morrow & Silvee Ave., Toronto. (S.1943)

Tooker, Guy L. Asst. Engr. of Roads, Engrg. Dept., City of Vancouver, B.C. For mail: 4962 Granville St. (S.1904. Jr.1913. A.M.1930. M.1940)

Tooker, Hugh Wakefield Divn. Engr., Can. National Rlys., Calgary, Alta. (A.M.1920. M.1940)

Toovey, Thos. W. Pulp & Paper Divn., Whitemarsh Research Labs., Pennsylvania Salt Mfg. Co., Wyndmoor, Pa. For mail: Kenilworth, Alden Park, Philadelphia, Pa., U.S.A. (A.M.1933. M.1937)

Topham, H. L. Jr. Hyd. Engr., P.F.R.A., Dom. Dept. of Agric., Saskatoon. For mail: Togo, Sask. (S.1944)

Topham, Wm. R. Special Proj. & Constrn., Can. Industries Ltd., McMasterville, Que. (S.1940. M.1946)

Torrens, G. C. Divn. Engr., Can. National Rlys., Moncton, N.B. (M.1942)

Torrington, Frank D. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (S.1940. Jr.1942)

Toupin, V. Heating Engr., Bldgs. Dept., City of Montreal. For mail: 2186 Souvenir Ave. (S.1925. Jr.1928. A.M.1932. M.1940)

Tourigny, Chas. E. Mgr. & Editor of Employees Magazine, Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (M.1942)

Tourigny, Paul 360 St. Denis Terrace, Montreal 18. (S.1942)

Tousignant, Denys 12 St. Denis Ave., Quebec. (S.1946)

Touzin, Thos. Engr. i/c Water Saving, City of Montreal. For mail: 4214 Chambord St. (Jr.1925)

Tovee, E. Harold Section Engr., Materials & Processes, Can. Westinghouse Co., Hamilton, Ont. For mail: 303 Charlton Ave. W. (Jr.1936)

Tovell, Jos. A. 2359 Chilver Rd., Walkerville, Ont. (S.1944. Jr.1946)

Towle, Harold M. 302 Côte de Liesse Rd., Town of Mount Royal, Que. (S.1937)

Townsend, C. J. Vice-Pres., Russell Constrn. Co., Harbour Administration Bldg., Toronto. A.M.1912. M.1922)

Townsend, Gilbert Engr., Ross & Macdonald Inc., 1010 St. Catherine St. W., Montreal. (A.M.1909. M.1940)

Townson, Arthur, 531-17th Ave., Lachine, Que. (S.1946)

Toy, Edwin L. Power Transf. Design, Can. Gen. Elec. Co., Toronto. For mail: 118 Garden Ave. (S.1932. Jr.1938)

Toye, Arthur M. Bridge Engr.'s Office, Dept. Highways of Ont., Toronto. For mail: 327 Bayview Ave. (Jr.1926. A.M.1934. M.1940)

Tracy-Gould, A. V. Dept. Public Works of Canada. P.O. Drawer 1417, Saint John, N.B. (M.1942)

Trahan, J. Alide Cons. Engr., Magloire Cauchon Ltd., 311 de LaSalle, Quebec. (M.1945)

Traill, J. J. Sr. Asst. Engr., Hydro-Elec Power Comm. of Ont., Toronto. For mail: 671 Lakeshore Road, Mimico, Ont. (A.M.1920. M.1926)

Traill, W. A. Demonstrator, Hyd. Lab., University of Toronto. For mail: 174 Woodmount Ave., Toronto. (S.1946)

Traver, Leonard Alton, Dominion Bridge Co., Montreal. For mail: 5325 Victoria Ave. (M.1943)

Travers, Fred J. Design Engr. i/c Dftg. Room, McColl-Frontenac Oil Co., 360 St. James St. W., Montreal. (S.1944. Jr.1946)

Traversy, V. I. Pres., Traversy & Co., 760 Notre Dame St. W., Montreal. (M.1945)

Traynor, J. Clair Jr. Engr., Underwood & McLellan, Saskatoon, Sask. For mail: 1017 University Drive. (S.1941. Jr.1945)

Treadgold, W. M. Prof., Dept. Civil Engrg., University of Toronto, Toronto 5. (M.1940)

Treble, Harold Edison Chief of Personnel Divn., Dept. Trade & Commerce, Ottawa. For mail: 534 Brierwood Ave. (S.1924. A.M.1936. M.1940)

Tregarthen, M. E. Chief Mech. & Elec. Engr., Dept. Road Transport & Tramways, Sydney, Australia. For mail: 5 Forest Road, Double Bay, Sydney. (A.M.1927. M.1940)

Treggett, Graham Ross Garage Supt., Coca Cola Ltd., 200 Bellechasse St., Montreal. (Jr.1940)

Tregillus, A. L. Reg. Advisor on Housing, British Ministry of Health, Reading, Berks., England. For mail: 15 Luckmore Drive. (A.M.1933. M.1940)

Treleaven, L. J. Jr. Hyd. Engr., P.F.R.A., Dom. Dept. of Agric., Swift Current, Sask. For mail: 3112 Angus St., Regina. (Jr.1946)

Treloar, George E. Chief Engr., Sarnia Bridge Co. and Pres., T. Tomlinson Foundry Co., Toronto. For mail: 14 St. Andrews Gardens. (M.1946)

Tremain, Kenneth H. Mgr., Mount Royal Importers Inc., 342 Madison Ave., New York, N.Y. (S.1928. Jr.1935. A.M.1939. M.1940)

Tremayne, J. E. Tech. Engr., Brunner Mond Canada Sales Ltd., Toronto. For mail: 123 Douglas Drive (M.1940).

Tremblay, Chas. Engr., Que. Provincial Electricity Board, Montreal. For mail: 5175 Fabre St. (M.1945)

Tremblay, G. René Can. Liquid Air Co., Kane & Agricola Sts., Halifax, N.S. (S.1941. Jr.1946)

Tremblay, Jules 212 d'Aiguillon St., Quebec. (S.1944)

Tremblay, S. N. Dist. Constrn. Supvr., Veterans' Land Act, 1253 McGill College Ave., Montreal. (A.M.1934. M.1940)

Trempe, Jacques 4292 St. Catherine St. W., Montreal. (S.1944)

Trenholm, C. L. Jr. Engr., New Brunswick Internl. Co., Dalhousie, N.B. For mail: Chaleur Inn. (S.1944. Jr.1946)

Trethewey, Graham D. Resch. Chem. Engr., B.C. Pulp & Paper Co. Ltd., Woodfibre, B.C. (Jr.1940. M.1944)

Treviranus, K. S. 61 Forest Hill Road, Toronto. (S.1946)

Trewartha, Frank E. Engrg. Dept., Canada Starch Co., Cardinal, Ont. (S.1944)

Trimingham, J. H. 1541 Despard Ave., Victoria, B.C. (S.1907. A.M.1913. M.1933)

Tripp, G. M. 1684 Yale St., Victoria, B.C. (A.M. 1919. M.1936)

Tripp, Harry H. Divn. Engr., Can. Pac. Rly., Fort William, Ont. For mail: 315 Catherine St. (A.M.1919. M.1940)

Troalen, Pierre Plant Asst., Compania Fleischmann Colombiana Inc., Carrera 13, Apartada 1215, Bogota, Colombia, South America. (S.1941)

Troop, Stewart Cons. Mining Engr., & Mgr., Chibougamau Properties Ltd., St. Elie de Caxton, Que. (A.M.1919. M.1940)

Trorey, Lyle Graeme Chairman & Chief Engr., Aerographic Surveys Ltd., 23 Queen's Road, Weybridge, Surrey, England. (A.M.1936. M.1940)

Trott, W. A. Partner, Greenlaw & Trott, Cons. Engrs., Electric Railway Chambers, Winnipeg, Man. (M.1940)

Trotter, H. L. Iberville, Que. (S.1903. A.M.1907. M.1922)

Trotter, W. Beauchamp Mgr., Trotter & Morton Ltd., Calgary, Alta. For mail: 1317-15th St. W. (A.M.1921. M.1940)

Trottier, Alfred Asst. Engr., City of Outremont, Que. For mail: 8816 Basile Routhier St. (S.1943)

Trottier, Antonio Office Engr., City Hall, Quebec. For mail: 7½ Lavigueur St. (M.1945)

Trout, R. G. Overseas. (S.1941. Jr.1946)

Trowsdale, R. S. Dist. Mgr., Can. Gen. Elec. Co., 502-11th Ave. W., Calgary, Alta. (A.M.1919. M.1940)

Trudeau, Alphonse, Gen. Supt., Atlas Constrn. Co. Ltd., Montreal. For mail: Ste. Anne de Bellevue, Que. (M.1945)

Trudeau, Jean R. Constrn. Engr., City of Montreal. For mail: 6957 Delanaudiere St. (S.1941. M.1945)

Trudeau, L. G. Dist. Engr., Dept. Public Works of Can., Hunter Bldg., Ottawa. (S.1910. Jr.1913. A.M.1916. M.1940)

Trudeau, Marc R. Design. Engr., Lalonde & Valois, Montreal. For mail: 6388 Delorimier Ave. (S.1939. Jr.1943)

Trudeau, Régis Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1945)

Trudeau, Roger T. Supt. Engr., H. J. O'Connell Ltd., Montreal. For mail: 4075 Berri St. (M.1943)

Trudel-Cossette, J. A. Controller, Que. Provincial Electricity Board, 132 St. James St. W., Montreal. (Jr.1938. M.1945)

Trudel, Louis Asst. Gen. Sec'y., The Engineering Institute of Canada, Montreal. For mail: 2347 Grand Blvd. (S.1934. A.M.1938. M.1940)

Trudel, Lucien La Cie Métropolitaine Goulet Ltée. For mail: Le Soleil Bldg., Quebec. (S.1945)

Trudel, Yves 942 Ste.-Geneviève St., Trois-Rivières, Que. (S.1946)

Trueman, J. C. Chief Design. Engr., Dominion Bridge Co., Canada Bldg., Winnipeg, Man. (M.1945)

Truman, K. A. Divn. Engr., Can. Pacific Rly., Medicine Hat., Alta. (M.1940)

Tubby, Allan Br. Mgr., Currie Products Ltd., Ottawa. For mail: 921 Bronson Ave. (M.1942)

Tuck, Albert E. Elec. Test Engr., Steel Co. of Can., Hamilton, Ont. For mail: 283 Tuxedo Ave. S. (M.1946)

Tuck, J. H. Supt., Monel Dept., Internl. Nickel Co., Port Colborne, Ont. For mail: P.O. Box T. (S.1928. Jr.1938. M.1941)

Tucker, Edwin C. Jr. Engr., Dominion Engrg. Works Ltd., Lachine, Que. For mail: 705-3rd Ave. (S.1946)

Tucker, Edward F. Vice-Pres., Stebbins Engrg. & Mfg. Co., Eastern Blvd., Watertown, N.Y., U.S.A. (A.M.1934. M.1940)

Tuff, Edmund M. Otis-Fensom Elevator Co., Hamilton, Ont. For mail: 211 James St. So. (S.1944)

Tulk, E. G. Jr. Elec. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 43 Mack Ave. (S.1942. Jr.1946)

Turcke, E. W. John Chief Engr., Arthur Surveyor & Co., Cons. Engrs., 1010 St. Catherine St. W., Montreal. (M.1945)

Turcotte, Gérard 3736a St. Hubert St., Montreal 24. (S.1945)

Turcotte, Léo René Shawinigan Water & Power Co., 97 Cascades St., Shawinigan Falls, Que. (S.1941)

Turgeon, Maurice Canadair Ltd., Cartierville. For mail: 354 Sherbrooke St. E., Montreal. (S.1941. M.1945)

Turley, F. E. Turley Bros. Ltd., Nanaimo, B.C. (S.1943)

Turnbull Aubrey Arnold Chief Engr., New Brunswick Telephone Co., Saint John, N.B. For mail: 3 Mt. Pleasant Court. (Jr.1920. A.M.1926. M.1940)

Turnbull, A. D. (A.M.1939. M.1940)

Turnbull, Donald O. Cons. Engr., 11 Ward St., Saint John, N.B. (Jr.1932. A.M.1939. (M.1940)

Turnbull, John Arnold 149 Rosemount Ave., Toronto. (S.1942. Jr.1946)

Turnbull, J. G. Asst. Supt., Mtce. & Constrn., Brunner Mond Canada Ltd., Amherstburg, Ont .(Jr.1938. M.1944)

Turnbull, Jas. T. Dist. Highway Engr., N.B. Dept. Public Works, Box 1268, Saint John, N.B. (A.M.1927)

Turnbull, W. R. Research Work, Rothesay, N.B. (M.1944)

Turner, Earle O. Dean of Engrg., University of New Brunswick, Fredericton, N.B. For mail: 128 Alexandra St. (A.M.1920. M.1937)

Turner, G. C. Stress Analyst, Airplane Divn., Curtiss-Wright Corp., Colombus, Ohio, U.S.A. For mail: 468 West 6th Ave. (M.1946)

Turner, G. R. 430 Daly Ave., Ottawa. (S.1914. Jr.1914. A.M.1920. M.1940)

Turner, Jas. T. Can. Engrg. Rep., Copperweld Steel Intrnl. Co., New York. For mail: 28 Winston Park Blvd., Downsview, Ont. (Jr.1938. M.1941)

Turner, L. C. Molson's Brewery, 1670 Notre Dame St. E., Montreal. (S.1941. Jr.1943)

Turner, Malcolm, Major, R.C.E., 430 Daly Ave., Ottawa. (S.1946)
Turner, M. W. Res. Engr., Manitoba Paper Co., Pine Falls, Man. (A.M.1921. M.1940)
Turner, W. E. Cost Engr., Toronto Transportation Comm. For mail: 136 Clifton Rd., Toronto 12. (M.1944)
Turtle, Alf C. Engr., Holden Co., 736 St. James St. W., Montreal. (Jr.1921. A.M.1926. M.1940)
Tuttle, P. D. Asst. Design Engr., Quebec Hydro-Elec. Comm., Montreal. For mail: 366 Clifton Ave. (S.1940. Jr.1946)
Tweeddale, R. E. 261 Douglas Ave., Saint John, N.B. (S.1935. Jr.1937. M.1945)
Twidale, Frank T. Asst. on Plant Constrn., Bell Telephone Co., Montreal. For mail: 428 Argyle Ave., Verdun, Que. (S.1945)
Twiss, James E. Dftsmn., Elec. Dept., Internl. Nickel Co., Copper Cliff, Ont. For mail: The Algoma Club. (S.1946)
Tye, Howard Warner Engr., Mtce. of Way & Structures, Northern Alberta Rlys. Co., Edmonton, Alta. For mail: 10957 90th Ave. (M.1941)
Tyerman, John A. 163 Jackson St. W., Hamilton, Ont. (S.1942. Jr.1946)
Tylee, Arthur K. 21 Burton Road, Forest Hill Village, Toronto. (M.1943)
Tyler, Wm. G. Cable Engr., Northern Electric Co., Montreal. For mail: 32 Brock Ave. N., Montreal West. (A.M.1921. M.1940)
Tyler, Wm. J. L. 32 Brock Ave. N., Montreal West. (S.1945)
Tyrer, T. G. Deputy Chief Surveyor, Land Titles Office, Regina, Sask. For mail: 2708 Regina Ave. (A.M.1931. M.1940)

U

Ulmann, Hans Chief Engr. & Asst. Mgr., Diesel Divn., Dominion Engrg. Works Ltd., Montreal. For mail: 4871 Hampton Ave. (A.M.1931. M.1940)
Uloth, M. M. Jr. Engr., Induction Motor Engrg. Dept., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 309 Park St. (Jr.1943)
Underwood, J. E. Partner, Underwood & McLellan, Grain Bldg., Saskatoon, Sask. (M.1938)
Upton, Franklin Howard Prodn. Mgr., Provincial Engineering, Niagara Falls. For mail: 8 E. Gore St., Stratford, Ont. (Jr.1942)
Ure, Wilfred G., Cons. Engr. & Ont. Land Surv., 9 Perry St., Woodstock, Ont. (A.M.1922. M.1940)
Urquhart, Robt. R. 1114 Rice Crescent, Niagara Falls, Ont. (S.1946)
Urry, Douglas Percy Strl. Engr., Dominion Bridge Co., Vancouver, B.C. (A.M.1924. M.1940)
Uruski, F. W. Seismograph Engr., International Petroleum Co., P.O. Box 830, Guayaquil, Ecuador, S.A. (S.1940. Jr.1944)
Uruski, Tony J. Res. Engr., Sask. Dept. Highways & Transportation. For mail: 138 Maple Ave., Yorkton, Sask. (S.1946)
Ussher, J. W. Supvr. of Water Treatment, Can. Pac. Rly., C.P.R. Station, Winnipeg, Man. (M.1945)

V

Vail, Bert F. Instr., Indust. Electronics Control, Nova Scotia Technical College, Halifax, N.S. (S.1942. M.1945)
Vaillancourt, Guy P. 956 MacNaughton Road, Town of Mount Royal, Que. (S.1944)
Vaillancourt, J. L. 3225 Lacombe Ave., Montreal 26. (S.1937. Jr.1946)
Vaillancourt, Rosaire 8131 Berri St., Montreal. (S.1943. Jr.1946)
Vaison, A. F. Tech. Advisor, Dom. Govt. Civil Service, Ottawa. For mail: 19 Butternut Terrace. (M.1937)
Valade, Jean-Paul 4029 Lacombe Ave., Montreal. (S.1944)
Valde, Bertrand Alan Divn. Engr., Imperial Oil Ltd., P.O. Box 220, Halifax, N.S. (M.1945)
Vale, Harvey J. Asst., Toll & Transm. Engr., Bell Telephone Co., Montreal. For mail: 2260 Regent Ave. (S.1944)
Valiquette, François Dist. Engr., Constrn. & Mtce. of Bridges, Que. Dept. Public Works, Montreal. For mail: 438 Gouin Blvd. E. (M.1945)
Valiquette, Francis P. City Mgr., City Hall, St. Jérome, Que. (S.1940. Jr.1945. M.1946)
Valiquette, Maurice L. Office Engr., Concrete Constrn. Ltd., Montreal. For mail: 2541 Maplewood Ave. (S.1938. Jr.1945)
Valiquette, Zéphirin 8 rue Champoux, Abord-à-Plouffe, Que. (S.1938. Jr.1946)
Vallée, Ivan E. Deputy Minister, Quebec Dept. Public Works, Quebec. For mail: 133 St-Cyrille. (S.1907. Jr.1913. A.M.1913. M.1940)
Vallières, Irénée A. Asst. Chief Engr., Montreal Sewers Comm. For mail: 4107 Van Horne Ave., Montreal. (S.1907. A.M.1927. M.1940)
van Beek, George J. 27 Moran St., Halifax, N.S. (S.1946)
Van Berkum, R. A. Jr. Dftsmn., Foster Wheeler Ltd., St. Catharines, Ont. For mail: R.R. No. 4, Fenwick, Ont. (S.1946)
Vance, Fenton R. Traffic Engr., Sask. Govt. Telephones, Regina, Sask. For mail: Y.M.C.A. (S.1940. M.1944)
Vance, James Alfred Prop. & Engr., James A. Vance, Gen. Contr., Woodstock, Ont. (S.1914. Jr.1919. A.M.1924. M.1939)
van Damme, Jos. Mech. Engr., Wm. Kennedy & Sons Ltd., Owen Sound, Ont. For mail: 281-9th St. W. (S.1941. Jr.1946)
Vandecan, C. E. Jr. Engr., Canners Machinery Ltd., 292 Colborne St. N., Simcoe, Ont. (S.1945)
Van den Broek, J. A. Prof. Engrg. Mechs., University of Michigan, Ann Arbor, Mich., U.S.A. (M.1942)
Vandervoort, G. A. Chief Engr., B.C. Power Comm., 918 Government St., Victoria, B.C. (A.M.1925. M.1940)
Van Every, Hugh D. Dftsmn., Dominion Bridge Co., Lachine. For mail: 337 Ballantyne Ave. N., Montreal West. (S.1937)
Van Every, Wm. Wishart 108 Kohler St., Sault Ste. Marie, Ont. (A.M.1905. M.1940)
Van Koughnet, E. M. Que. Provincial Electricity Board, 132 St. James St. W., Montreal. (S.1922. Jr.1928. A.M.1936. M.1940)
Van Norman, Clarence P. Materials Supt., Way Dept., Toronto Transportation Comm. For mail: 46 St. Germaine Ave., Toronto (S.1909. A.M.1913. M.1940)
Van Patter, D. M. Resch. Physicist, Mass. Inst. of Tech., Cambridge, Mass. For mail: 612 Belmont Ave., Westmount, Que. (S.1944)
Van Patter, Hugh S. Mgr. & Chief Engr. Hyd. Dept., Dominion Engrg. Works Ltd., P.O. Box 220, Montreal. (A.M.1920. M.1940)
Van Scoyoc, Harry S. Cons. Engr., 205 Brock Ave. N., Montreal West. (A.M.1915. M.1921)
Van Winckle, Jack M. Plant Engr., Can. Bridge Co., Walkerville, Ont. For mail: 1393 Gladstone Ave., Windsor. (Jr.1943)
Van Wyck, Kenneth R. Prodn. Engr. in Trng., Barber Die Casting Co., Hamilton. For mail: 234 Rosedale Heights Drive, Toronto. (S.1946)
Varley, Percy Asst. Elec. Engr., Can. Industries Ltd., P.O. Box 10, Montreal. (Jr.1932. A.M.1935. M.1940)
Vatcher, Allan Cons. Engr., Corner Brook, Nfld. (M.1924)
Vatcher, Chesley H. Sales Engr., Can. National Carbon Co., 1226 Homer St., Vancouver, B.C. (S.1938. Jr.1942)
Vaudrin, J. R. Yvon 6048 St. Hubert St., Montreal. (S.1944)
Vaughan, Frank P. P.O. Box 1294, Saint John, N.B. (A.M.1919. M.1920)
Vaughan, John D. 117 Leinster St., Saint John, N.B. (S.1946)
Vaughan, H. W. Engr. Supt., Elec. Divn., City of Montreal, 4050 Park Ave., Montreal. (S.1920. A.M.1926. M.1940)
Vaughan, J. Philip Res. Engr., N.S. Dept. Highways & Public Works, Halifax, N.S. For mail: 294 North St. (S.1943)
Vaughan, Rupert H. Res. Engr., Dept. Public Works of B.C. Duncan, V.I., B.C. (A.M.1921. M.1940)
Vaughan, Robt. P. Prodn. Engr., Paper Mach. Divn., Dominion Engrg. Works Ltd., Montreal. For mail: 7 Grove Park, Westmount, Que. (S.1939. M.1945)
Veale, F. J. Supt. of Waterworks, City Hall, Hamilton, Ont. (M.1943)
Veitch, James Insptg. Engr., Western Canada Fire Underwriters' Assn. For mail: Rochester Apts., Winnipeg, Man. (A.M.1920. M.1940)
Veitch, W. M. City Engr., London, Ont. (A.M.1922. M.1940)
Venables, Wm. N. (S.1940. Jr.1946)
Venart, C. H. S. 718 North 14th St., Dade City, Fla., U.S.A. (A.M.1939. M.1940)
Venne, Paul Asst. Elec. Line Engr., Montreal Tramways Co. For mail: 1848 Plessis St., Montreal. (M.1945)
Vennes, H. J. Western Electric Co. For mail: 507 Park Ave., Towson, Md., U.S.A. (A.M.1923. M.1940)
Venton, Donald Maxwell Res. Engr. on Town Sewerage Project, Armstrong, Anderson & Co. of Toronto. For mail: Box 146, Clinton, Ont. (S.1945)
Vercoe, H. L. 145 Douglas Drive, Toronto. (M.1920)
Verdier, Henrik 1205 Drummond St., Montreal. (S.1945)
Verdier, Paul A. 1205 Drummond St., Montreal. (S.1941)
Verge, G. A. 88 Turnbull Ave., Quebec. (S.1934)
Vergin, Leonard John Jr. Elec. Engr., Aluminum Co. of Can., Kingston, Ont. For mail: Y.M.C.A. (S.1944. Jr.1946)
Vermette, Narcisse J. A. Chief Surveyor, Que. Dept. of Roads, St. Lambert, Que. For mail: 5139 Bannantyne Ave., Verdun. (S.1913. A.M.1920. M.1940)
Vernot, George Edward City Assessor, City of Montreal. For mail: 5567 Côte des Neiges. (S.1923. Jr.1928. M.1942)
Verschoyle, Patrick D. Shop Mgr., Tech. Dept., Royal Ordnance Factory. For Mail: Flanrhyd, Ogmore-by-Sea, Bridgend, Glamorgan, South Wales. (Jr.1936)
Vessot, Chas. U. Works Engr., Fry-Cadbury Ltd., Montreal. For mail: 845 Kenilworth Road, Town of Mt. Royal, Que. (S.1916. A.M.1925. M.1940)
Vézeau, Jean-Claude 5317 Fabre St., Montreal. (S.1945)
Viberg, Ernest F. Works Mgr., Steel Foundry Divn., Can. Car & Foundry Co., Montreal. For mail: 4823 Wilson Ave. (A.M.1936. M.1940)
Vickerson, Geo. L. G. R. Locker Co., 1467 Mansfield St., Montreal. (S.1925. Jr.1928. A.M.1938. M.1940)
Viens, Ephrem Test. Labs., Dept. Public Works of Can., West Block, Ottawa. (A.M.1919. M.1925)
Villemure, Phileas Supt. of Works, City Hall, Grand'Mère, Que. (S.1931. Jr.1937)
Villeneuve, Jean-Joseph Ecole Polytechnique, 1430 St. Denis St., Montreal. (S.1944)
Villeneuve, Louis Philippe St. André de Roberval Co., Roberval, Que. (S.1946)
Vince, E. Raban R.R. No. 1, Woodstock, N.B. (M.1944)
Vincent, Arthur Cons. Engr., Arch. & Land Surv., 517 St. Lawrence Blvd., Montreal. (A.M.1898. M.1940)
Vincent, Jacques 837 Hartland Ave., Outremont, Que. (S.1942)
Vincent, Paul E. A. Chief Engr., Quebec Dept. of Colonization, Parliament Bldg., Quebec. (S.1934. Jr.1935. A.M.1938. M.1940)
Vincent, Roch Arthur Patent Attorney & Que. Land Surv., also Engr. & Arch., City of Montreal. For mail: 1668 St. Joseph Blvd. E. (A.M.1927. M.1940)
Vinet, Eugene 19 E. 82nd St., New York 23, N.Y., U.S.A. (S.1907. Jr.1912. A.M.1917. M.1925)
Vinet, Jacques Foundation Co. of Can., Montreal. For mail: 5112 Parthenais St. (M.1942)
Vinet, Pierre-Paul Cons. Engr. & Prof., Ecole Polytechnique, 1430 St. Denis St., Montreal. (A.M.1937. M.1940)
Vogan, George Oliver Hyd. Engr., Can. & General Finance Co., 25 King St. W., Toronto. (Jr.1919. A.M.1928. M.1940)
Vokes, Christopher, Maj.-Gen., G.O.C. Central Command, Dept. National Defence, 159 Bay St., Toronto. (A.M.1932. M.1940)
Vollmer, G. F. 113 Yates St., St. Catharines, Ont. (M.1920)
Vollmer, G. L. T. Chem. Engr., Can. Drawn Steel Co., Hamilton. For mail: 1 Rosedale Ave., Bartonville, Ont. (M.1944)
Vroom, H. H. Teleph. Shop Supt., Northern Electric Co., Montreal. For mail: 32 Union Blvd., St. Laurent, Que. (S.1908. Jr.1913. A.M.1922. M.1940)
Vye, D. M. Devlpt. Engr., N.B. Resources Devlpt. Board. For mail: Derby Junction, N.B. (M.1945)

W

Waddell, Neil M. Dist. Engr., Can. Nat. Rlys., Dominion Public Bldg., Winnipeg, Man. (A.M.1919. M.1940)
Waddington, G. W. Prof. Dept. Mining Engrg., Laval University, Que. (A.M.1927. M.1940)
Wade, M. L. Cons. Elec. & Hyd. Engr., Bank of Commerce Bldg., Kamloops, B.C. (Jr. 1914. A.M.1917. M.1936)
Wadsorth, W. J. Gordon Ont. Land Surv. Dept. of City Planning & Surveying, Toronto. For mail: 34 Ardagh St. (Affil. 1940)
Wagener, L. Ross Sub. Lt. (Elec.) R.C.N., H.M.C.S. Warrior. For mail: 133 Third Ave., Ottawa. (S.1946)
Waghorne, Murray Ashton Engr., Ford Motor Co. of Can., Windsor, Ont. For mail: 1772 Lincoln Rd. (S.1944. Jr.1946)
Wagner, Herbert L. Strl. Design Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (M.1942)
Wagner, Norman Cons. Engr., Wagner & Oliver, Lister Bldg., Hamilton, Ont. (A.M.1921. M.1940)
Waines, Russell T. Lecturer, Dept. Mech. Engrg., University of Toronto. For mail: 43 Albertus Ave., Toronto 12. (M.1943)
Wainwright, James G. R. P.O. Box 578, Lakefield, Ont. (S.1890. A.M.1899. M.1940)
Wakefield, Wm. Edward Chief, Divn. Timber Mechs., Forest Prod. Lab., Dept. Mines & Resources, Isabella & Metcalfe Sts., Ottawa. (A.M.1927. M.1940)
Walcot, J. B. Dom. Land Surv., Dept. Mines & Resources, Ottawa. For mail: P.O. Box 364 .(Jr.1919. A.M.1923. M.1940)
Walcott, Wm. D. Asst. Lab. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 13 Parkview Gardens. (S.1911. A.M.1919. M.1940)
Waldron, J. R. Bell Telephone Co. of Can., Toronto. For mail: 39 Lynd Ave. (S.1942. Jr.1944)
Wales, Donn (S.1946)

Walkden, Wm. 91 Ferndale Ave., Norwood, Winnipeg, Man. (Jr.1913. A.M.1917. M.1940)
Walkem, Geo. Alex. 5775 Sperling St., Vancouver, B.C. (A.M.1906. M.1920)
Walkem, Richard Sales Engr., Vancouver Iron Works Ltd., 1155-6th Ave. W., Vancouver, B.C. (S.1929. Jr.1937. M.1945)
Walker, A. Paverley, 138 Lascelles Blvd., Toronto. (A.M.1888. M.1898)
Walker, A. S. Chief Dftsmn., Commns. Dept., Can. Pac. Rly., 204 Hospital St., Montreal. (S.1942)
Walker, Chas. F. Plant Engr., Can. Intrnl. Paper Co., Box 510, Three Rivers, Que. (M.1946)
Walker, Edward Arthur, Strl. Engr., Can. Industries Ltd., Montreal. For mail: 1238 Bishop St. (S.1944)
Walker, Howard James Disbtn. Engr., Shawinigan Water & Power Co., Three Rivers, Que. (S.1940)
Walker, Harley Havelock Jr. Engr., Thompson Bros. Machinery Co., Liverpool, N.S. For mail: Milton, Queen's Co., N.S. (Jr.1946)
Walker, John Divn. Engr., Can. Nat. Rlys. For mail: 91 Harvery St., North Bay, Ont. (A.M.1921. M.1936)
Walker, J. Alexander Exec. Engr., Vancouver Town Planning Comm., 626 West Pender St., Vancouver, B.C. (S.1909. Jr.1911. A.M.1917. M.1935)
Walker, L. A. Demonstr. in Surveying, Ajax Divn., University of Toronto. For mail: 728 Queen's Road, Ajax, Ont. (S.1943. Jr.1946)
Walker, L. J. Surveyor & Instrmn., Geodetic Service of Canada, Dept. Mines & Resources, Ottawa. (S.1946)
Walker, Melvyn Lothian Mech. Design Engr., Imperial Oil Ltd., Sarnia, Ont. For mail: 479 Nelson St. (Jr.1920. A.M.1930. M.1940)
Walker, R. H. Capt., R.C.E., M.D. No. 11, Vancouver, B.C. For mail: Grandview, Man. (S.1941. Jr.1946)
Walker, Roy M. Strl. Engr., Quebec Hydro-Elec. Comm., Montreal. For mail: 220 First St., St. Lambert, Que. (S.1910. Jr.1913. A.M.1921. M.1940)
Walker, R. S. Design. Engr., Spruce Falls Power & Paper Co., Kapuskasing, Ont. For mail: 94 Riverside Drive. (S.1929. A.M.1936. M.1940)
Walker, Wm. 8 Douglas Ave., Westmount, Que. (A.M.1910. M.1940)
Walkinshaw, Wm. Maxwell Design. Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (M.1946)
Wall, A. S. Dominion Bridge Co., Montreal. For mail: 3540 Connaught Ave. (A.M.1917. M.1927)
Wall, Edward Walter Constrn. Engr., 5757 Plantagenet St., Montreal. (M.1923)
Wall, J. Gilbert Dept. of Transport, Tegler Bldg., Edmonton, Alta. (S.1939. Jr.1946)
Wallace, James Bruce 17 Birdsall Ave., Toronto. (S.1946)
Wallace, George A. Assoc. Prof. Elec. Engrg., McGill University, Montreal. (S.1917. Jr.1920. A.M.1925. M.1940)
Wallace, Gordon L. Cons. Engr., Strl., Toronto. For mail: 36 Evelyn Crescent. (A.M.1923. M.1938)
Wallace, Ivan M. Dftsmn., Can. Bridge Co., Walkerville, Ont. For mail: 1743 Chilver Road. (Jr.1939)
Wallace, J. M. Engr., Dom. Water & Power Bureau, Vancouver, B.C. For mail: 1757 West 40th St. (S.1944. Jr.1946)
Wallace, Keith B. Chief Engr., Barry & Staines Linoleum (Canada), P.O. Box 233, Farnham, Que. (S.1929. A.M.1938. M.1940)
Wallace, R. C. Principal & Vice-Chancellor, Queen's University, Kingston, Ont. (Hon.M.1941)
Wallace, R. H. Canada Starch Co., Cardinal, Ont. (S.1924. Jr.1929. A.M.1936. M.1940)
Wallace, W. Robt. J. Elec. Supt., Canadair Ltd., Cartierville. For mail: 2262 Papineau St., Montreal. (S.1943)
Waller, Arnold B. Tool Tech., Dom. Ammunition Divn., Can. Industries Ltd., Box 317, Brownsburg, Que. (S.1946)
Waller, Milford J. Design Engr., Northern Electric Co., 1261 Shearer St., Montreal. (S.1940. Jr.1945)
Waller, Stephen J. H. Asst. to Dist. Engr., Can. Nat. Rlys., Quebec. For mail: 284 St. Cyrille St. (S.1907. A.M.1912. M.1940)
Wallingford, Vivien Miles Field Engr., Anglo-Canadian Pulp & Paper Mills Ltd., Forrestville, Que. (Jr.1944)
Wallis, J. H. Gen. Mgr., Dominion Hoist & Shovel Co., Lachine, Que. For mail: 671 Grosvenor Ave., Westmount, Que. (A.M.1921. M.1940)
Wallis, W. Herbert C. Proj. Engr., Canadair Ltd., Cartierville. For mail: 4278 Sherbrooke St. W., Montreal. (S.1936. Jr.1942)
Wallman, C. G. Mech. Engr., Canada Starch Co., Cardinal, Ont. For mail: P.O. Box 69. (S.1934. Jr.1942)
Walls, John A. Pres., Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md., U.S.A. (S.1904. A.M.1904. M.1940)
Walsh, Frederick F. Plant Utility Engr., Polymer Corp. Ltd., Sarnia, Ont. (M.1945)
Walsh, Geoffrey Brig., Commander & Chief Engr., Northwest Highway System, Whitehorse, Yukon. (M.1945)
Walsh, J. S. Sales Devlpt. Mgr., Dominion Bridge Co., Lachine. For mail: 1112 Elgin Terrace, Montreal. (M.1944)
Walsh, N. S. Dir., Boiler Inspn. Dept., Quebec Dept. of Labour, 88 St. James St. E., Montreal. (A.M.1923. M.1940)
Walter, H. K. Designr., John Inglis Co., Toronto. For mail: 260 Perth Ave. (S.1944)
Walter, John 549 Atlas Ave., Toronto. (S.1933. Jr.1936)
Walters, Paul W. Dom. Civil Service Comm., Ottawa. For mail: 39 Hickory St. (M.1942)
Walton, C. G. 2973 Peter St., Windsor, Ont. (A.M.1928. M.1940)
Walton, E. N. Indust. & Power Elec. Design, H. G. Acres & Co., Niagara Falls, Ont. For mail: Welland St., Chippawa, Ont. (M.1946)
Wanek, Alexander T. Mgr., Indust. Planning Divn., Manning Maxwell & Moore Inc., 11 Elias St., Bridgeport, Conn., U.S.A. (M.1940)
Wang, Sigmund Mgr. of Resch. & Devlpt. Labs., Can. Internl. Paper Co., Hawkesbury, Ont. (A.M.1919. M.1931)
Wangel, R. Design, Can. Industries Ltd., Montreal. For mail: 1459 Mackay St. (A.M.1937. M.1940)
Wanless, Graham George St. Clair Processing Corp., Sarnia, Ont. (Jr.1938)
Ward, F. Lindsay, 514 Regent St., Fredericton. (S.1943)
Ward, Frank N. Vice-Pres. & Mng. Dir., Reavell & Co. (Canada) Ltd., 606 Cathcart St., Montreal. (A.M.1936. M.1940)
Ward, Herbert James Supt. of Property, Shawinigan Water & Power Co., Shawinigan Falls, Que. For mail: 65 Broadway Ave. (A.M.1924. M.1940)
Ward, H. John Cons. Rep., Holophane Co. of Toronto. For mail: 5454 Isabella Ave., Montreal. (M.1940)
Ward, John Jr. Engr., Operations Dept., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 538 Roselawn Ave. (S.1944. Jr.1946)
Ward, Jack H. Supt. & Engr., H. J. McFarland Constrn. Co., Picton, Ont. For mail: P.O. Box 92. (S.1944)
Ward, J. W. (S.1944. Jr.1946)
Ward, J. W. Elec. Supt., Aluminum Co. of Can., Arvida, Que. (A.M.1929. M.1940)
Ward, K. R. Major, R.C.E.M.E. For mail: 81 King St., Kingston, Ont. (S.1938. Jr.1944)
Ward, Lyle C. Res. Engr., Dept. Highways & Transportation, Regina, Sask. For mail: Aylsham, Sask. (S.1946)
Ward, L. W. 617 Eastlake Ave., Saskatoon, Sask. (S.1946)
Ward, R. A. 3647 University St., Montreal. (S.1943)
Ward, Robt. G. D. Inspr., Elec. & Gas, Dept. Trade & Commerce, Regina, Sask. For mail: 1934 College Ave. (M.1945)
Ward, Wm. A. Dept. Public Works of Can., Halifax, N.S. For mail: Armdale P.O. (M.1942)
Ward, W. G. (S.1939. Jr.1946)
Wardle, Edward B. Cons. Engr. Consolidated Paper Corp., Montreal. For mail: 33 Winthrop Terrace, Meriden, Conn., U.S.A. (M.1929)
Wardle, James M. Dir., Surveys & Engrg. Br., Dept. Mines & Resources, Cartier Bldg., Ottawa. (Jr.1913. A.M.1916. M.1925)
Wardleworth, T. H. Design. Aerocrete Constrn. Co., Montreal. For mail: 168 Côte St. Antoine Road. (S.1923. Jr.1931. A.M.1937. M.1940)
Wardrop, W. Leslie Demonstrator, Univ. of Manitoba, Winnipeg, Man. For mail: 616 Banning St. (S.1939. Jr.1941)
Warkentin, C. P. Engr., Imperial Oil Ltd., Sarnia, Ont. (S.1924. Jr.1927. M.1943)
Warner, Geo. W. Office Bldg. Mgr., Price Bros. & Co. and Mgr., Price Navigation Co., Quebec. For mail: 65 Ste. Anne St. (M.1945)
Warner, John E. A. Chief Engr., Robert Gair Co., New York. For mail: 280 West Ave., Milford Conn., U.S.A. (A.M.1920. M.1940)
Warnick, W. M. Dominion Foundries & Steel Co., Hamilton, Ont. For mail: 67 Ontario Ave. (S.1936. A.M.1939. M.1940)
Warnock R. N. Vice-Pres., Chas. Warnock & Co., McGill Bldg., Montreal. (S.1931. Jr.1936. A.M.1938. M.1940)
Warnock, Sam Elec. Engr., Boeing Aircraft Co. Seattle 14, Wash., U.S.A. (M.1941)
Warren, Hector Priv. Prac., Pointe-au-Pic, Que. (A.M.1918. M.1940)
Warren, M. P. 921 St. Joseph Blvd. E., Montreal. (Jr.1946)
Warren, R. B. Can. Liquid Air Co., 858 Burlington St. Hamilton, Ont. (Jr.1938)
Warrender, A. Campbell Test Course, Can. Gen. Elec. Co., Toronto. For mail: 1088 St. Clarens Ave. (S.1946)
Warrington, Geo. A. Chief Surveyor, Dept. Public Works of Man., Winnipeg, Man. For mail: 150 Elm St. (M.1945)
Wass S. B. Box 110, Uxbridge, Ont. (A.M.1909. M.1940)
Waterous, Chas. A. 69 Dufferin Ave., Brantford, Ont. (S.1898. A.M.1903. M.1909)
Waters, Wm. Divn. Engr., Can. Nat. Rlys., Prince Albert, Sask. (A.M.1938. M.1940)
Waters, Wm. L. Cons. Engr., 150 Nassau St., New York, N.Y. (M.1918)
Watier, Arthur H. Asst. to Supt., Generating Divn., Shawinigan Water & Power Co., Box 70, Shawinigan Falls, Que. (S.1931. Jr.1936. M.1942)
Watson, Alexander Marine Supt., Dept. of Transport, Montreal. For mail: 600 Berwick Ave., Town of Mt. Royal, Que. (M.1937)
Watson, A. W. Chem. Analyst & Res. Engr., Internl. Nickel Co., Ormiston, Sask. (M.1940)
Watson, George L. c/o Postmaster, Sea Girt, N.J., U.S.A. (S.1906. A.M.1907. M.1922)
Watson, H. D. Sales Engr., Linde Can. Refrigeration Co., 355 St. Peter St., Montreal. (S.1931. A.M.1940. M.1940)
Watson, Howard Douglas Asst. Supvr. of Mines, Dept. Natural Resources, Co-op. Creamery Bldg., Regina, Sask. (S.1943. Jr. 1946)
Watson, H. M. Contracting Engr., Dom. Bridge Co., Lachine. For mail: 660 Belmont Ave., Westmount, Que. (A.M.1927. M.1940)
Watson, John P. Mech. Designer, Dom. Bridge Co., Lachine. For mail: 4186 Melrose Ave., Montreal. (S.1907. Jr.1912. A.M.1920. M.1940)
Watson, John T. City Mgr., Lethbridge, Alta. For mail: 605-11th St. S. (A.M.1925. M.1940)
Watson, M. Barry Prof., Univ. of Toronto, and Cons. Engr., 119 St. George St., Toronto. (Jr.1912. A.M.1919. M.1938)
Watson, N. S. B. Elec. & Mech. Engr., Chief Arch.'s Dept., Can. Nat. Rlys., 355 McGill St., Montreal. (M.1944)
Watson, Robt. G. 11632 Edinboro Road, Edmonton, Alta. (A.M.1921. M.1940)
Watson, Wm. S. Switchgr. Dftsmn., English Electric Co., St. Catharines, Ont. For mail: 201 Russell Ave. (S.1945)
Watt, Andrew G. Chief Dftsmn., Strl. Steel Dept., Saint John Drydock & Shipbuilding Co. For mail: Fairville Station, King's Co., N.B. (M.1946)
Watt, John Simons Mech. Dept., Mtl. East Refinery, Imperial Oil Ltd. For mail: 4738 Adam St., Montreal. (S.1942. Jr.1946)
Watt, W. C. Mech. Supt., Robt. Simpson Co., Yonge St., Toronto. (M.1945)
Watts, J. P. Asst. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 12 Anne St. (M.1944)
Watts, T. O. Hoover Co. Ltd., Hamilton, Ont. For mail: 173 Longwood Road. (M.1942)
Waugh, Bruce W. Sr. Surveyor, Hydrographic & Map Serv., Dept. Mines & Resources, 105 George St., Ottawa. (M.1922)
Way, Ernest Owen Dir., Weights & Measures, Dept. Trade & Commerce, West Block, Ottawa. (A.M.1919. M.1940)
Way, Wm. Russell Gen. Supt., Oper. Dept., Shawinigan Water & Power Co., 107 Craig St. W., Montreal. (S.1916. Jr.1919. A.M.1934. M.1940)
Waycott, R. L. Res. Engr., Dept. Highways & Public Works of N.S., Halifax, N.S. (M.1940)
Wayland, Raymond J. Lessard, Wayland & Co., Mngment. Engrs., Montreal. For mail: 96 Père Marquette, Quebec. (M.1944)
Weatherbe, D'Arcy c/o Chartered Bank of India, Bishopsgate St., London E.C., England. (A.M.1901. M.1905)
Weatherbie, W. E. Yard Supt., Bathurst Power & Paper Co., Bathurst, N.B. (S.1931. Jr.1932. A.M.1939. M.1940)
Weaver, H. L. Chief Dftsmn., Standard Steel Constrn. Co., Welland, Ont. For mail: R.R. No. 5. (M.1943)
Webb, Chris. Everest Dist. Chief Engr., Dom. Water & Power Bureau, Dept. Mines & Resources, 744 Hastings St. W., Vancouver, B.C. (S.1911. A.M.1913. M.1928)
Webb, D. Roland Mgr., Webb Electric Co., 107 Germain St., Saint John, N.B. (S.1933. M.1942)
Webb, J. A. Constrn. Engr., Burns & Co. Ltd., Calgary, Alta. For mail: 1714-12th Ave. W. (S.1943. Jr.1946)
Weber, A. M. Elec. Engr., Trans-Canada Airlines, Winnipeg, Man. For mail: 261 Balmoral St. (M.1943)
Weber, Peter Asst. Engr., Can. Nat. Rlys., St. Thomas, Ont. For mail: 342 Wellington St. E., R.R. No. 2. (S.1940. Jr.1942)
Weber, Thos. Eugene Engr.-Geol., M. G. Smerchanski, Mining Geol., McArthur Bldg., Winnipeg, Man. (S.1942)
Webster, Chas. W. Asst. Res. Engr., Dept. Highways of Ont., Grimsby, Ont. (A.M.1932. M.1940)
Webster, David R. Dftg. & Field Engr., Consolidated Paper Corp., Three Rivers, Que. (S.1944. Jr.1946)
Webster, Ernest B. Mining Engr., 1210 Harwood St., Vancouver, B.C. (M.1938)
Webster, Frederick Deputy Chief Scientific Adviser to Ministry of Works, Lambeth Bridge House, London, S.E.1, England. (Hon.M.1942)

Webster, G. F. Res. Engr., Refining Dept., Me-Coll-Frontenac Oil Co., Toronto. For mail: 219 Balsam Ave. (S.1942. Jr.1943)
Webster, Geddes M. Cons. Mining Engr., Doris Yellowknife Gold Mines Ltd., Yellowknife N.W.T. (S.1939. Jr.1944)
Webster, Gordon W. Prodn. Engr., Home Oil Co., Calgary, Alta. For mail: 1236-15th Ave W. (M.1946)
Webster, John Alexander 3274 Marine Drive. Holborn, B.C. (S.1942. M.1945)
Webster, R. C. P. Mgr. & Partner, Maitland Charts, and Pres., Hex Baits Ltd., and Vice-Pres., Maitland Devlpt. Co., Maitland. Ont. (S.1922. A.M.1931. M.1940)
Weekman, B. T. Asst. to Indust. Heatg. Engr., Can. Gen. Elec. Co., Toronto. For mail: 1581 Dufferin St. (S.1945)
Weeks, John G. Instr. in Physics, University of Alberta, Edmonton. For mail: Egremont, Alta. (Jr.1946)
Weeks, Otis 2529 Eccles Ave., Ogden, Utah, U.S.A. (A.M.1907. M.1940)
Weightman, L. Mtce. Engr., Steel Co. of Canada, Montreal. For mail: 4190 Beaconsfield Ave. (Affil.1943)
Weigel, M. P. Chief Engr. & Purch. Dir., Aluminum Co. of Can., Sun Life Bldg., Montreal. (M.1943)
Wein, Harry G. 989 Pratt Ave., Outremont, Que. (S.1941. M.1945)
Weiner, Norman D. 121 Henry St., Halifax, N.S. (S.1945)
Weinreb, Marcel Stadler, Hurter & Co., Montreal. For mail: 1518 Mackay St. (M.1945)
Weinstein, Saul Arnold Indust. Engr., Sask Govt. Box Factory, Prince Albert, Sask. (S.1943. Jr.1946)
Weintraub, Jos. M. Owner, Barrie Utility Mfg. Co., 1179 Drummond St., Montreal. (S.1943)
Weir, C. Victor F. Asst. Supt., Calgary Transit System, Car Barns, Victoria Bridge, Calgary, Alta. (A.M.1938. M.1940)
Weir, H. McI. Asst. City Engr., City of Saskatoon, Sask. (M.1938)
Weir, R. A. 170 Geoffrey St., Toronto. (S.1945)
Weir, W. C. Dist. Constrn. Supvr., Veterans' Land Act, Ottawa. For mail: 121 Fairmont Ave. (Jr.1937)
Welch, Donald H. Supvr., Butadiene Plant, Polymer Corp., Sarnia, Ont. For mail: 290 Savoy St. (M.1946)
Welch, H. R. Pres. & Gen. Mgr., Welch & Johnston Ltd., 474 Bank St., Ottawa. (S.1917. Jr.1923. A.M.1930. M.1940)
Welch, Kenneth (S.1944)
Weldon, G. H. Supvr., Defence Industries Ltd., Winnipeg, Man. For mail: 124 Fulham Ave. (S.1937. Jr.1943)
Weldon, R. Laurence Pres., Bathurst Power & Paper Co., Sun Life Bldg., Montreal. (S.1915. Jr.1918. A.M.1921. M.1931)
Weller, Robt. C. Surveys Engr., Topog. Survey, Dept. Mines & Resources, Ottawa. (S.1942. Jr.1946)
Wellington, J. R. Jr. Chem. Engr., Consolidated Mining & Smelting Co., 211 Kootenay Ave., Trail, B.C. (S.1941. Jr.1946)
Wells, Alexander V. Mech. Engr., Dom. Govt., Ottawa. For mail: 87 Fentiman Ave. (M.1942)
Wells, Edward E. Heatg. & Ventilg. Engr., Aluminum Co. of Canada, Montreal. For mail: 6 St. John Road, Pointe Claire, Que. (M.1945)
Wells, James Edwin Process Supvr., Merck & Co., Valleyfield, Que. (S.1941. Jr.1946)
Wellwood, Frank E. Engr., Dept. of Bldgs., City Hall, Toronto. (S.1921. Jr.1929. M.1942)
Wellwood, H. Cedar Harbour, Alcona Beach, via Stroud, Ont. (M.1921)
Wellwood, Robt. W. Assoc. Prof., Dept. of Forestry, Univ. of British Columbia, Vancouver, B.C. (M.1944)
Welsford, H. G. Vice-Pres. & Gen. Mgr., Dominion Engrg. Works Ltd., P.O. Box 220, Montreal. (S.1914. A.M.1920. M.1940)
Welsh, J. G. Asst. Chief Engr., Dom. Tar & Chemical Co., Montreal. For mail: 908 Grande-Côte, Rosemere, Que. (S.1935. A.M.1940. M.1940)
Werth, Frank J. Chief Chemist, Gas & Oil Refineries Ltd., Hartell, Alta. (M.1941)
Wesa, Gus Asst. Engr., Sask. Power Comm., 1739 Cornwall St., Regina, Sask. (S.1943. Jr.1946)
Weselake, Edw. J. Design. Engr., Cowin & Co., Winnipeg, Man. For mail: 136 Tait Ave. (S.1927. Jr.1937. M.1942)
Wesley, W. G. 1445 Van Horne Ave., Outremont, Que (S.1936. Jr.1943)
West, Arthur E. Operatg. Mgr., Can. Bridge Co., 1219 Walker Rd., Walkerville, Ont. (A.M.1922. M.1930)
West, C. W. Supt. Engr., Welland Ship Canal, Dept. of Transport, St. Catharines, Ont. (Jr.1915 A.M.1920. M.1940)
West, Frank Leslie Prof. of Engrg., Mount Allison University, Sackville, N.B. (S.1915. A.M.1920. M.1927)
West, Thos. Macdonald Secy.-Dir., & i/c Plant Resch., J. & J. Taylor Safe Works Ltd., 145 Front St. E., Toronto. (S.1921 Jr.1924. A.M.1939. M.1940)
West, Welsford A. i/c Mtce., Provincial Govt. Bldgs. of Nova Scotia, Halifax, N.S. (M.1940)
Westberg, Harold A. Instr., University of Saskatchewan, Saskatoon, Sask. For mail: 321-6th Ave. N. (S.1946)
Weston, John F. Engrg. & Business Consultant, 217 Broadway Ave., Tillsonburg, Ont. (Jr.1939)
Weston, Norman O. Illum. Engr., Can. Westinghouse Co., Hamilton, Ont. For mail: 294 Hunter St. W. (S.1935. Jr.1943)
Weston, S. R. Chairman, B.C. Power Comm., P.O. Box 606, Victoria, B.C. (A.M.1922. M.1925)
Wetterberg, Donald Carleton Tropical Oil Co., El Centro, Colombia, S.A. (S.1945. Jr.1946)
Weyman, Chas. Edw. Engr. on Constrn., Caldwell Constrn. Co., Fredericton, N.B. For mail: 59 Lansdowne St. (S.1945)
Whaley, Claire E. Engrg. Asst., Bell Telephone Co., Montreal. For mail: 4592 Patricia Ave. (S.1943. Jr.1946)
Wharton, Wm. H. Chief Engr., Howard Smith Paper Mills, 1235 McGill College Ave., Montreal. (M.1940)
Whealy, Joe E. Post-grad., Box 925, Stanford University, Calif., U.S.A. (S.1941. Jr.1946)
Wheatley, Eric E. Prof. Mech. Engrg., University of New Brunswick, Fredericton, N.B (S.1930. Jr.1935. M.1940)
Wheatley, James H. Mech. Supt., Quebec Hydro-Elec. Comm., 176 Dalhousie St., Montreal. (A.M.1919. M.1940)
Wheaton, I. G. Chief Engr., General Sales, Imperial Oil Ltd., Toronto. For mail: 147 Glendonwynne Road. (M.1945)
Wheaton, L. H. 42 Scholfield Ave., Toronto. (A.M.1894. M.1940)
Wheelwright, Barton Chief Engr., Can. Nat. Rlys., 360 McGill St., Montreal. (M.1945)
Whelen, D. A. Asst. Engr., Municipality of Burnaby. For mail: 2367 Sussex Ave., Burnaby, B.C. (S.1943. Jr.1946)
Whelen, Morland P. Rates Engr., Toronto Hydro-Elec. System, 14 Carlton St., Toronto. (S.1919. Jr.1923. A.M.1929. M.1940)
Wheten, W. A. Irrigation Engr., Govt. of Ceylon, Minneriya, Ceylon. (Jr.1940. M.1943)
Whigham-Teasdale, Jas. R. Dept. Municipal Affairs of Alta., Administration Bldg., Edmonton, Alta. (M.1941)
Whillans, Thos. Geo. Douglas Designg. Engr., Spruce Falls Power & Paper Co., Kapuskasing, Ont. (S.1943. Jr.1946)
Whillans, Thos. O. Patent Examiner, Dom. Govt., Langevin Bldg., Ottawa. (A.M.1922. M.1940)
Whitaker, A. W., Jr. Vice-Pres., Aluminum Co. of Can., Montreal. For mail: 3940 Côte des Neiges Road. (A.M.1931. M.1938)
Whitby, E. M. 123 Mountain Blvd., Hamilton, Ont. (M.1938)
White, A. F. Chief Engr., Toronto, Hamilton & Buffalo Railway Co., Hamilton, Ont. (A.M.1937. M.1940)
White, Chas. E. Asst. Engr., Can. Nat. Rlys., Cochrane, Ont. For mail: P.O. Box 618. (A.M.1914. M.1940)
White, C. H. Asst. Engr., Burns & Co., Calgary, Alta. (S.1938. M.1945)
White, Donald A. Pres., D. A. White & Co., Montreal. For mail: 1628 Seaforth Ave. (S.1909. Jr.1914. A.M.1922. M.1940)
White, F. O. Chief Engr., Fraser Companies Ltd., Edmundston, N.B. (M.1919)
White, George A. Engr., Foundation Co. of Can. For mail: 31 Bentnick St., Sydney, N.S. (Jr.1940)
White, G. L. Editorial Dir., Westman Publications Ltd., 137 Wellington St. W., Toronto. (Affil. 1942)
White, H. Edward Strl. Design., Dominion Bridge Co., Lachine, Que. For mail: 1730 St. Joseph St. (S.1944. Jr.1946)
White, Harry Manning Chief Engr., West. Divn., Dominion Bridge Co., P.O. Box 2918, Winnipeg, Man. (A.M.1920. M.1936)
White, John R. Engr., Defence Industries Ltd., 625 Dorchester St. W., Montreal. (Jr.1944)
White, Robt. Sales Engr., Williams & Wilson Ltd., 544 Inspector St., Montreal. (Jr.1912. A.M.1914. M.1940)
White, Thos. W. Dist. Engr., Can. Nat. Rlys., Depot, Edmonton, Alta. (A.M.1909. M.1940)
White, Wm. Barr Asst. Engr., Track Dept., Can. Nat. Rlys., Union Station, Winnipeg, Man. (S.1937. M.1944)
White, Walter Edmund Elec. & Radar Engr., Can. Arsenals Ltd., Ottawa. For mail: 317 Pacific Ave., Toronto. (Jr.1931. M.1943)
White, W. N. Instructor, College of Engrg., Univ. of Sask., Saskatoon. For mail: 316 Albert Ave. (Jr.1940)
Whiteley, Eric Asst. D.C. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 611 Weller St. (S.1937. Jr.1939. M.1945)
Whiteley, F. B. Dept. of Highways of Ont., Cochrane, Ont. (M.1942)
Whiteman, R. H. Jr. Resch. Engr., National Research Council, Ottawa. For mail: 92 O'Connor St. (S.1944)
Whiteway, Lorne B. Town Engr., Stellarton, N.S. (Jr.1938. M.1945)
Whiting, Harold J. Engr., Can. Intrnl. Paper Co., Hawkesbury, Ont. For mail: 24 Smerden Ave. (Jr.1921. A.M.1926. M.1940)
Whitman, Clyde Oliver St. Estimates Engr., Dept. of Reconstruction, Ottawa. For mail: 85 Richmond Road, Ottawa West. (Jr.1919. A.M.1923. M.1940)
Whitman, K. E. Designg. Engr. of Bridges, Dept. of Highways & Public Works of N.S., Halifax. For mail: 43 Tower Road. (A.M.1919. M.1938)
Whitson, Duncan D. Civil Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (S.1926. A.M.1935. M.1940)
Whittaker, H. J. J. Herbert Smith Ltd., Station Hill, Kidderminster, England. (Jr.1921. A.M.1922. M.1940)
Whittall, Fred R. Cons. Engr., 21 Shorncliffe Ave., Westmount, Que. (M.1945)
Whittemore, C. R. Chief Metalgst., Deloro Smelting & Refining Co., Deloro, Ont. (S.1921. A.M.1927. M.1940)
Whittier, Albert R. Suptg. Engr., Dept. of Transport, Ottawa. For mail: 84 Grove Ave. (Jr.1920. A.M.1922. M.1940)
Whittier, Chas. C. Partner, Nutrition Research Labs., Chicago. For mail: Casa de Manana, La Jolla, Calif., U.S.A. (M.1915)
Whyte, G. Neilson Jr. Resch. Physicist, National Research Council, Chalk River, Ont. For mail: 263 Second Ave., Ottawa. (S.1946)
Whyte, Jas. S. Mech. Engr., Longlac Pulp & Paper Co., Schreiber, Ont. (S.1946)
Whyte, J. S. Chief Engr., Shawinigan Chemicals Ltd., Shawinigan Falls, Que. For mail: 45 Hemlock Ave. (M.1944)
Whyte, Keith O. Elec. Engr., Dominion Bridge Co., P.O. Box 280, Montreal. (A.M.1920. M.1940).
Whytock, Jas. W. Engrg. Sales Mgr., Bata Shoe Co. of Can., Batawa, Ont. (S.1932)
Wickenden, Alfred A. Mgr., Lands & Engrg. Dept., Consolidated Paper Corp., Sun Life Bldg., Montreal. (Jr.1911. A.M.1913. M.1940)
Wickenden, John F. Pres., John F. Wickenden Co., Engrs. & Contrs., Ameau Bldg., Three Rivers, Que. (Jr.1921. A.M.1929. M.1940)
Wickware, H. F. Traffic Methods Engr., Sask. Govt. Telephones, Regina, Sask. For mail: 2035 Athol St. (M.1945)
Wickwire, D. S. Town Engr., Yarmouth, N.S. (M.1940)
Wickwire, Jas. L. Asst. Chief Engr., Dept. Highways & Public Works of N.S., Halifax, N.S. (Jr.1927. M.1940)
Wickwire, Robt. D. T. Engr., N.S. Power Comm., Halifax, N.S. For mail: 41 South Park St. (S.1945)
Wickwire, W. A. Keith 56 Edward St., Halifax, N.S. (S.1932)
Widdifield, Ivan S. Indust. Applns. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 239 Manor Road E. (M.1943)
Wideman, Norman Edward Dist. Relay Engr., Hydro-Elec. Power Comm. of Ont., Box 120, Burlington, Ont. (M.1942)
Wiebe, Leslie Chief of Furnishings Section, Canadair Ltd., Cartierville. For mail: 2531 Maplewood Ave., Montreal. (S.1939. Jr.1942)
Wigdor, E. I. Res. Tech. Officer. British Air Comm. in the U.S. For mail: British Office, Republic Aviation Corp., Farmingdale, L.I., N.Y., U.S.A. (S.1934. M.1942)
Wigdor, Leon Resch. Chem. Engr., Ault & Wiborg Co. of Can., Toronto. For mail: 114 Havelock St. (S.1941. Jr.1946)
Wigen, S. C. Hydrographic Service, Post Office Bldg., Victoria, B.C. (S.1943)
Wiggs, G. Lorne Cons. Indust. Engr., G. Lorne Wiggs & Co., 1411 Crescent St., Montreal. (S.1916. A.M.1927. M.1937)
Wight, Calvin Clarence Engrg.-Apptce., Westinghouse Electrical Corp., 288 Emerald St. N., Hamilton, Ont. (S.1941. Jr.1946)
Wight, Cecil Douglas Asst. Commr. of Works, City of Ottawa. For mail: 46 Bellwood Ave. (A.M.1931. M.1940)
Wightman, Brice Alan 473 Toronto St., Winnipeg, Man. (S.1946)
Wightman, F. Carman Town Mgr., Sackville, N.B. (A.M.1920. M.1937)
Wightman, John Supt., Consolidated Mining & Smelting Co., Caribou Gold Mines, Halifax Co., N.S. (S.1920. Jr. 1928. A.M.1934. M.1940)
Wilbur, G. P. Mgr., Ont. Divn., Dominion Bridge Co., Toronto. For mail: 18 Rumsey Road, Leaside. (A.M.1921. M.1940)
Wilbur, Robt. A. Gen. Mgr. & Chief Engr., Ajax Engineers Ltd., 328 Dupont St., Toronto (M.1943)
Wilcock, Walter Engr., Union Gas Co. of Can., 521 McDougal St., Windsor, Ont. (M.1943)
Wilcox, Robt. B. Elec. Lieut., R.C.N., H.M.C.S. Stadacona, Halifax, N.S. For mail: 111 Young Ave. (S.1944. Jr.1946)
Wilcox, S. C. Divn. Engr., Can. Pac. Rly., Kenora, Ont. (S.1906. A.M.1911. M.1940)

Wilde, W. C. Br. Mgr., Automatic Electric (Can.) Ltd., Edmonton, Alta. For mail 9758-82nd Ave. (Jr.1938)
Wildi, Theodore 539 Pine Ave. W., Montreal. Que. (S.1943. Jr.1946)
Wildwood, Harry V. Field Engr., Electro-Metallurgical Co., Welland, Ont. For mail: Fonthill Ont. (M.1943)
Wiles, Alfred Payne Physics Lab. Instr., University of Sask., Saskatoon. For mail: Kewatin Apts. (S.1943)
Wiles, Albert V. 35 Robie St., Amherst, N.S. (S.1945)
Wilford, Frederick R. Pres. & Mgr., F. R. Wilford & Co., Lindsay, Ont. (A.M.1894. M.1903)
Wilford, H. D. County Engr. & Road Supt., County of Victoria, Court House, Lindsay, Ont. (Jr.1924)
Wilhjelm, Erik Land Surveyor, Can. Nat. Rlys., Moncton, N.B. For mail: P.O. Box 304. (M.1943)
Wilk, M. B. 5990 Durocher Ave., Outremont, Que. (S.1944)
Wilkins, E. B. Instrmn., Dept. of Transport, Yellowknife, N.W.T. For mail: 1407-4th Ave., Lethbridge, Alta. (S.1943. Jr.1946)
Wilkins, R. E. Lt.Col., Commandant, Royal Candn. School of Military Engrg., Chilliwack, B.C. (S.1935. Jr.1938)
Wilkinson, J. B. 143 Stanley Ave., Hamilton, Ont. (A.M.1918. M.1940)
Wilkinson, W. C. 64 Smyth Road, Nedlands, Perth, Western Australia. (S.1937. Jr.1940)
Wilks, George Haden, Field Engr., Ducks Unlimited (Canada), Regina. For mail: 121-5th Ave. N., Saskatoon, Sask. (S.1945)
Willet, Norman E. P.O. Box 289, Banff, Alta. (A.M.1939. M.1940)
Williams, Arthur Samuel Supt., Hydro Plant, Winnipeg Electric Co., Seven Sisters Falls, Man. (S.1920. Jr 1924. A.M.1928. M.1940)
Williams, C. G. Prof. Mining Engrg., Univ. of Toronto, Toronto. (M.1938)
Williams, Chas. Reginald Vice-Pres., Dickie Constrn. Co., Toronto. For mail: 91 Dewbourne Ave. (M.1945)
Williams, E. C. Mgr., Air Conditng. Divn., Can. Gen. Elec. Co. For mail: 573 King St., Peterborough, Ont. (Jr.1930. A.M.1934. M.1938)
Williams, Frank Chief Mech. Engr., Can. Nat. Rlys., 360 McGill St., Montreal. (A.M.1921. M.1940)
Williams, G. B. Exec. Asst. to Deputy Minister, Dept. Public Works of Man., Legislative Bldg., Winnipeg, Man. (M.1945)
Williams, G. M. 2515 Garfield St., Lincoln, Nebr., U.S.A. (A M.1920. M.1939)
Williams, J. L. A. P. Green Fire Brick Co., Leaside, Ont. (S.1943. Jr.1946)
Williams, Lloyd S. Chief Chemist, Can. Hanson & Van Winkle Co., Toronto. For mail: 107 Indian Road Crescent. (S 1943. Jr.1946)
Williams, Ralph E. Res. Engr., Paper Mill Constrn., Long Lac Pulp & Paper Co., Box 129, Schreiber, Ont. (M.1941)
Williams, R. K. Indust. Engr., Industrial Development Bank, Toronto. For mail: 206 Langley Ave. (A.M.1939. M.1940)
Williams, Richard L. Designer, Mech. Dept., Dominion Bridge Co., Lachine, Que. For mail: 1649 Provost St. (S.1930. Jr.1933. A.M.1937. M.1940)
Williams, S. E. Res. Mgr., St. Lawrence Paper Mills Co., Three Rivers, Que. (M 1946)
Williams, Thomas B. Commr. of Petrol. & Nat. Gas, B.C. Dept. of Lands, Parliament Bldgs., Victoria, B.C. (M.1941)
Williams, V. T. B. Dist. Engr.. Can. Ingersoll-Rand Co., Sydney, N.S. For mail: 133 Shandwick St. (M.1945)
Williams, Wm. A. Tech. Asst. to Head Prodn. Control Dept., Imperial Oil Ltd., S. Christina St., Sarnia, Ont. (M.1945)
Williamson, David Allen Supvg. Engr., Chief Arch.'s Br., Dept Public Works of Can., Ottawa. For mail: 728 Echo Drive. (A.M.1912. M.1940)
Williamson, Harold J. Dist. Radio Aviation Engr., Air Services Br., Dept. of Transport, Tegler Bldg., Edmonton, Alta. (M.1944)
Williamson, J. R. Mount Allison University, Sackville, N.B. (S.1944)
Willingdon, The Most Honourable, The Marquess, Warden of the Cinque Ports. For mail: 5 Lygon Place, London S.W.1, England. (Hon.M.1927)
Willis, Edwin A. Electrician, Elec. & Gas Inspn. Lab., Dept. Trade & Commerce, National Research Bldg., Ottawa. (Jr 1939. M.1943)
Willis, L. E. Overseas. (S.1941. Jr.1944)
Willis, R. R. Chief Engr., Ross Engrg. Co., Verdun, Que. For mail: 5131 Earnscliffe Ave., Montreal. (S.1931 Jr.1936. M.1943)
Willis, Sherred Works Mgr., Can. Gypsum Co., Windsor, N.S. (M.1945)
Willis, Reuben W. Chief Engr., Strl. Steel Divn., John T. Hepburn Ltd., 18-60 Van Horne St., Toronto. (Jr.1929. A.M.1935. M.1940)
Willis, W. Paul R. Sales Specialist, Can. Gen. Electric Co., 174 King St., London, Ont. (Affil.1945)
Willmot, Richard Stewart Indust. Rep., McColl-Frontenac Oil Co., Toronto. For mail: 124 Glen Road. (Jr.1946)
Willows, Fred Res Engr. on Constrn., Beauharnois Light, Heat & Power Co.. Box 100, Beauharnois. Que. (S.1929. Jr.1936. M.1942)
Wills, N. James (S.1940. Jr.1946)
Wills, R. Kenneth Dist. Highway Engr., Dept. Public Works of N B., Box 670, Chatham, N.B. (M.1942)
Willson, Bruce F. Jr. Engr., Northwestern Utilities Ltd., 10124-104th St., Edmonton, Alta. (S.1943. Jr.1946)
Wilmot, L. Allan Tech. Advisor on Foreign Trade Rulings, 67 Yonge St., Toronto. (A.M.1929. M.1940)
Wilson, Alex. Mgr., Montreal Office, Can. Comstock Co., 1010 St. Catherine St. W., Montreal. (A.M.1920. M.1940)
Wilson, Alexander Mgr., Pumps & Softeners Ltd., London, Ont. For mail: 476 Colborne St. (Affil.1944)
Wilson, A. G. 408-20th E., Saskatoon, Sask. (S.1946)
Wilson, A. McD. Asst. Engr., Algoma Central & Hudson Bay Rly. Co., Sault. Ste. Marie, Ont. (Jr.1929. A.M.1935. M.1940)
Wilson, Barry Power Comm., City of Saint John, N.B. (M.1942)
Wilson, Clifford St. J. Pickings & Wilson, Roy Bldg., Halifax, N.S. (Jr. 1913. A.M.1919. M.1940)
Wilson, H. O. Sales Engr., English Electric Co. of Can., 1243 University St., Montreal. (Jr.1939)
Wilson, Hugh W. Jr. Resch Engr., Aerodynm. Sec., National Research Council, Ottawa. For mail: 155 O'Connor St. (S.1944)
Wilson, J. A. 178 Rideau Terrace, Ottawa. (A.M.1910. M.1936)
Wilson, Jas. C. Constrn. Engr., Water Works Dept., Ottawa. For mail: 667 Cumberland St., Ottawa. (S.1914. A.M.1925. M.1940)
Wilson, John Edward Dftsmn., Dominion Bridge Co., Toronto. For mail: 62 Oakmount Road. (S.1945)
Wilson, J. E. (S.1944)
Wilson, J. F. 2737 McCallum Ave., Regina, Sask. (S.1946)
Wilson, J. H. Elec. Engr., Elec. Light Dept., City of Calgary, Alta. For mail: 718-14th St. E. (S.1924. A.M.1929. M.1940)
Wilson, John H. Supvg. Mgr., Wilson Co., Hudson, Que. For mail: Hudson Heights, Que. (S.1940. Jr.1946)
Wilson, John M. Dist. Engr., Dom. Dept. of Public Works, 36 Adelaide St. E., Toronto. (S.1907. A.M.1909. M.1918)
Wilson, J. S. Dir. & Engrg. Cons., Dryden Paper Co. For mail: P.O. Box 262, Uxbridge, Ont. (Jr.1919. A.M.1923. M.1930)
Wilson, J. S. Pres. & Gen. Mgr., Tyee Machinery Co., Granville Island, Vancouver, B.C. (M.1942)
Wilson, J. T. Prof. Geophysics, University of Toronto, 49 St. George St., Toronto. (M.1943)
Wilson, Murray E. Elec Inspr., Atlantic Reg., Can. Nat. Rlys., Moncton, N.B. For mail: 34 Enterprise St. (S.1937. Jr.1944)
Wilson, Norman Marine Services, Hunter Bldg., Ottawa. (S.1912. Jr.1916. A.M.1919. M.1940)
Wilson, Norman D. Wilson & Bunnell, Cons. Engrs., 388 Yonge St., Toronto. (S.1905. A.M.1910. M.1925)
Wilson, Robt. Chief Teleph. Engr., Northern Electric Co., 1261 Shearer St., Montreal. (M.1943)
Wilson, Robt. G. Service Dept., Can. Westinghouse Co., Sanford Ave. N., Hamilton, Ont. (Jr.1946)
Wilson, Robt. G. Dftsmn., machine design, Goodyear Tire & Rubber Co., New Toronto. For mail: 137 Garden Ave., Toronto. (S.1946)
Wilson, Ronald S. Asst. Engr. (Mech.) National Harbours Board, 357 Common St., Montreal. (Jr.1945)
Wilson, R. S. L. 11044-81st Ave., Edmonton, Alta. (S.1907. A.M.1913. M.1926)
Wilson, Selwyn H. Plant Engr., Ottawa Car & Aircraft Ltd., Ottawa. For mail: 1 Maple Lane, Rockcliffe Park. (S.1920. A.M.1925. M.1940)
Wilson, T. W. Sales Engr., Can. Bitumuls Co., Leaside, Ont. For mail: 13 Fairview Blvd., Toronto. (S.1932. Jr.1938. M.1941)
Wilson, V. W. G. Supt. Material Testing Labs., McGill University, Montreal. (M.1944)
Wilson, W. B. Annandale Apts., Sydenham St., Kingston, Ont. (A.M.1937. M.1940)
Wilson, Wm. Fairbairn Glenshiel Guest House, Victoria, B.C. (A.M.1934. M.1940)
Wilson, Wm. H. 1471 Crawford Bridge Ave., Verdun, Que. (S.1942. Jr.1946)
Wilson, Wm. Jas. F. Power Equipt. Engr., Northern Electric Co., Montreal. For mail: 1470 Closse St. (S.1943)
Wilson, Wm. M. P.O. Box 574, Springhill, N.S. (S.1945)
Wilson, Wm. Seath Field Engr., Algoma Steel Corp., Sault Ste. Marie, Ont. For mail: 210 McGregor Ave. (S.1906. A.M.1911. M.1940)
Wilson, W. S. Chief Engr., Dominion Steel & Coal Corp., Sydney, N.S. For mail: 847 George St. (A.M.1921. M.1940)
Wilson, Wm. Stewart Asst. Dean & Secy., Faculty Applied Science & Engrg., Univ. of Toronto, Toronto. For mail: 20 Humewood Drive. (S.1921. A.M.1926. M.1935)
Windelcr, Henry S. Chief Engr., Anglo-Newfoundland Development Co, Grand Falls, Nfld. (S.1912. A.M.1921. M.1940)
Winder, John Elec. Supt., Molson's Brewery Ltd., 1670 Notre Dame St. E., Montreal. (Affil.1934)
Windsor, H.R.H. The Duke of (Hon.M.1919)
Winfield, Jas. Henry Maritime Telegraph & Telephone Co., P.O. Box 110, Halifax, N.S. (M.1918)
Winfield, W. A. Pres. & Mng. Dir., Maritime Telegraph & Telephone Co., Hollis St., Halifax, N S. (M.1920)
Wing, Daniel O. Engr. of Gas Distbn., Quebec Hydro-Elec. Comm., Power Bldg., Montreal. (A.M.1917. M.1940)
Wing, Ernest Plant Engr., Canada & Dominion Sugar Co., 1410 Montmorency St., Montreal. (A.M.1938. M 1940)
Wingfield, Alex. H. Psychologist, Board of Education, Hamilton, Ont. (A.M.1929. M.1940)
Winn, James Overseas. (S.1935. Jr.1946)
Winnikow, A. Metallurgist, Aluminum Co. of Can., Shawinigan Falls, Que. For mail: 14a Fifth St. (M.1945)
Winslow, K. Sales Dept., Aluminum Co. of Can., Montreal. For mail: 3061 Westmount Blvd. (Jr.1922. A.M.1934. M.1940)
Winterbourne, J. A. Jr. Engr., Shawinigan Engrg. Co., Power Bldg., Montreal. (S.1945)
Winterburn, Fred Elec. Supt., Howard Smith Paper Mills Ltd., Cornwall, Ont. (Affil.1943)
Wintermaik, C. R. Plant Engr., Robt. Mitchell Co., Montreal For mail: 1487 Chomedy St. (M.1946)
Wiren, R. C. Assoc. Prof. Mech. Engrg., University of Toronto, Toronto. (A.M.1929. M.1936)
Wirtanen, Ernest W. Apparatus Divn., Can. Gen. Elec. Co., 265 Notre Dame Ave. W., Winnipeg, Man. (S.1942)
Wise, Alfred J. Inspr. & Elec. Engr., Can. Underwriters' Assn., Montreal. For mail: 5530 Côte St. Luc Road. (S.1925. A.M.1937. M.1940)
Wise, Chas. G. F. Office Engr., Halifax Refinery, Imperial Oil Ltd., P.O. Box 490, Dartmouth, N.S. (M.1944)
Wiseblatt, L. 3408 Northcliffe Ave., Montreal. (S.1946)
Wishart, W. D. Overseas. (S.1932. Jr.1934)
Wisnicki, B. Paul Asst. Engr., Western Bridge & Steel Fabricators Ltd., Vancouver, B.C. For mail: 3751 Cartier St. (M.1945)
Withrow, J. Fred D. Patent Attny. & Cons. Engr., Route 1, Box 235, Vista, San Diego Co., Calif., U.S.A. (A.M 1921. M.1940)
Woermke, Orville R. Plant Engr., Electric Reduction Co. of Can., Buckingham, Que. For mail: Box 87. (Jr.1943. M.1944)
Wolever, F. D. 536 Prince Albert Ave., Westmount, Que. (Jr.1946)
Wolff, A. O. Asst. Engr., Mtce. of Way, Can. Pac. Rly., Union Station, Toronto. (A.M.1920. M.1926)
Wolff, Martin, Office Engr., M. D. Barclay Inc., Montreal. For mail: 442 Argyle Ave., Westmount, Que. (S.1906. A.M.1911. M.1940)
Wolstenholme, P. G. Elec. Engr., Brown Corp., La Tuque, Que. (Affil.1941)
Wong, Henry G. Vice-Pres., Utah Electronics (Can.) Ltd., Longueuil, Que. For mail: 1090 Chenneville St., Montreal. (S.1934. Jr.1941)
Wong, J. K. 696 East Pender St., Vancouver, B.C. (S.1946)
Wong, James Yetow Y.M.C.A., Winnipeg, Man. (S.1945)
Wong, P. Huey 73 Lagauchetière St. W., Montreal. (S.1943)
Wong, Walter J. Strl. Engr., Aluminum Co. of Can., Sun Life Bldg., Montreal. (Jr.1943. M.1946)
Wood, Albert L. Asst. Engr., Fisheries Research Board of Can., Atlantic Fisheries Experimental Station, Halifax, N.S. (S.1930. M.1940)
Wood, Chas. O. Mayfair Apts., Metcalfe St., Ottawa. (A.M.1904. M.1940)
Wood, E. M. Planning Engr., Hydro-Elec. Power Comm. of Ont., 620 University Ave., Toronto. (M.1941)
Wood, E. Oren Jr. Engr., Ontario-Minnesota Pulp & Paper Co., Fort Frances, Ont. (S.1945)
Wood, Ernest W. Shop Dir., Prov. Inst. of Technology & Art, Calgary, Alta. For mail: 420 Tenth Ave. N.W. (M.1942)
Wood, F. M. Assoc. Prof., Dept. of Maths., Queen's University, Kingston, Ont. (A.M.1920 M.1940)

Wood, George H. Sr. Asst. Engr., Dom. Water & Power Bureau, Dept. Mines & Resources, Ottawa. (Jr.1921. A.M.1922. M.1940)
Wood, J. R. City Engr., City Hall, Calgary, Alta. (A.M.1919. M.1935)
Wood, John R. Asst. Engr., Can. Gen. Elec. Co., Peterborough, Ont. For mail: 334 Reid St. (Jr.1945)
Wood, W. A. Works Mgr., Harrington Tool & Die. Co., 755 First Ave., Lachine, Que. (M.1941)
Wood, W. C. E. Arnprior, Ont. (S.1943. Jr.1946)
Wood, W. R. Muir 784 Wilder Ave., Montreal 8. (S.1946)
Woodall, Gordon, Constrn. Engr., Woodall Bros., Gen. Contrs., 1711 Walker Road, Windsor, Ont. (Jr.1944)
Woodard, Silas H. Cons. Engr., 10 East 40th St., New York, N.Y. (M.1910)
Woodfield, Percy Raymond Test Engr., Gas Turbines, A. V. Roe (Canada) Ltd., Malton, Ont. (S.1938. Jr.1944)
Woodhall, T. L. Chief Dftsmn., Manitoba Power Comm., Winnipeg, Man. For mail: 121 Baltimore Road. (S.1930. Jr.1946)
Woodman, H. J. Asst. Constrn. Engr., Dept. Highways of Sask., Regina, Sask. For mail: 3014 McCallum Ave. (A.M.1939. M.1940)
Woods, F. C. Engrg. Dept., City of Westmount, Que. For mail: 765-44th Ave. Lachine, Que. (S.1927. A.M.1936. M.1940)
Woods, G. M. Design Engr., Defence Industries Ltd., Montreal. For mail: 681 Godin Ave., Verdun, Que. (S.1940. Jr.1942)
Woods, John Myer Chem. Engr., Mill & Devlpt., Restigouche Co. Ltd., Campbellton, N.B. For mail: General Delivery. (S.1943. Jr.1946)
Woods, John P. Steam Engr., Consolidated Paper Corp., Grand'Mere, Que. For mail: 50-1st. Ave. (Jr.1946)
Woodside, James Gatineau Power Co., Ottawa. For mail: 37 Fulton Ave. (A.M.1926. M.1940)
Woodyatt, Jas. B. Pres. & Gen. Mgr., Southern Canada Power Co., 355 St. James St. W., Montreal. (S.1907. A.M.1916. M.1931)
Woolfrey, G. R. Elec. Engr., Shawinigan Engrg. Co., Montreal. For mail: 2217 Hampton Ave. (S.1944)
Woollcombe, Edward M. Gen. Mgr. Foundation Maritime Ltd. & Maritime Towing & Salvage Ltd., Halifax, N.S. For mail: 17 Bloomingdale Terrace. (M.1945)
Woolsey, E. G. Astronomer, Dominion Observatory, Ottawa. For mail: 35 Anna St., Stevensons Place. (S.1944. M.1946)
Woolsey, John T. 2 Airdrie Road, Leaside, Ont. (S.1932. Jr.1938. M.1945)
Woolward, Chas. Desmond Chief Engr., Anglin Norcross Que. Ltd., Montreal. For mail: 3546 Durocher St. (S.1921. Jr.1926. A.M.1930. M.1940)
Wootton, Allen S. Priv. Prac., 975 Lagoon Drive, Vancouver, B.C. (M.1923)
Worby, C. D. Princeton Apts., Winnipeg, Man. (S.1945)
Worcester, W. G. Prof. Ceramic Engrg., University of Saskatchewan, Saskatoon, Sask. (M.1923)
Worembrand, Carl H. Mech. Engr., Can. Vickers Ltd., Montreal. For mail: 5268 St. Urbain St. (S.1943. Jr.1946)
Workman, W. R. Asst. Dist. Engr., B.C. Dept. Public Works, Smithers, B.C. (S.1927. Jr.1936)
World, Harry P. Sales Mgr., Wm. & J. G. Greey Ltd., Toronto. For mail: 1533 Mt. Pleasant Road. (A.M.1936. M.1940)
Worley, Harold G. Engrg. Supvr., Windsor Salt Works, Can. Industries Ltd., P.O. Box 10, Montreal. (M.1944)
Worsfold, C. C. 325-4th St., New Westminster, B.C. (S.1893. A.M.1898. M.1901)
Worthington, Wm. Robt. Pres., W. R. Worthington Constrn. Co., Toronto. For mail: 332 Lytton Blvd. (A.M.1916 M1940)
Wotherspoon, R. B. Asst. Supt., Drop Forge Works, Steel Co. of Can., Gananoque, Ont. For mail: P.O. Box 36. (Jr.1939)
Wrangell, K. Frederick Mech. Engr., E. B. Eddy Co., Hull, Que. For mail: 172 Bayswater Ave., Ottawa. (Jr. 1931. A.M.1935. M.1940)
Wray, J. D. 68 Margaret Ave., Kitchener, Ont. (S.1943)
Wray, R. H. Elec. Engr. & Tech. Asst., Calgary Transit System, Calgary, Alta. (S.1939. Jr.1946)
Wright, Archibald E. 1836 Duchess Ave., West Vancouver, B.C. (M.1920)
Wright, A. Meade Field Engr., Constrn., Foundation Maritime Ltd, 142 Duke St., St. John, N.B. (S.1938. Jr.1943)
Wright, Chas. Harvey 110 Oxford St., Halifax, N.S. (M.1918)
Wright, C. P. Engr., Western Canada Insurance Underwriters' Assn., Paris Bldg., Winnipeg, Man. (M.1940)
Wright, Errol H. Supvg. Engr., Constrn., Northwestern Utilities Ltd., Edmonton, Alta. For mail: 11021-126th St. (A.M.1937. M.1940)
Wright, Gordon M. Resch. Physicist, National Research Council, Ottawa. For mail: 184 Bolton St. (S.1943. Jr.1946)
Wright, Howard R. Engr.-in-Trng., Shawinigan Water & Power Co. For mail: 57 Bégin Ave, Quebec. (S.1944)
Wright, H. S. C. A. Energia Electrica de Venezuela, Marcaibo, Venezuela, S.A. (S.1922. Jr.1931)
Wright, John H. 1629 Selkirk Ave., Montreal. (S.1946)
Wright, J. Robt. 295 Alfred St., Kingston, Ont. (S.1946)
Wright, L. Austin General Secretary, The Engineering Institute of Canada, 2050 Mansfield St., Montreal. (Jr.1914. A.M.1938. M.1940)
Wright, Noel N. East. Dist. Mgr., Ferranti Electric Ltd., Tramways Bldg., Montreal. (Jr.1928. A.M.1938. M.1940)
Wright, R. W. Plant Engrg. Dept., Can. Gen. Elec. Co., Toronto. For mail: 201 Stibbard Ave. (Jr.1943)
Wright, W. J. T. Prof. & Dir. of Studies at Ajax, University of Toronto. For mail. 126 Melrose Ave., Toronto. (M.1940)
Wrightson, Norman Dftsmn., Darling Bros. Ltd., Montreal. For mail: 5977 Jeanne Mance St. (S.1940)
Wrigley, Frederick R. G. Chief Engr., Mason's Ltd. & B.E.M.A., St. Vincent St., Port of Spain, Trinidad, B.W.I. (M.1941)
Wrong, Jas. S. Constrn. Engr., F. E. Cummings, Gen. Contr., Ottawa. For mail: Box C-57, Westboro, Ont. (S.1943. Jr.1946)
Wurtcle, D. B. 116 Howick St., Rockcliffe, Ottawa. (Jr.1946)
Wurtele, J. S. H. Vice-Pres. & Plant Mgr., Southern Canada Power Co., and Plant Mgr., Power Corp. of Can., Montreal. For mail: 756 Upper Lansdowne Ave., Westmount, Que. (M.1917)
Wyatt, Digby Mgr. for Ont., Cresswell Pomeroy Co., Toronto. For mail: 26 Castleview Ave. (M.1943)
Wyckoff, E. G. Admin. Engr., Otis-Fensom Elevator Co., Victoria Ave. N., Hamilton, Ont. (A.M.1938. M.1940)
Wyeth, Eric A. Sr. Engr., Aircraft Mech. Equipt., Trans-Canada Airlines, Dorval, Que. For mail: 4838 Dornal Ave., Montreal. (S.1944)
Wylie, L. H. Capt., R. C. Signals. For mail: 180 Cartier St., Ottawa. (S.1943. Jr.1946)
Wylie, Jas. M. Sr. Estim., Strl. Steel Contract. Dept., Can. Bridge Co., 1219 Walker Rd., Walkerville, Ont. (M.1942)
Wyman, H. K. Asst. Chief Engr., Shawinigan Chemicals Ltd., Shawinigan Falls, Que For mail: 47 Hemlock St. (A.M.1925. M.1940)
Wyman, John K. Gen. Supt. of Grain Elevators, National Harbours Board, 357 Common St., Montreal. (S.1907. A.M.1912. M.1940)
Wyman, R. A. Resch. Engr., Aluminium Laboratories Ltd., Arvida, Que. For mail: 133 High St. (M.1946)
Wynn, E. M. Dftsmn., Mathews Conveyer Co., Port Hope, Ont. For mail: Box 584. (A.M.1919. M.1940)
Wynn, G. M. Vice-Pres., T. Pringle & Son Ltd., 485 McGill St., Montreal. (A.M.1915. M.1926)

Y

Yachimec, Peter 9930 Jasper Ave., Edmonton, Alta. (S.1946)
Yack, W. L. Mech. Supt., Molson's Breweries Ltd., Montreal. For mail: 4452 Oxford Ave. (A.M.1929. M.1940)
Yamanaka, R. H. Burke Electric & Ray Co., Toronto. For mail: 95 Bowmore Road. (S.1943. Jr.1946)
Yan, Cecil Jr. Test. Engr., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 665 Bathurst St. (S.1946)
Yapp, Raymond A. Sales Mgr., Bepco Canada Ltd., 4018 St. Catherine St. W., Montreal. (A.M.1934. M.1940)
Yarrow, Norman A. 105 Union Blvd., Victoria, B.C. (A.M.1918. M.1940)
Yee, Thos. M. (S.1940. Jr.1946)
Yeomans, L. H. Sussex, N.B. (S.1944)
Yespelkis, Chas. Robt. Que. Dept. Public Works, Parliament Bldgs., Quebec. (S.1942)
Yong, Mark Dftsmn., Horton Steel Works Ltd., Fort Erie, Ont. (A.M.1939. M.1940)
Yorgan, W. J. Gen. Supt., Gas Dept., Quebec Hydro-Elec. Comm., Montreal. For mail: 3791 Vendome Ave. (A.M.1932. M.1940)
York, Theodore C. Engrg. Dftsmn., Powell River Co., Powell River, B.C. For mail: Box 623. (S.1941)
Yost, Winfield H. P.O. Box 243, Berwick, Pa., U.S.A. (A.M.1924. M.1940)
Youell, Leonard L. Engrg. Rep., Stone & Webster Engrg. Corp., Toronto. For mail: 52 Nina Ave. (M.1945)
Youmatoff, S. A. Sr. Processor, Elec. Ships Components, War Assets Corp., Montreal. For mail: 2050 Decarie Blvd. (M.1944)
Young, Alex. A. 477 Bayview Ave., Toronto. (S.1909. A.M.1913. M.1940)
Young, Clarence Richard Dean, Faculty of Applied Science & Engrg., University of Toronto, Toronto. (S.1903. A.M.1908. M.1913)
Young, Dudley Stewart Asst. Gen. Sales Mgr., Canada Wire & Cable Co., P.O. Box 340, Toronto. (M.1945)
Young, Frank Engr., City of Saskatoon, Sask. For mail: 520—28th St. (A.M.1938. M.1940)
Young, F. B. Calgary Power Co., Calgary, Alta. (Jr.1919. A.M.1923. M.1940)
Young, Hume B. Instrmn., City of Vancouver, B.C. For mail: 3163 West 3rd Ave. (S.1939. Jr.1946)
Young, H. R. Field Engr., C. D. Howe Co., Port Arthur, Ont. (Jr.1946)
Young, J. Douglas Sales Engr., Bailey Meter Co., 980 St. Antoine St., Montreal. (M.1945)
Young, John K. Transitman, Can. Pac. Rly., Saint John, N.B. For mail: McAdam, N.B. (S.1945)
Young, J. P. Supt. of Constrn., Dept. Public Works of Ont., Toronto. For mail: 263 Runnymede Road. (A.M.1938. M.1940)
Young, J. R. Pres., Sun Electrical Co., 1943 Scarth St., Regina, Sask. (A.M.1938. M.1940)
Young, J. W. Asst. Field Supt., Madison Natural Gas Co., Turner Valley, Alta. (A.M.1936. M.1940)
Young, K. B. 262 Second Ave., Ottawa. (S.1943. Jr.1946)
Young, Kenneth J. 460 Erie St. W., Windsor, Ont. (S.1946)
Young, L. Currie Major, R.C. Signals, Dist. Signals Officer, M.D. No. 6, Halifax, N.S. For mail: 365 Morris St. (A.M.1939. M.1940)
Young, M. D. Asst. Gen. Supt., Winnipeg Hydro-Elec. System. For mail: 1404 Wellington Cres. (S), Winnipeg, Man. (M.1946)
Young, Ross A. Supt. of Constrn., McColl-Frontenac Oil Co., Montreal. For mail: 5275 Cote St. Luc Road. (A.M.1938. M.1940)
Young, Roderick B. Asst. Dir. of Resch., Hydro-Elec. Power Comm. of Ont., Toronto. For mail: 30 Brumell Ave. (S.1911. Jr.1916. A.M.1918. M.1923)
Young, Stewart Dir. Community Planning, Dept. Municipal Affairs of Sask., Regina, Sask. For mail: 2822 Rae St. (A.M.1917. M.1935)
Young, Wray B. 46 Cedar St., Ajax, Ont. (S.1946)
Young, W. Brand Mng. Dir., Products & Plastics Ltd., North Vancouver, B.C. For mail: 1204 Cotton Road, c/o Lynnmour P.O., North Vancouver, B.C. (A.M.1919. M.1940)
Young, W. H. 358 Holland Ave., Ottawa. (Jr.1936. M.1942)
Young, Wm. R. Design. & Supvr. of Constrn., Can. Internl. Paper Co., Temiskaming, Que. For mail: Staff House. (S.1924. M.1941)
Younger, H. R. Dist. Engr., Can. Pac. Rly., Calgary, Alta. (A.M.1913. M.1940)
Yuile, Arthur McL. Sales Engr., Peacock Bros. Ltd., Ville LaSalle, Que. For mail: 4707 Upper Roslyn Ave., Montreal. (S.1944)
Yuill, A. C. R. Cons. Engr., 675 Hastings St. W., Vancouver, B.C. (A.M.1919. M.1927)
Yuill, E. S. Engr., Wire & Cable Divn., Northern Electric Co. Ltd., Montreal. For mail: 4946 Wellington St., Verdun, Que. (Jr.1946)
Yuill, Russell Port Mgr., National Harbours Board, Prince William St., Saint John, N.B. (S.1914. A.M.1920. M.1940)

Z

Zabek, Valerian Metalgst., Harrington Tool & Die Co., Lachine, Que. For mail: 64 King's Road, Valois, Que. (S.1945)
Zabner, S. J. 168 McCaul St., Toronto. (S.1946)
Zacharias, E. R. Factory Mgr., Jos Stokes Rubber Co., Welland, Ont. For mail: Box 763. (M.1944)
Zaharuk, Peter Jr. Resch. Engr., Foster Wheeler Ltd., St. Catharines, Ont. (S.1945)
Zealand, Edward L. Constrn. Engr., Pigott Constrn. Co., Hamilton, Ont. For mail: The Pines, R.R. No. 2, Freeman, Ont. (S.1920. Jr.1924. A.M.1928. M.1940)
Zides, Murray 71 Irving St., New Haven, Conn., U.S.A. (S.1943. Jr.1946)
Zimmerman, G. Douglas i/c Mtl. Office, Fischer & Porter Co., Montreal. For mail: 119 O'Brien Blvd., St. Laurent, Que. (S.1943)
Zink, Joseph W. 241 Weldon St., Moncton, N.B. (S.1944)
Zion, Alfred B. Prodn. Mgr., Dominion Lock Co., 7301 Decarie Blvd., Montreal. (S.1935. Jr.1941)
Zirul, M. L. Asst. Dist. Engr., Water Rights Br., Dept. Lands & Forests of B.C., Nelson, B.C. For mail: 717 Hall St. (Jr.1944)
Zorzi, J. Design Engr., Foundation Co. of Can., Montreal. For mail: 1414 Crescent St. (M.1945)
Zurowski, Raymond A. Demonstrator, University of Saskatchewan, Saskatoon, Sask. For mail: 721 Main St. (S.1945)
Zweig, Irving I. 4156 DeBullion St., Montreal. (S.1941. Jr.1943)
Zweig, Jos. P. 4156 DeBullion St., Montreal. (S.1944)
Zwicker, B. H. C. Asst. Equipt. Engr., Maritime Telephone & Telegraph Co., Halifax, N.S. For mail: 4 Tower Terrace. (S.1928. M.1941)

GEOGRAPHICAL LIST OF MEMBERS

Corrected to September 15th, 1946

ZONE A

(The four Western Provinces)

Victoria Branch District

(Vancouver Island and the Gulf Islands Tributary to Vancouver Island.)

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Esquimalt (Br.Res.), MEMBERS, N. T Carson, A. G. M. Davy, R. H. Stevens.
Campbell River (Br.NonRes.), MEMBER, T. M. McIntyre; JUNIOR, R. A. Cunningham; STUDENT, F. F. Slaney.
Ladysmith (Br NonRes.), MEMBER, H. E. Stevens
Nanaimo (Br.NonRes.), MEMBER, H. F. Bourne, D. C. Stephenson; JUNIOR, A. P. Alexander; STUDENTS, H. M. Tapay, F. E. Turley.
Parksville (Br.Res.), MEMBER, F. Lee.
Port Alberni (Br NonRes.), JUNIOR, A. J. Narod.
Port Alice (Br.NonRes.), MEMBER, C. C. Ryan.
Port McNeill (Br.NonRes.), JUNIOR, I. A. Abramson.
Royal Oak (Br.Res.), MEMBERS, A. L. Ford, H. T. Hughes.
Royal Roads (Br Res.), JUNIOR, H. U. Ross.
Royston (Br.Res.), STUDENT, J. S. Edwards.
Salt Spring Island (Br.NonRes.), MEMBER, F. O. Mills.
Savary Island (Br.NonRes.), MEMBER, Chas. L. Bates.
Sidney (Br.NonRes.), MEMBER, C. W. Gamble; STUDENT, J. R. Moran.
Tod Inlet (Br.NonRes.), MEMBER, R. E. Haskins.
Victoria (Br.Res.),

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C. A. Magrath.

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STUDENTS

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Vancouver Branch District

(The balance of British Columbia, except that allocated to Kootenay Branch)

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Burnaby (Br.Res.), MEMBER, G. N. Stowe; JUNIOR, D. A. Whelen.
Chilliwack (Br.NonRes.), MEMBER, H. M. B. Inglis; JUNIOR, R. E Wilkins; STUDENT, L. J. Bayly.
Cultus Lake (Br.NonRes.), JUNIOR, J. A. Merchant.
Eburne (Br.NonRes.), STUDENT, N. E. Greenaway.
Fort St. John (Br.NonRes.), Member, E. O Greening; AFFILIATE, A. Holland.
Grantham's Landing (Br.Res.), STUDENT, R. E. Fisher.
Granville Island (Br.Res.), MEMBER, W. E. Jenkins.
Greenwood (Br.NonRes.), MEMBER, S. H. Davis.
Haney (Br.NonRes.), MEMBER, A. E. Sharpe.
Hollyburn (Br.Res.), MEMBER, E. H. Jupp; STUDENT, E. Parnum.
Hope (Br.NonRes.), STUDENT, J. A. Dennison
Kaleden (Br.NonRes.) , MEMBER, A. K. Robertson.
Kamloops (Br.NonRes.), MEMBERS, H. L. Cairns, J. E. Hanlon, H. L. Hayne, W. Ramsay, J. H. A. Steven, M. L. Wade; JUNIOR, A. R. Colby.
Kelowna (Br.NonRes.), HON. MEMBER, G. Stirling; MEMBERS, A. J. Gayfer, F. W. Groves, D. K. Penfold.
Ladner (Br Res.), MEMBER, C. E. Cooper; STUDENT, J. D. Robertson.
Lynn Valley (Br.Res.), MEMBER, W. Anderson.
New Westminster (Br.Res.), MEMBERS, G. B. Dixon, L. B. Elliot, E. S. Jones, W. E. Keyt, J. B Lambert, G. Macleod, K. W. Morton, J. D. Nicol, R. E. Potter, C. Raley, F. J. Simpson, P. M. Smith, C. C. Worsfold; JUNIORS, C. H. Clay, A. C. Cooper, G. R. Davidson, J S. Slater; STUDENTS, K. L. Hall, F. A. MacLean, E. S. Rhodes, M. C. Robinson, H. A. C. Stokes.
Ocean Falls (Br.NonRes.), MEMBERS, P. A. Frattinger, C. W. E. Locke; JUNIOR, R. R Snyder.
Oliver (Br.NonRes.), MEMBER, A. Cox.
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Port Coquitlam (Br.Res.), JUNIOR, S. M. Schofield.
Port Mellon (Br. NonRes.), MEMBER, J. G. D'Aoust.
Powell River (Br.NonRes.), MEMBERS, D. A. Evans, W. Jamieson, J. S. Motherwell; JUNIOR, A. E. Chard; STUDENT, T. C. York.
Prince Rupert (Br. NonRes.), MEMBERS, K. Dixon, E. A. Phillips; STUDENTS, L. G. G. Holtby, D. Mackay.
Princeton (Br. NonRes.), STUDENT, A. C. Dimock.
Shalalth (Br.NonRes.), MEMBER, C. R. Lindsay; JUNIOR, R. Chambers.
Sherman (Br.Res.), STUDENT, J. E. Smith.
Smithers (Br.NonRes.), JUNIOR, W. R. Workman; STUDENT, R. M. Cook.
Squamish (Br. NonRes.), STUDENT, J. C. Confortin.
Vancouver (Br.Res.),

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G. W. Allan, J. Alton, H. P. Archibald, J. S. Ball, F. H. Ballou, H. Balmforth, G. H. Bancroft, P. W. Barchard, J. B. Barclay, I. C. Barltrop, F. R. Barnsley, R. Bell-Irving, M. D. Berry, T. V. Berry, W. A. Bickell, E. E. Bissett, R. T. Blair, P. N. Bland, W. R. Bonnycastle, C. Brakenridge, H. R. Brownell, E. E. Brydone-Jack, P. H. Buchan, J. E. Buerk, L. H. Burpee, E. F. Carter, J. Chalmers, G. T. Chillcott, A. W. G. Clark, C. E. Cleveland, E. A. Cleveland, C. J. Cock, C. A. Colpitts, G. S. Conway, P. E. Cooper, F. P. V. Cowley, W. R. Craig, A. D. Creer, C. R. Crysdale, J. Cunningham, C. W. Deans, S. H. deJong, A. Dickson, V. Dolmage, J. M. Duncan, A. C. Eddy, L. J. Ehly, R. A. Emerson, M. J. Evans, W. P. Ferguson, J. N. Finlayson, H. C. Fitz-James, E. Floyd, J. P. Fraser, W. T. Fraser, H. W. Frith, M. L. Gale, A. S. Gentles, G. McD. Gilbert, A. I. E. Gordon, A. Granger, J. R. Grant, J. Green, E. E. Gregg, W. B. Greig, C. T. Hamilton, J. B. Hamilton, W. G. Heslop, H. B. Hicks, S. Hogg, J. B. Holdcroft, A. Holsten, H. M. Howard, W. L. Inglis, J. A. Jones, J. A. D. Keay, W. N. Kelly, W. L. Kent, A. T. Kerr, N. D. Lambert, T. Lees, D. O. Lewis, H. M. Lewis, D. A. Livingston, K. Y. Lochhead, J. R. Lyall, A. S. Mansbridge, W. O. Marble, C. G. Mills, H. H. Minshall, H. St. J. Montizambert, T. M. Moran, W. G. Murrin, J. B. Macdonald, H. MacKenzie, H. J. MacLeod, H. N. Macpherson, A. C. McEachern, C. J. McGavin, J. McHugh, R. A. McLachlan, D. McRoberts, F. Noakes, J. C. Oliver, J. B. Parham, E. L. Paterson, K. E. Patrick, A. Pearson, A. Peebles, A. H. Perry, F. R. Phillips, G. L. Phillips, A. A. Plummer, W. H. Powell, R. C. Pybus, W. Rae, R. Rennie, H. Rindal, E. N. Ridley, J. Robertson, R. Rome, A. M. Ross, S. Ross, P. R. Sandwell, W. Scales, C. D. Schultz, C. A. Scott, R. G. Scott, W. O. Scott, N. C. Sherman, W. Smaill, D. S. Smith, L. B. Stacey, E. J. Stephen, F. C. Stewart, G. P. Stirrett, W. M. Stobbart, P. B. Stroyan, W. G. Swan, J. A. Tames, F. B. Taylor, G. F. Taylor, E. C. Thrupp, G. L. Tooker, D. P. Urry, G. A. Walkem, R. Walkem, J. A. Walker, C. E. Webb, E. B. Webster, R. W. Wellwood, J. S. Wilson, B. P. Wisnicki, A. S. Wootton, A. E. Wright, W. B. Young, A. C. R. Yuill.

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J. L. Adams, R. G. Bentall, B. N. Brockhouse, M. S. Brown, J. A. Burton, J. Carrothers, W. R. Cheriton, H. V. Casson, D. G. Crook, J. A. Deptford, J. H. Ferguson, R. H. Garrett, S. S. Gilmour, J. B. Glenn, W. G. Grimble, G. J. Henrickson, R. W. Hole, R. J. Kenst, F. R. Killam, F. Langenek, S. C. Laughlan, F. C. Leroux, L. W. MacDougall, C. D. Marlatt, J. L. Miller, V. L. Mosher, L. F. Morrison, L. G. McDiarmaid, W. G. McIntosh, D. J. Rattenbury, R. C. Robson, R. G. Scarisbrick, A. C. Smith, H. L. Smith, W. D. Stewart, J. H. Swerdfeger, C. H. Vatcher, J. M. Wallace, H. B. Young.

STUDENTS

J. D. Anderson, F. J. Andrew, F. B. Baker, D. R. Bakewell, W. A. Bateman, R. F. Binnie, J. M. Bird, J. Brandlmayr, Jr., F. R. Bunnell, A. Burnham, J. A. Burton, R. Bushfield, P. W. Chutter, R. H. Currie, E. G. Davis, C. M. Douglas, O. C. Edwards, D. R. Elliott, G. M. Ellis, A. M. Eyre, R. M. Ferguson, A. G. Fletcher, E. E. Gallagher, A. V. Gallon, G. M. Genge, R. Goleman, H. B. R. Graves, W. M. Gray, W. G. Grimble, J. L. Harbell, D. G. Heal, P. S. Herring, C. G. Hewlett, J. B. Hicks, R. F. Hooley, F. R. Hole, N. Hudak, G. M. Josephson, W. E. Kenny, J. C. Kent, R. G. Kerr, H. Kolbeins, S. S. Lefeaux, A. Ludwick, R. G. Lye, W. E. Lyle, D. J. Manning, L. R. Munroe, W. A. McDill, J. H. McNaughton, S. J. Nelson, A. S. Nemetz, J. N. Olsen, R. L. Payne, G. R. Phare, R. A. Pillman, E. T. Quirk, D. L. Pitman, R. W. Racine, W. G. Robinson, E. A. Robertson, W. B. Scott, C. C. Taylor, L. H. Taylor, J. T. Teevan, E. R. Tinney, J. K. Wong.

AFFILIATES

C. B. Huyck, R. L. Bartlett, G. E. Herrman, G. N. Lancaster.

Vernon (Br.NonRes.), MEMBER, B. H. Schroter.
Westbank (Br.NonRes.), JUNIOR, J. Barber-Starkey.
White Rock (Br.Res.), MEMBER, M. C. Nesbitt.
Woodfibre (Br. NonRes.), MEMBERS, W. A. Bain, G. D. Trethewey.
Yale (Br.NonRes.),MEMBER, W. K. Gwyer.

Kootenay Branch District

(The territory in British Columbia included between the 119° parallel on the west, the United States boundary on the south, and the boundaries of the province on the north and the east.)

Cranbrook (Br.NonRes.), MEMBER, C. E. MacKinnon.
Fernie (Br.NonRes.), MEMBER, G. E. Elkington.
Holborn (Br.NonRes.), MEMBER, J. A. Webster.
Kimberley (Br.NonRes), MEMBER, P. S. Barratt; JUNIORS, M. Cantwell, J. W. Reynolds; STUDENT, W. H. Poole.
Nakusp (Br.NonRes.), STUDENT, L. E. Parent.
Nelson (Br.NonRes.), MEMBER, R. Pollard; JUNIORS, J. G. Matthews, M. L Zirul.
Rossland (Br.Res.), MEMBERS, D. J. S. Irvine, W. N. Papove, A. C. Ridgers.
South Slocan (Br.NonRes.), MEMBERS, A. A. Lambert, W. J Tindale.
Trail (Br.Res.), MEMBERS, E. B. Broadhurst, A. H. W. Busby, L. A. Campbell, J. P. Coates, E. A. G. Colls, R. W. Diamond, A L. Garvin, H. P. Hamilton, W. G. Jewitt, T. W. Lazenby, C. E. Marlatt, E. Mason, S. C. Montgomery, J. V. Rogers, E. M. Stiles, J. P. Svarich; JUNIORS, G. R. McMeekin, J. R. Wellington; STUDENTS, G. W Downie, R. J. Gray, W. V. Nicholson, A. Swystun.

Calgary Branch District

(The territory in Alberta included between the north boundary of township thirteen from Saskatchewan to the British Columbia boundary, northerly on the interprovincial boundary to the north boundary of township forty-two; east to the east boundary of range twelve (west of the fourth meridian); south to the north boundary of township thirty-seven; east on the north boundary of township thirty-seven to the Saskatchewan boundary; and south on the interprovincial boundary to township thirteen.)

Banff (Br.NonRes.), MEMBERS, C. R. Cornish, F. G. Haven, P. J. Jennings, R. McC. Martin, N. E. Willett; JUNIOR, W. H. Ball; STUDENT, J. H. Peatfield.
Black Diamond (Br.NonRes.), JUNIOR, R. H. Teskey.
Bowness (Br.Res.), MEMBER, W. F. Elford; JUNIOR, G. H. Galbraith.
Brooks (Br.NonRes.), MEMBER, W. Crook.
Calgary (Br.Res.),

MEMBERS

W. Anderson, E. Avery, R. Barnecut, A. Baxter, F. K. Beach, R. L. Black, G. P. F. Boese, E. W. Bowness, R. W. Brews, F A. Brownie, J. E. Brown, R. A. Brown, W. P. Cheney, J. W. Clarke, F. B. Connors, S. G. Coultis, B. H. Corey, M. Cranston,

J. C. Dale, P. Davidson, S. J. Davies, E. H. Davis, J. B. deHart, F. C. Dempsey, H. E. Denton, C. V. Dunne, F. S. Dyke, D. C. Fleming, J. N. Ford, W. L. Foss, W. S. Fraser, F. T. Gale, A. B. Geddes, W. J. Gold, D. P. Goodall, W. J. Gray, L. Green, J. A. Haberman, J. Haddin, D. F. Hamelin, J. J. Hanna, D. A. Hansen, H. E. Hansen, S. H. Hawkins, H. R. Hayes, A. Higgins, R. C. Hind, R. T. Hollies, O. H. Hoover, W. C. Howells, E. H. Hunt, J. S. Irwin, M. W. Jennings, G. D. Kellam, F. A. Killer, J. F. Langston, H. B. LeBourveau, J. G. MacGregor, R. MacKay, M. H. Marshall, P. D. Mellon, W. St. J. Miller, K. W. Mitchell, H. H. Moore, H. J. McEwen, J. McMillan, A. S. Neil, J. S. Neil, V. A. Newhall, K. K. Paget, J. H. Palmason, J. R. Paget, J. H. Parks, T. M. Parry, A. A. Peebles, P. F. Peele, S. G. Porter, H. Randle, F. N. Rhodes, W. E. Robinson, H. H. Ross, J. H. Ross, T. Schulte, W. G. Sharp, H. B. Sherman, W. A. Smith, B. W. Snyder, H. C. Spence, T. D. Stanley, H. J. Stephens, H. LeM. Stevens, Guille, J. I. Strong, W. D. Suitor, D. G. Tapley, F. C. Tempest, H. W. Tooker, W. B. Trotter, R. S. Trowsdale, G. W. Webster, C. V. F. Weir, C. H. White, J. H. Wilson, E. W. Wood, J. R. Wood, F. B. Young, H. R. Younger.

JUNIORS

A. G. Ballantyne, F. E. Balshaw, J. E. Beach, A. I. Clark, D. Cramer, T. C. Elliott, C. W. Elliott, D. H. Evers, S. D. Foote, F. W. Fraser, J. W. Gregg, N. R. Hannah, C. M. Harding, H. H. Heisler, W. A. Hiller, C. R. Hoar, D. C. Jones, E. L. Jones, O. M. Julson, W. A. King, D. F. Kobylnyk, J. A. Lamb, D. D. Livingstone, R. O. Lockwood, H. N. Lukes, G. MacLeod, J. R. Milne, S. G. Moseson, W. R. McRae, G. G. D. Robertson, P. L. Rule, N. Safran, W. A. B. Saunders, T. M. Schulte, G. C. Scowcroft, A. E. Sick, J. L. Sloan, I. Smith, R. B. Snyder, W. D. Stothert, W. H. Tate, J. A. Webb, R. H. Wray.

STUDENTS

F. Black, L. E. N. Carr, J. A. Clow, G. A. Hutton, S. L. W. Mann, W. A. McLaggan, S. R. Nelson, P. J. Robinson, W. R. Sadler, S. E. Rutledge, A. J. Spence, J. G. Spencer.

AFFILIATE

G. Key-Jones.

Canmore (Br.NonRes.), MEMBER, C. S. Dewis.

Exshaw (Br.NonRes.), MEMBER, J. B. Hanly.

Olds (Br.NonRes.), MEMBER, G. N. Houston.

Seebe (Br.NonRes.), JUNIORS, G. V. Eckenfelder, B. A. Monkman; STUDENT, O. E. Enarson.

Stettler (Br.NonRes.), MEMBER, W. D. Gray.

Strathmore (Br.NonRes.), MEMBERS, G. H. Patrick, P. M. Sauder.

Turner Valley (Br.NonRes.), MEMBERS, R. G. Laird, G. D. Phelps, J. W. Young; JUNIOR, G. A. Connell.

Edmonton Branch District

(All the Provinces of Alberta north of the northern boundary of the Calgary Branch, plus Yukon and the Northwest Territories)

Bruderheim (Br.NonRes.), STUDENT, R. S. Kittlitz.

Cadomin (Br.NonRes.), MEMBER, H. McLeod.

Chinook (Br.NonRes.), STUDENT, R. G. Proudfoot.

Delia (Br.NonRes.), STUDENT, G. W. Herzog.

Dawson (Br.NonRes.), MEMBERS, A. G. Barrett.

Edmonton (Br.Res).

MEMBERS

J. A. Allan, A. M. Allen, F. M. Barchard, T. E. Bate, H. A. Bowden, N. A. Bradley, F. R. Burfield, J. B. Burke, W. F. Byers, J. Callaghan, W. A. Capell, C. W. Carry, J. W. S. Chappelle, D. B. Collier, J. E. B. Cranswick, J. F. Cunningham, J. G. Dale, T. W. Dalkin, W. J. S. Dawson, P. L. Debney, W. J. Dick, R. M. Dingwall, W. A. Donaldson, A. C. Dunn, N. W. DuBois, G. P. Duncan, J. M. Forbes, A. Frame, C. E. Garnett, J. Garrett, R. J. Gibb, A. W. Haddow, R. M. Hardy, P. Hargrove, D. Hutchison, O. Inkster, W. J. Johnston, J. W. Judge, J. E. Kellett, H. P. Keith, W. W. Kelland, O. G. Kelly, W. D. Kirkland, T. N. Louden, J. D. A. Macdonald, N. W. Macpherson, N. H. G. McClary, J. F. McDougall, W. I. McFarland, R. N. McManus, F. McPherson, R. C. McPherson, C. Z. Monaghan, G. H. N. Monkman, I. F. Morrison, W. R. Mount, E. Nelson, C. E. Nix, A. M. Paull, V. Pearson, G. R. Pinchbeck, B. W. Pitfield, J. W. Porteous, M. M. Price, D. B. Rees, A. M. Reid, H. A. Ripley, D. W. Ritchie, D. Ross, B. Russell, C. J. Sanderson, R. Scott, E. Skarin, E. L. Smith, D. R. Stanley, R. J. Stephenson, W. F. Stevenson, L. A. Thorssen, H. W. Tye, R. G. Watson, J. R. Whigham-Teasdale, T. W. White, H. J. Williamson, R. S. L. Wilson, E. H. Wright.

JUNIORS

D. K. Campbell, J. M. Casault, E. K. Cumming, R. L. Davies, S. G. Davis, C. Farstad, J. W. Forster, L. E. Gads, L. G. Grimble, R. A. Hemstock, R. H. Hislop, H. Hole, N. A. Lawrence, R. H. Linke, D. L. MacDonald, R. B. A. MacKenzie, F. A. Madill, D. M. Marshall, G. F. McAulay, R. B. McDiarmaid, L. H. McManus, R. E. Phillips, C. F. Phripp, G. E. Poole, J. E. Poole, J. W. Preboy, W. W. Preston, P. J. Prokopy, A. B. Samuel, S. R. Sinclair, C. A. Stollery, J. G. Wall, B. F. Willson.

STUDENTS

R. J. Allman, S. H. Asselstine, W. D. Baines, G. W. Bernard, A. L. Berry, R. A. Brown, H. A. Carswell, W. H. Cowley, J. W. N. Fead, J. Gregory, S. J. Hampton, E. Hochhausen, R. J. Hollingshead, W. S. Jones, H. L. Kasten, K. R. Lobb, I. F. B. McBride, R. E. McClary, L. W. Nelson, M. Nicolson, R. H. Nicolson, C. Nyberg, C. H. Olson, W. B. Ozust, E. J. Sanden, H. C. Shannon, E. M. Smith, M. E. Stewart, P. Yachimec.

AFFILIATE

G. H. Milligan.

Egremont (Br.NonRes.), JUNIOR, J. G. Weeks.

Erskine (Br.NonRes.), JUNIORS, W. M. Huddleston, D. A. Kennett.

Fort Resolution (Br.NonRes.), MEMBER, H. A. Ingraham.

Fort Simpson (Br.NonRes.), MEMBER, G. Knutson.

Grande Prairie (Br.NonRes.), JUNIOR, W. J. Blackstock.

Jasper (Br.NonRes.), MEMBER, J. B. Snape, STUDENT, W. L. Hayhurst.

Lougheed (Br.NonRes.), STUDENT, V. E. McCune.

Norman Wells (Br.NonRes.), JUNIOR, J. D. Harvie.

Peace River (Br.NonRes.), MEMBER, J. H. Johnston.

Port Radium (Br.NonRes.), MEMBER, E. J. Bolger.

Vermillion (Br.NonRes.), MEMBER, B. E. Bury.

Wetaskiwin (Br.NonRes.), MEMBER, P. J. Maggs.

Whitecourt (Br.NonRes.), JUNIOR, L. E. Smith.

Whitehorse (Br.NonRes.), MEMBERS, W. B. Akerley, L. S. Keith, G. Walsh, JUNIOR, G. E. McDougall.

Yellowknife (Br.NonRes.), MEMBERS, D. A. G. Smith, W. G. Stuart, JUNIORS, H. Lepp, G. M. Webster, STUDENT, J. K. C. Mulherin.

Lethbridge Branch District

(Territory in Alberta included between the United States boundary and the northern boundary of township thirteen.)

Bellevue (Br.NonRes.), STUDENT, J. Longworth.

Blairmore (Br.NonRes.), MEMBER, J. A. Brusset.

Cardston (Br.NonRes.), STUDENT, R. D. Low.

Coaldale (Br.Res.), MEMBER, H. W. Rowley.

Coleman (Br.NonRes.), MEMBER, F. J. Hastie; JUNIORS, H. E. Hewitt, R. L. Sanders.

Diamond City (Br.Res.), MEMBER, A. J. Branch.

Hartel (Br.NonRes.), MEMBER, F. J. Werth; STUDENT, R. E. Martyn.

Lethbridge (Br.Res.),

MEMBERS

R. C. Bell, N. H. Bradley, G. S. Brown, J. M. Campbell, C. S. Clendening, J. M. Davidson, A. G. Donaldson, C. S. Donaldson, J. Haimes, P. E. Kirkpatrick, R. S. Lawrence, T. Miard, M. S. Mitchell, R. B. McKenzie, A. L. H. Somerville, J. T. Watson.

JUNIORS

R. E. Grant, J. H. Harding, E. B. Wilkins.

STUDENTS

E. A. Lawrence, I. M. Scott.

Macleod (Br.NonRes.), MEMBER, H. C. Ritchie.

Magrath (Br.Res.), MEMBER, M. F. R. Lloyd.

Maycroft (Br.NonRes.), JUNIOR, G. E. P. Eastwood.

Medicine Hat (Br.NonRes.), MEMBERS, J. M. Anderson, A. C. Gardner, D. W. Hays, C. M. Moore, K. A. Truman; JUNIORS, A. N. Gunter, W. F. Hall.

Pincher Creek (Br.NonRes.), MEMBER, T. O. Neumann.

Suffield (Br.NonRes.), MEMBER, T. Pascoe; JUNIOR, I. C. Scarlett.

Walsh (Br.NonRes.), JUNIOR, H. T. Hargrave.

Saskatchewan Branch District

(The Province of Saskatchewan)

Alsask (Br.NonRes.), STUDENTS, W. F. Reeder, W. W. Robertson.

Ardill (Br.NonRes.), STUDENT, A. Mowchenko.

Aylsham (Br.NonRes.), STUDENT, L. C. Ward.

Bienfait (Br NonRes.), STUDENT, J. Birbrager.

Bishopric (Br.NonRes.), MEMBER, M. F. Frombach.

Brancepeth (Br.NonRes.), STUDENT, R. E. Shore.

Bulyea (Br.NonRes.), STUDENT, G. R. Mather.

Cabri (Br.NonRes.), STUDENT, J. A. L. Robinson.

Canwood (Br.NonRes.), JUNIOR, D. E. Haldane.

Cheviot (Br.NonRes.), STUDENT, E. E. Brooks.

Claybank (Br.NonRes.), MEMBER, S. Matthews.

Climax (Br.NonRes.), STUDENT, J. A. Francis.

Cupar (Br.NonRes.), JUNIOR, D. B. Hall.

Davidson (Br.NonRes.), MEMBER, R. L. Bigg.

Eatonia (Br.NonRes.), STUDENT, E. L. Smith.

Elfros (Br.NonRes.), STUDENTS, W. J. Babey, J. C. Hughes.

Estevan (Br.NonRes.), STUDENTS, A. D. Moore, G. A. Peterson.

Gravelbourg (Br.NonRes.), JUNIOR, L. J. L'Heureux.

Indian Head ,Br.NonRes.), STUDENT, D. H. McCorkindale.

Invermay (Br.NonRes.), JUNIOR, G. I. Loucks.

Island Falls (Br.NonRes.), AFFILIATE, H. T. Olson.

Kennedy (Br.NonRes.), MEMBER, I. F. Hilts.

Kincaid (Br.NonRes.), JUNIOR, T. A. J. Leach.

Langham (Br.NonRes.), STUDENT, D. A. Buhr.

Limerick (Br.NonRes.), JUNIOR, M. Hawkeye.

Markinch (Br.NonRes.), JUNIOR, D. A. Stann.

Meadow Lake (Br.NonRes.), STUDENT, E. R. Carpenter.

Melville (Br.NonRes.), JUNIOR, E. H. Gavlas.

Moose Jaw (Br.NonRes.), MEMBERS, G. B. Alexander, C. K. Buchbach, A. W. E. Fawkes, K. C. Graham, R. M. Henderson, A. A. Holland, C. J. Somers, C. M. Thompson; JUNIORS, I. Shicnfield, W. Smith; STUDENTS, M. P. Durrant, E. E. Nixon.

Naicam (Br.NonRes.), STUDENT, O. Swenson.

North Battleford (Br.NonRes.), MEMBERS, H. P. Fuller, R. R. Keith, D. D. Low, M. H. Stevenson; STUDENTS, H. W. Klassen, A. H. G. Snow.

Ormiston (Br.NonRes.), MEMBER, A. W. Watson.

Pense (Br.NonRes), JUNIOR, W. E. Boyle.

Perdue (Br.NonRes.), STUDENT, R. J. Brehler.

Prince Albert (Br.NonRes.), MEMBERS, W. Christie, G. H. L. Dempster, D. M. Dunlop, J. B. Hamilton, H. J. Hermanson, J. Jonsson, W. Waters; JUNIOR, S. A. Weinstein; STUDENT, M. D. Robb.

Regina (Br.Res.),

MEMBERS

R. W. Allen, W. H. Bentley, A. I. Bereskin, R. Bing-Wo, H. K. Black, C. A. Boulton, W. L. Bunting, W. L. Campkin, H. R. Carscallen, E. S. C. Carpenter, H. S. Carpenter, F. C. Christie, W. E. Crossley, D. C. M. Davies, W. E. Denley, H. J. deSavigny, J. N. DeStein, S. G. Dethridge, C. W. Doody, A. H. Douglas, E. J. Durnin, F. E. Estlin, J. W. D. Farrell, R. J. Fyfe, A. C. Garner, S. Harding, K. T. Hawley, C. C. Hay, D. W. Houston, R. W. Jickling, G. E. Kent, S. T. Lewis, A. P. Linton, W. O. Longworthy, E. E. Lord, P. G. McAra, D. A. R. McCannel, D. S. MacDonald, T. McGuinness, G. L. MacKenzie, H. R. MacKenzie, O. W. Martyn, G. G. Milne, W. Mock, B. Montbriand, S. R. Muirhead, G. N. Munro, H. I. Nicholl, J. M. Patton, W. W. Perrie, W. B. Ramsay, H. G. Randlesome, H. G. Riesen, H. L. Roblin, J. G. Schaeffer, A. W. Shattuck, F. J. Slominski, F. H. Smail, C. W. Sparrow, M. J. Spratt, E. Stewart, W. M. Stewart, J. J. A. Street, B. J. O. Strong, L. A. Thornton, T. G. Tyrer, F. R. Vance, R. G. D. Ward, H. F. Wickware, H. J. Woodman, J. R. Young, S. Young.

JUNIORS

W. T. Bothwell, L. A. Dokken, L. F. Eull, J. C. Fyfe, M. G. Jacoby, H. L. M. King, D. A. Larmour, H. L. Lexier, C. A. Loden, J. G. S. McMorine, F. D. Sturdy, A. G. Teskey, L. J. Treleaven, W. B. Thomson, H. D. Watson, G. Wesa.

STUDENTS

A. R. Boall, D. A. Fraser, C. A. Loden, D. R. Low, D. H. Marshall, R. V. Mills,

R. L. Moyer, D. McIntyre, R. W. Ottem, G. Petuk, S. A. Weinstein, J. F. Wilson.
Richlea (Br.NonRes.), STUDENT, S. T. Ostevik.
Saskatoon (Br.NonRes.),

MEMBERS

G. D. Archibald, A. L. C. Atkinson, A. L. Cole, H. R. Davis, F. H. Edmunds, C. R. Forsberg, J. S. Fowler, I. M. Fraser, W. A. Friebel, A. R. Greig, J. Guthrie, N. B. Hutcheon, T. B. Jackson, W. E. Lovell, A Michalenko, A. A. Murphy, F. McCallum, W. G. McKay, R. A. McLellan, A. B. Olson, G. W. Parkinson, P. C. Perry, R. Peterson, E. H. Phillips, E. K. Phillips, R. A. Spencer, J. M. Taylor, J. E. Underwood, H. McI. Weir, W. G. Worcester, F. Young.

JUNIORS

L. G. Chan, G. W. Clarke, R. M. Coons, J. B. Edwards, G. C. Hamilton, K. F. Humphrey, N. L. Iverson, T. V. Kennedy, J. B. Mantle, G. C. McLeod, L. R. McLeod, E. L. Miners, R. F. Pearson, C. F. Ripley, E. S. Smith, W. R. Staples, J. C. Traynor, W. N. White.

STUDENTS

B. N. Burwell, W. R. Campbell, G. E. Carss, J. L. Cook, R. Dabinsky, F. J. Dusel, W. J. English, A. B. Farnam, D. A. Ferguson, J. A. Funk, H. M. Graham, G. H. Green, W. H. Harper, C. P. Lentz, R. E. Ludwig, J. G. Matthews, D. A. Powell, M. B. Pierce, W. A. Reed, C. F. Ripley, J. H. Saldat, D. Thierman, L. W. Ward, H. A. Westberg, A. P. Wiles, G. H. Wilks, A. G. Wilson, R. A. Zurowski.

Shaunavon (Br.NonRes.), MEMBER, J. A. McCoubrey.
Swift Current (Br.NonRes.), MEMBERS, H. W. Carss, J. E. Mollard, V. E. Thierman; JUNIOR, J. S. G. Middleton.
Stoney Creek (Br.NonRes.), JUNIOR, D. M. McLeod.
Tantallon (Br.NonRes.), STUDENT, R. W. Ormiston.
Togo (Br.NonRes.), STUDENT, H. L. Topham.
Val Marie (Br.NonRes.), STUDENT, G. A. Duey.
Verwood (Br.NonRes.), JUNIOR, L. T. Holmes.
Watrous (Br.NonRes.), STUDENT, J. D. Mollard.
Watson (Br.NonRes.), STUDENT, A. M. Hill.
Weyburn (Br.NonRes.), MEMBERS, J. E. Bennett, A. J. Cameron; STUDENT, H. N. Gawley.
Wilkie (Br.NonRes.), JUNIOR, C. Garrett.
Yorkton (Br.NonRes.), MEMBER, H. M. Bailey; STUDENTS, R. P. L. Daniels, M. N. Spector, T. J. Uruski.

Winnipeg Branch District

(The Province of Manitoba)

Birtle (Br.NonRes.), JUNIOR, V. L. Dutton.
Boisevain (Br.NonRes.), JUNIOR, W. J. Milhausen.
Brandon (Br.NonRes.), MEMBERS, R. F. P. Bowman, W. W. Fotheringham, C. G. Peters, W. H. Shillinglaw; JUNIOR, G. W. Lawson.
Charleswood (Br.NonRes.), MEMBER, G. R. Fanset
Churchill (Br.NonRes.), MEMBER, C. G. J. Luck; JUNIOR, F. J. Sergi.
Dauphin (Br.NonRes.), MEMBER, R. C. Robinson; AFFILIATE, E. Ashton.
Flin Flon (Br.NonRes.), MEMBER, M. K. Reikie; STUDENT, N. C. Croome.
Fort Whyte (Br.Res.), MEMBER, C. W. Edmonds.
Glenboro (Br.NonRes.), STUDENT, K. G. Anderson.
Grandview (Br.NonRes.), JUNIOR, R. H. Walker.
Lydiatt (Br.NonRes.), MEMBER, W. A. James.
McCreary (Br.NonRes.), STUDENT, R. S. Everall.
Morden (Br.NonRes.), STUDENT, P. A. Livingston.
Pine Falls (Br.NonRes.), MEMBER, M. W. Turner; STUDENTS, N. Bachynski, D. D. Munro, J. P. V. Palmer, C. Rempel.
Poplar Point (Br.NonRes.), STUDENT, F. T. Kuzyk.
Pointe du Bois (Br.NonRes.), JUNIOR, R. H. Ansley.
Rivers (Br.NonRes.), STUDENTS, D. Danylkiw, E. D. Manchul.
Selkirk (Br.Res.), STUDENT, L. H. Howard.
Seven Sisters Falls (Br.NonRes.), MEMBERS, A. L. Oddleifson, A. S. Williams.
Snow Lake (Br.NonRes.), JUNIOR, J. A. Caverly.
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Sault Ste. Marie Branch District

(The counties of Algoma, Cochrane, Nipissing (north of the Mattawa River), Sudbury (including Manitoulin Island), Timiskaming, Ont., and the area in the United States within a radius of twenty-five miles of Sault Ste. Marie.)

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From Month to Month

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

COMMONWEALTH CONFERENCE

This conference was referred to in general terms in the October issue of the *Journal*. Now that the resolutions and conclusions have been presented to Council, it becomes possible to report in greater detail. In view of the uniqueness of the conference, the wide representation and the possibility of expansion in activities and cooperation that it proposed, it is believed the membership in general will be interested to know more about it.

In the first place it should be recorded that the arrangements for every detail of the programme were perfect. Not a single item was overlooked and the precise timing kept the conference going at the fast pitch necessary to complete the agenda within the prescribed period. The officers of the three "host" institutions who were responsible for the programme deserve great credit for the perfection of all arrangements, and for the warmth of their hospitality.

The participating organizations and the delegates were as follows:

The Institution of Civil Engineers:

Sir Thomas Peirson Frank, president
Sir William Thomson Halcrow, president-elect
Sir Reginald Edward Stradling, vice-president
Sir Roger Gaskell Hetherington, member of council
Sir Frederick Charles Cook, vice-president
Mr. E. Graham Clark, secretary

The Institution of Mechanical Engineers:

Mr. Oliver Vaughan Bulleid, president
Professor F. C. Lea, past-president
Dr. H. J. Gough, vice-president
Mr. Alfred Roebuck, councillor
Mr. D. R. Pye, councillor
Dr. H. L. Guy, secretary

The Institution of Electrical Engineers:

Dr. Percy Dunsheath, president
Mr. V. Z. deFerranti, president-elect
Sir Arthur Fleming, past-president
Mr. T. G. N. Haldane, vice-president
Mr. Percy Good, vice-president
Mr. W. K. Brasher, secretary

The Institution of Engineers, Australia:

T. E. Upton, president
W. R. Hebblewhite, councillor

The Institution of Engineers, India:

Rai Bahadur P. R. Agarwal, councillor
John Chambers, councillor

The New Zealand Institution of Engineers:

C. W. Hamann, councillor
D. B. Mansergh, past councillor

South Africa: Representing (a) The Society of Civil Engineers, (b) The Institution of Engineers, and (c) The Institute of Electrical Engineers: Professor W. G. Sutton, past president (a) and (b).

A. J. Adams, Secretary of Associated Scientific and Technical Societies.

The Engineering Institute of Canada:

J. B. Hayes, president
L. Austin Wright, general secretary

As this was the first conference it was not possible to reach final conclusions on all items. Many were left to be discussed further between organizations after additional consideration had been given them by the individual organizations. The advisability of holding additional conferences at regular intervals was discussed but it was agreed that no decision be made at the present time. It was evident, however, that the present conference had attained its objectives, and would go towards advancing the interests of the profession within the Commonwealth.

It was a matter of satisfaction to all that there were no differences of opinion on any subject, and there was a very ready and complete accord on all proposals to exchange privileges between organizations. The spirit of full cooperation between all parts of the Commonwealth was very apparent and very inspiring.

The conference opened with a luncheon at Claridges on Monday, September 16th, at which Mr. O. V. Bulleid, president of the Institution of Mechanical Engineers, presided. A business session in the council room of the Institution of Civil Engineers followed the luncheon where under the chairmanship of Sir Peirson Frank, president of the Institution of Civil Engineers, consideration was given to the possibility of establishing procedures for the joint publication and discussion of technical papers; and to a comparison of practices with regard to abstracting services, library classification systems and public relations. The agenda provided also an opportunity to discuss the exchange of membership privileges and other courtesies to members of any one organization visiting in the country of another, with the object of agreeing on a reasonably uniform procedure.

Consideration was given to broadening throughout all the organizations the presently partially established principle of providing the publications of one society to the

Front row, left to right: T. E. Upton, O. V. Bulleid, Sir T. Peirson Frank, Dr. P. Dunsheath, J. B. Hayes. Second row: Sir Wm. T. Halcrow, Prof. W. G. Sutton, W. R. Hebblewhite, Rai Bahadur P.R. Agarwal, Dr. H. L. Guy, D. B. Mansergh, V. Z. deFerranti, Dr. H. J. Gough, W. K. Brasher, C. W. Hamann. Last row: Graham Clark, Dr. L. Austin Wright, A. J. Adams, John Chambers.

members of another at a privilege rate, and to the activities of the three senior organizations in the various parts of the Commonwealth in relationship to the activities of the societies already established there and represented at the conference.

The second day provided an all day programme of events outside the council room. It began with a visit to the great Battersea Power Station, and included an inspection of the extensive buildings of the London County Council where in the engineers office the plans of the new Waterloo Bridge were examined. Immediately after, the bridge itself was visited.

A rare privilege was afforded at noon when the delegates were the guests of the Worshipful Company of Goldsmiths for luncheon in Goldsmiths' Hall. A much appreciated feature was an exhibition of some of the Company's oldest plate compared with examples of the designs of modern artists and artisans. Mr. G. R. Hughes, clerk to the company, received the guests on behalf of the Master and Wardens.

In the afternoon a tour was made of the devastated areas of the City of London. The delegates were fortunate to have as their guide Mr. F. J. Forty, City Engineer, whose intimate knowledge of the old city before the blitz and his affection for it provided a stirring story of stirring events. It is not likely that any person in London was better suited to this assignment. His thrilling short talk about the Guildhall, while the group stood in the badly damaged Great Hall, the only remaining part of that famous institution whose history goes back 2000 years, will remain forever in the minds of the listeners.

The afternoon was concluded with a reception to the delegates at the Institution of Civil Engineers, where an opportunity was afforded of meeting the officers of the three senior institutions and other distinguished representatives of British engineering and science, including Sir Alexander Gibb, Sir Robert Watson-Watt, Air Commodore Frank Whittle, Sir Ben Lockspeiser.

Wednesday's sessions were held at the headquarters of the Institution of Mechanical Engineers. It is interesting to note that the original plan to meet in the council room had to be abandoned because of the noise of pneumatic drills and chippers across the way which were removing the heavy brick window enclosures that had protected the room where the British Cabinet had met after their premises had been bombed at Westminster. Under these circumstances, a room on the other side of the Institution building made a better meeting place.

The session was presided over by Mr. O. V. Bulleid, president of the Institution of Mechanical Engineers, and Chief Mechanical Engineer, Southern Railway. The entire session was devoted to a discussion of standards of education and training as a basis for membership in the societies, to see if there were some possibility of agreeing on requirements that would be uniform for all organizations. Luncheon was provided at the Cafe Royal by the president and council of the Institution of Mechanical Engineers.

All day Thursday was spent at the National Physical Laboratory at Teddington where, under the leadership of Sir Charles Darwin, director, many interesting departments were visited and much was learned about the vast amount and variety of war work done in this institution.

Luncheon was held in the nearby Mitre Hotel at Hampden Court, during which Sir Charles Darwin made an informal but informative short address, after which the party returned to the National Physical Laboratory.

Friday's sessions were held in the council room of the Institution of Electrical Engineers at Savoy Place immediately adjacent to the new Waterloo Bridge. The chairman was Dr. Percy Dunsheath, president of the Institution, and W. K. Brasher acted as secretary, both of whom are well known to Institute members who met them at the 1946 annual meeting in Montreal. The luncheon was given by the president and council of the Institution of Electrical Engineers at the Savoy Hotel.

The agenda dealt with the requirements other than educational for admission and transfer in the various organizations, and compared the different membership classifications, to see if any changes could be agreed upon that would promote closer uniformity in such classifications.

The agenda provided also for a discussion of the desirability and practicability of evolving some form of joint membership between organizations. The discussion disclosed many constitutional difficulties in the way of this objective, but further study is to be given to it.

At five o'clock, J. B. Hayes, the president of the Institute received the delegates and overseas members of the Institute at the Dorchester Hotel, as noted elsewhere in this *Journal*.

There were no fixed engagements over the week-end but the conference was resumed on Monday, Sept. 23rd in the council room of the Institution of Civil Engineers with Sir Peirson Frank in the chair.

The agenda dealt generally with the status of the engineer in the public esteem, and in detail provided a multitude of interesting divisions of the subject. It brought to light great differences in the situation in Canada as compared to other parts of the Commonwealth. In no other country is the responsibility for protection of the public divorced from the work of the professional society as it is in Canada. Membership in the technical society is the qualification looked upon by the public as a guarantee of competence. All organizations were greatly interested in the advances made in Canada, and it was shown that somewhat similar steps have been taken in New Zealand and considered in Australia, India and Africa.

Considerable time was taken to discuss the relationship of the senior societies to specialized societies that catered solely to a single phase of the larger field of engineering, with the object of discovering additional means by which the groups could further develop cooperation. As a subdivision of this subject there was a discussion on the relationship between the professional society and subprofessional groups that operate in the same field.

Employment services were also dealt with at length, as were also the possibilities of developing a service to give information on emigration conditions, and arrangements for interchange of teaching staff and apprentices.

Another item of interest to the Canadians dealt with the move to establish in some parts of the Commonwealth associations or guilds of engineers having protectionist motives as the basis of their policy.

Tuesday's programme gave the delegates some of the highlights of the whole conference. First, a tour was made of the London docks and the Royal Dock Group under the guidance of Mr. Shepherd-Barron, chief engineer of the Port of London Authority. These areas constitute a city in themselves with their miles of dock frontage and acres of warehouses and dock space. No one who has not seen the docks can have any conception of their extent and their facilities. They are mute testimony to the leading position that London occupies in world trade. It was surprising to learn of the relatively small amount of damage suffered from bombs and fire during the war in spite of the special attention paid to the area by the Huns.

The party was embarked in an Admiralty launch and after an exceedingly interesting trip on the River Thames, was greeted at Greenwich by Engr. Vice-Admiral Sir John Kingcombe, Engineer in Chief of the Fleet. As his guests they had luncheon in the famous Painted Hall of the Royal Navy College, a rare and much appreciated privilege. The Hall was only slightly damaged by bombs, mostly restricted to the destruction of several of the large windows. The paintings which completely cover the walls and ceilings of this Hall are remarkable, and in conjunction with the splendid architectural design and the severe furnishings produce a most unusual and striking effect. The paintings took nineteen years to complete.

In the afternoon a visit was made to the Royal Observatory during which many of the earliest pieces of astronomical apparatus were inspected. Later the group visited the National Maritime Museum which contains many of the most important and interesting objects in England. In the library are many very old and rare volumes, and the delegates were permitted to see and handle some of the most interesting, such as an original Ptolomey Geographia dated 1462, a volume of Pepys, Capt. Cook's Narrative of his Second Voyage, and a Volume of Lady Hamilton's letters. In the museum one of the most interesting exhibits was that of timekeepers, and included Harrison's model which was the first really successful timekeeper in the world. With it he won the £20,000 prize in 1713, after a trip in a sailing ship to Jamaica during which it was out only five seconds. That evening the delegates were received at the Savoy Hotel by Nowab Zain Tar Jung, president of the Institution of Engineers (India).

On Wednesday the 25th the conference continued in the council room of the Institution of Electrical Engineers with Dr. Percy Dunsheath in the chair, and was devoted principally to a consideration of the part played and to be played by the institutions in the encouragement of and provision of facilities for research. In several parts of the Commonwealth, but principally in England the societies have funds for research work. The object of the meeting was to see if a measure of cooperation could be developed between organizations to expand and to amplify this work.

In the afternoon the party was taken to the General Post Office Research Establishment at Dollis Hill where they were met by the Controller Dr. W. G. Radley. Many interesting departments were visited and particular interest was shown in television developments.

At six o'clock all delegates attended the British Commonwealth and Empire Lecture of the Royal Aeronautical Society held in the auditorium of the Institution of Civil Engineers, at which Sir Henry Self was the speaker, after which they adjourned to the headquarters of the Society in Hamilton Place where they were dinner guests of the council of the Society. The president, Sir F. Handley-Page, presided. The company included many persons whose names are closely associated with the advance of aeronautics and industry in England, such as Lord Teddar, Marshal of the R.A.F., Lord Winster, Minister of Civil Aviation, Lord Knollys (B.A.O.C). Lord Amherst (B.E.A.C.), Air Vice-Marshal D. C. T. Bennett (B.S.A.A.), Sir John S. Buchanan, Sir Alan Cobham, Air Marshal Sir Ralph Cochrane, O.C. Transport Command, Sir Roy Fedden.

Thursday was set aside as a day of divertissement. In the morning the party was driven to the country club of the Royal Automobile Club at Epsom where they were welcomed by Col. C. W. Myddleton, vice-president of the Club. Late in the afternoon the party returned to the Institution of Civil Engineers to hear the Parson Memorial Lecture delivered by Sir Hugh Chance on "Recent Developments in Optical Glass Manufacture." After the lecture the delegates dined with the council of the Institution under the chairmanship of Sir William Halcrow, president-elect. During the function they were privileged to meet representatives of the Royal Society (Sir Rob. Robinson, President) the Physical Society (Prof. D. Brunt, President), the North East Coast Institution of Engineers and Shipbuilders, the Institution of Marine Engineers, and the Institution of Naval Architects.

Friday the 27th was the last day of the formal programme. The session was carried on in the council room of the Institution of Mechanical Engineers with Mr. O. V. Bulleid in the chair. The time was devoted principally to the preparation of resolutions which summarized the work and conclusions of the conference, and to a discussion of details related to publicity and future policy. Several items of new business were also introduced and discussed as fully as time permitted. Arrangements were made for additional conferences in special subjects for the following week. An invitation was submitted by Prof. Sutton (South Africa) on behalf of the three societies he represented to hold a similar conference in South Africa.

That evening the conference was formally concluded by a banquet given at Grosvenor House by the councils of the three host institutions.

Lord Dudley Gordon (vice-president Institution of Mechanical Engineers) proposed the toast to "Engineering and the Commonwealth", which was replied to by Professor W. G. Sutton of South Africa and J. B. Hayes of Canada.

LONDON MEETING

An event unique in Institute history took place in London, England, on Friday, September 20th. Taking advantage of the presence of the president and general secretary a meeting was held for all members resident in that country.

The meeting was held at the Dorchester Hotel and took the form of a reception. As a feature the president presented to Prof. Fred Webster the certificate of Honorary Membership which was awarded him by Council on December 19th, 1942. In acknowledgment Professor Webster spoke of the pleasure it had given him to be in Canada during the war, and by his lectures on the effects of bombing on structures, to make contribution to Canada's war effort.

Members and non-members in many parts of Canada

Prof. Fred Webster, Hon.M.E.I.C., Sir Peirson Frank, Mr. A. J. Adams, Prof. W. G. Sutton, Mr. C. W. Hamann.

Prof. Fred Webster receives from President J. B. Hayes his certificate of Honorary Membership in the Institute.

will well remember the series of lectures given by Prof. Webster in Hart House at the University of Toronto under the auspices of the Institute and the several lectures delivered to branches. It was a rare privilege to have instruction on this then important topic from the Allies outstanding expert.

Many suggestions were made by members as to future activities of the Old Country group. It was felt that as one-time residents of Canada it would be pleasant and advantageous to meet once or twice throughout the year,

Col. G. M. Carrie, Col. L. Eon and Mrs. Eon, Col. van Steenburgh, Dr. H. L. Guy.

and it was agreed that further consideration would be given to the proposals.

Special guests of the Institute were the officers of the British Institutions, and the delegates to the Commonwealth conference. The complete list of those present follows:

Frank, Sir Thomas Peirson, President; Halcrow, Sir Wm. T., President-elect; Clark E. Graham Secretary; Institution of Civil Engineers.

Dunsheath, Dr. Percy, President; de Ferranti, V. Z., President-elect; Brasher, W. K., Secretary; The Institution of Electrical Engineers.

Bulleid, Oliver Vaughan, President; Railing, Sir Harry, President-elect; Guy H. L., Secretary; Institution of Mechanical Engineers.

Col. Wm. Van Steenburgh, and the delegates to the Commonwealth Conference.

Members: Abbott, C. A., Gravesend; Collier, Col. E. V., London; Carrie, Col. G. M., London; Eon Col. L. Guy, London; Gibb, Sir Alexander, London; Hollyhock, W. S., Surrey; Houghton, J. W., Finchley; Hubble, C. W., Surrey; Hughes, G. F. G., Glasgow; Johnson, Howard, Aberdeen; Fergusson, H. B., London; Kennedy, Duncan, Kent; Lester, J. F., Wolverhampton; Pinto, E. A., London; Rhodes, Brig.-Gen. Sir Godfrey, Sussex; Simpson, P. London; Thomas, C. O., Bedford; Webster, Prof. Fred., London; Verschoyle P. D., Glamorgan, South Wales.

BRITISH COMMONWEALTH STANDARDS CONFERENCE

The British Commonwealth Standards Conference, which has been sitting in London for the past fortnight, was attended by representatives from the national standards organizations of Australia, Canada, Eire, India, New Zealand, Palestine, South Africa and the United Kingdom.

The Conference agreed on methods to be employed for continuous co-operation between the Commonwealth countries with a view to the development of unified standards for materials, articles, appliances, etc.

It has also been decided to co-ordinate scientific, technical, trade and commodity terms and definitions in association with any country using the English language and prepared to participate.

The Conference has made some very important recommendations in connection with the use and control of marks to indicate conformity to a national standard.

Opportunity was taken to discuss in detail a number of technical subjects including Commonwealth dairying standards for methods of testing dairy products, plant and machinery, and the materials used in the processes employed.

CO-OPERATION WITHIN THE COMMONWEALTH

Elsewhere in this number of the *Journal* appears a factual account of a conference held in London during the month of September. There are some points that might be of interest to the members beyond the mere statement of facts. For instance, this is the first time that representatives of engineering organizations within the British Commonwealth of Nations have met together to discuss common problems and to seek out new collective means and methods for improving their usefulness to their members and to the profession.

The conference was prompted at least partially by events which took place during the war. The impromptu methods adopted to exchange membership privileges brought about such a wide use of these privileges that it seemed apparent that some organized arrangement should be discussed in order to make available even greater benefits. The close cooperation between individual engineers in various parts of the Empire indicated that some organized means to continue these contacts would be helpful to the individual, to his professional associates and to the common cause. These matters, and others made up the agenda for two weeks of meetings in London, England.

It was interesting and significant to note that there were absolutely no fundamental differences of opinion on any subject. Occasionally, established customs, which were working satisfactorily in one country, and which were beyond the control of engineering groups, made it impossible to agree to changes which were proposed in order to bring about uniformity of practice, but such instances were few and were not of great importance. It was surprising to find out how closely the problems of the profession in one country were duplicated in another.

The outstanding feature of the conference was the unanimous and eager desire to cooperate. It was encouraging to discover this immediately the conference met. It was not felt that at the moment any formal organization need be established to produce these results, but that through the secretariat of the institutions in London adequate contact could be maintained until all objectives were attained or further meetings became desirable.

The initiative of the three "host" institutions in arranging the conference and their generosity in the handling of it was greatly appreciated. Their skill in the arranging and carrying out of the programme made the conference an outstanding success and a tribute to their organizing ability.

There is no doubt but that the business concluded, and the contacts established between organizations and between individuals, will result in permanent improvements of great importance, and will establish channels through which further negotiations may be carried out successfully as occasion offers. This conference will go down in history as a first post war step towards full cooperation between engineering organizations.

Coming from various parts of the United States and Canada, a group of men who have achieved eminence in the engineering profession assembled in New York, October 18 and 19, for the annual meeting of the Engineers' Council for Professional Development. The Institute, as one of E.C.P.D.'s eight constituent bodies, had ten representatives out of a total of about fifty attending the business sessions. Dean C. R. Young and Dr. de Gaspé Beaubien, two of the three Institute representatives on the Council were present as well as the following representatives on E.C.P.D.'s committees: Student Selection and Guidance, L. F. Grant of Kingston, Ont.; Committee on Professional Training, R. deL. French of Montreal; Junior Committee on Professional Training, J. W. Brooks of Kapuskasing, Ont.; Committee on Professional Recognition, J. A. Vance of Woodstock, Ont., and his successor E. V. Buchanan of London, Ont.; Committee on Employment Conditions, R. E. Heartz of Montreal; Committee on Information, the assistant general secretary substituting for Dr. Wright. In addition, R. C. Flitton of Montreal, a councillor of the Institute, was present.

The committee reports on the year's activities were discussed at length and the work was planned for the coming year.

Professional Recognition

Dean N. W. Dougherty of the University of Tennessee, reporting for the Committee on Professional Recognition, suggested means of bringing the work of engineers before the public, and made a plea " to all engineers for greater participation in civil and political fields." He stated that in addition to activity in community gatherings, the power of the press must not be overlooked. " Excellent books have been written during the last few years on the work of the engineer. Unfortunately, the book-reading public is relatively small in number as compared with those who buy magazines. This field has been neglected by us in late years." To encourage the preparation of articles with popular appeal for such magazines as the *Saturday Evening Post* and *Readers' Digest*, Dean Dougherty suggested " an annual competition sponsored by E.C.P.D., for the ten best papers popularizing the specific work of the author, of a type acceptable to the editors of the national magazines with large circulations."

" Another medium of popularizing is of course the screen ", he continued. "Too often the lay public thinks only of the professional engineer as the builder of bridges and skyscrapers. Could we not write specifications for a series of ten-minute films illustrating phases of the making of everyday necessities, each concluding ' March of Time '-wise with ' The luxuries of yesterday have become the necessities of today and are provided by that service-rendering group, the engineers '? "

Recommendations of this committee were:

" More rapid action toward developing a uniform code of ethics;

" Uniform membership requirements and uniform nomenclature for grades of membership in the technical engineering societies;

" Producing a permanent and popular record of engineering achievements during the war;

" That technical societies through their publications emphasize the professional phases of engineering and

" That constituent bodies should use their influence to prevent further multiplication of engineering specialties."

Student Selection and Guidance

Reporting for the Committee on Student Selection and Guidance, Carl J. Eckhardt, Jr., University of Texas, Austin, pointed out the widespread use of a screening test for pre-engineering students. Called the " Pre-engineering Inventory ", its purpose is to " select engineering students with the expectation which accompanies the selection of materials with which engineers deal." During the 1945-1946 academic year, thirty-two institutions used the inventory for 12,300 students.

A second screening is proposed with the preparation of " Sophomore Achievement Examinations." These will " serve to reassure those students who should continue their engineering studies." Their usefulness to the colleges in sampling the needs of their students is evident. Proposed, but not yet prepared, are " Senior Examinations " to provide information for graduating students, their educators and prospective employers. Money for these tests has been made available by the Carnegie Corporation of New York and by the Carnegie Foundation for the Advancement of Teaching, the American Society for Engineering Education, and E.C.P.D.

Over 70,000 copies of the booklet " Engineering as a Career " have been distributed through colleges, high schools, professional societies, book stores and commercial agencies. In Canada, over 25,000 copies of the booklet " The Profession of Engineering in Canada ", prepared by the Engineering Institute, have been distributed and a third printing is now in process.

Accrediting Engineering Curricula

At an early date, re-examination of the curricula of all those engineering schools which had already had curricula accredited, was recommended by the Committee on Engineering Schools. A questionnaire was sent to all such institutions to determine their readiness for re-examination. Most institutions have replied that, because of difficulties encountered in returning to " normal " after the unusual experience of the war years, they would prefer that such inspection be postponed until 1947-1948.

The accrediting of technical institutes is well under way by a committee headed by Dean H. P. Hammond of The Pennsylvania State College.

The committee also recommended that a program of accrediting graduate curricula should be inaugurated.

D. B. Prentice, president of Rose Polytechnic Institute, chairman of the committee, reported that out of 167 degree-granting institutions in the United States, 133 now have one or more curricula accredited by E.C.P.D., with a total of 580 curricula accredited in major and specialized fields.

Professional Training Aids Provided

To assist the engineer in his professional development after graduation, the Committee on Professional Training has prepared and circulated a number of aids. In his report, Dr. C. A. Pohl, New York consulting engineer, listed the following: reading lists and bibliographies, personal appraisal blanks, lists of college extension programs, lists of appropriate articles, and reprints of certain pertinent articles. Dr. Pohl's committee urged closer co-operation between practicing engineers and younger members of the profession, to the end that encouragement and direction be given to the professional development of those entering the engineering profession.

Remuneration of Engineers

The Committee on Employment Conditions for Engineers reported that during the year its chairman, V. T. Boughton, associate editor, *Engineering News-Record*, had studied the activities of the Engineers' Joint Council, Committee on the Economic Status of the Engineer, which is actively surveying the compensation of the whole engineering profession. In view of the progress being made by EJC and the doubtful value of duplicating the effort, Mr. Boughton's committee recommended that this group be discharged and that E.C.P.D. request permission to continue to have an observer sit in at meetings of the EJC committee.

Code of Ethics

The Committee on Principles of Engineering Ethics, under the chairmanship of D. C. Jackson, professor emeritus of electrical engineering at Massachusetts Institute of Technology, reported the development of a universal "Canon of Ethics" for all engineers. The code has been prepared after extensive study of the respective codes of the participating societies and the draft has been approved by a number of constituent organizations. The final code is expected to be issued soon.

Engineering Societies Directory

The preparation of a list of all engineering societies in the United States and Canada was an accomplishment reported by the Committee on Information. Sydney Wilmot, chairman of the committee, reported that 237 organizations had been listed with classification according to "grade of membership subject to admission requirements." This committee also reported the pending publication of the Fifteenth Anniversary Booklet of E.C.P.D.

Fifteenth Anniversary Booklet

This booklet has been prepared for dual purposes—information on the activities of E.C.P.D. and the stimulation of contributions to a professional development research fund to be administered by the Ways and Means Committee. This program will be under the direction of a special subcommittee headed by R. L. Goetzenberger, vice president of Minneapolis-Honeywell Regulator Company. This subcommittee reported that "fund-raising is our primary objective . . . to defray the expense of" a professional development fund supervised by Engineers' Council for Professional Development. To give meaning to the fund-raising campaign, the committee called for "a listing of projects which require investigations within its scope to perform, and for the accomplishment of which funds are necessary."

The annual dinner was held Friday night at the Pennsylvania Hotel with an attendance of about eighty. The main feature was a presentation on the screen of the proposed layout of the material for the booklet referred to above.

E.I.C. Reports

At the business session on Saturday morning, representatives from the eight constituent bodies reported on the activities of their respective groups in furthering the aims of E.C.P.D. during the previous year.

Dean C. R. Young reported as follows on behalf of the Engineering Institute:

"In an effort to advance the common objectives of ECPD and The Engineering Institute of Canada, the latter arranged a unique gathering on the occasion of its annual meeting in Montreal last February. The Institute invited to a three-day conference the president of the undergraduate engineering society from each of the eleven universities or colleges in Canada granting degrees in applied science or engineering. It bore the entire cost of bringing these delegates to Montreal. Six separate sessions were held during which valuable discussions and interchanges of views took place. Nine resolutions on matters affecting engineering students and new graduates were adopted. These were later submitted to a conference of deans and teachers of engineering which was also held during the annual meeting.

"Most important of the purposes of this student conference was the desire of the Institute to discuss with student representatives themselves the means by which the graduate engineer can help the undergraduate. It was thought that by bringing the students together on the important occasion of the annual meeting of the Institute, which was attended by large numbers of senior engineers, valuable specific information might be obtained and many useful contacts afforded the juniors. Discussions were left entirely to the students, the Institute officers serving merely as guides and consultants. This method produced excellent results and promoted free and open debate of all subjects. No delegate had any reason to feel himself under restraint.

"Exchange of views by engineering educationists on matters of vital concern to the myriads now thronging the engineering schools was furthered by the action of the Institute in arranging for a conference of deans and teachers of engineering on the occasion of the annual meeting at Montreal. It had been suggested that the professional engineering organizations might have some proposals of value to those whose full time duty it is to serve young men in the educational institutions. Material contained in the nine resolutions adopted by the students' conference was placed before the conference of deans, with results that were thought-provoking and stimulating.

"Growing out of the preliminary gathering of deans at Montreal came a more representative conference of engineering educationists on the occasion of the annual meeting of the National Conference of Canadian Universities at Toronto in June. As a result, a Committee on Applied Science and Engineering Education was set up within the Conference to concern itself with educational problems in Canada as does the American Society for Engineering Education in a larger field.

"During the year, the EIC Committee on the Training and Welfare of the Young Engineer has directed its efforts to the guidance of high school students interested in entering the engineering profession and to advice and assistance to young men who have graduated or have but lately become employed as engineers. The secondary school aspect of the work has been carried out jointly with the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada. Counsellors have been appointed at many important centers in Canada for the purpose of visiting schools and addressing students whenever called upon by the principal of the school or the provincial Department of Education. These counsellors are drawn from various branches of the engineering profession and are in a position to give comprehensive and dependable information to enquiring students.

"Assistance to the younger members of the profession is afforded through the agency of the 27 branches of the Institute throughout Canada. Each branch is asked to take steps to welcome the young engineer and his family, if he is married, when he first arrives in a new environment and has also been asked to assure him of opportunities for discussion and advice from older engineers concerning his own professional life. Each branch is asked to appoint a young engineer to correspond with the chairman of the Committee on the Training and Welfare of the Young Engineer concerning the problems and wishes of himself and his contemporaries.

"In support of the work of this committee, so ably guided by the late Harry F. Bennett, there has now been established what is known as 'The Harry F. Bennett Educational Fund of The Engineering Institute of Canada.' Its objectives are to promote and advance the study of engineering sciences, more particularly the establishment of scholarships and fellowships to deserving persons; to encourage the establishment of departments in schools and colleges for the study of engineering and science; to make loans to deserving students under regulations primarily for the purposes of enabling them to pursue advanced study in engineering sciences, and generally do any matter which will advance and assist in the growth and development of such engineering sciences. This represents a practical form of assistance that will do much to convince young men entering the profession of the sincere desire of the older men to help them.

"The EIC continues in its efforts to further the adoption of a uniform code of professional ethics. A new Committee on Professional Ethics has been appointed to review the situation from the viewpoint of the EIC, and it is hoped that proposals will be advanced that will make the work of the ECPD committee so much the easier.

"During the year the Institute has continued to press for a more favorable attitude of the Civil Service Commission to the engineer in the matter of salary. A strong committee presented a brief to the Royal Commission on Administrative Classification in the Public Service advocating extensive revision of the existing system. While the response was not satisfactory, at least it may be said that the Institute has been pressing the matter in the true spirit of the ECPD charter.

"Work of very great value to engineers emerging from the armed forces has been carried out by the Committee on Rehabilitation of the Institute. Incidental to its activities was the preparation of a booklet entitled 'The Engineer's Return to Civil Life' which was remarkably well done. Communication was established with members of the Institute while still in the forces, employment information was supplied to them, and a careful scrutiny was given to all government rehabilitation measures that might affect the engineer. High commendation of the Institute's activity in this regard has been publicly voiced, notably in a CBC radio broadcast on December 4, 1945."

New Officers

The following officers and committee chairmen were elected for 1946-1947:

Chairman: James W. Parker, president, Detroit Edison Company.

Vice-Chairman: T. T. Read, professor of mining, Columbia University.

Secretary: H. H. Henline, national secretary, American Institute of Electrical Engineers.

Assistant Secretary: A. B. Parsons, secretary, American Institute of Mining and Metallurgical Engineers.

Chairman, Committee on Student Selection and Guidance: Carl J. Eckhardt, Superintendent of utilities, University of Texas.

Chairman, Committee on Engineering Schools: D. B. Prentice, president, Rose Polytechnic Institute.

Chairman, Committee on Professional Training: Chas. A. Pohl, consulting engineer, New York.

Chairman, Committee on Professional Recognition: N. W. Dougherty, dean of engineering, University of Tennessee.

Chairman, Committee on Information: G. Ross Henninger, editor, American Institute of Electrical Engineers.

CORRESPONDENCE

Who Is It?

215 Melrose Avenue
Ottawa, Ont.
September 25, 1946

The Editor
The Engineering Journal
Montreal, P.Q.

Dear Sir:

The attached print is taken from an original autographed photograph which was acquired by the writer in England during the recent war. Although the signature will give a clue, it is not sufficiently clear to tell the full story and I wonder how many of your readers will recognise this outstanding member of our profession.

You will observe that he is dressed "for the job" and, except for the hat, is as suitably turned out as many a present day construction man, complete with "seegar".

I should assume that the background is composed of anchor chains from "The Great Eastern". I was informed that the picture was taken in the late fifties.

Yours sincerely,

V. S. Thompson, M.E.I.C.

(*See Answer Page 701*)

MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters, on Saturday, October 26th, 1946, convening at nine-thirty a.m.

Present: Vice-President J. E. Armstrong (Montreal) in the chair; Vice-Presidents G. F. Layne (Quebec) and W. R. Manock (Fort Erie); Councillors P. E. Buss (Thorold), A. Cunningham (Kenogami), G. J. Currie (Halifax), R. S. Eadie (Montreal), R. C. Flitton (Montreal), A. R. Jones (Peterborough), E. Lavigne (Quebec), C. A. Peachey (Montreal), P. E. Poitras (Montreal), J. B. Stirling (Montreal); Treasurer J. A. Lalonde (Montreal); R. E. Heartz, chairman of the Committee on Employment Conditions, and Assistant General Secretary Louis Trudel.

Death of Past-President G. H. Duggan: Council noted with sincere regret the accidental death of Past-President G. H. Duggan, which had occurred on October 8th, 1946. The following resolution was passed unanimously:

"The President and Council of The Engineering Institute of Canada desire to record their deep regret on learning of the death of Past-President George Herrick Duggan.

During his long and active membership he rendered many valuable services to the Institute; his interest in the Institute's work was untiring, his benefactions were notable and his wise counsel was constantly available. He was the recipient of many well-deserved honours.

The passing of a man of such outstanding achievements leaves a vacancy which will indeed be hard to fill. His loss will be specially felt by those of his friends and associates who are charged with the direction of the affairs of the Institute. The President and Council beg to express their most sincere condolence with the members of Mr. Duggan's family on the occasion of this sad bereavement."

Death of Dean R. L. Sackett: Mr. Trudel announced the death, on October 6th, 1946, of Dr. R. L. Sackett, of New York, who had been dean of engineering at Pennsylvania State College for over twenty years, having retired in 1937. In the last ten years he had been connected with the American Society of Mechanical Engineers and with the Engineers' Council for Professional Development, and in his work with these societies had been closely associated with officers and members of the Institute. Dean Sackett was particularly interested in the welfare of the young engineer, and has been of great assistance to the Institute's committee. A letter expressing the sympathy of the Institute had been sent to Dean Sackett's family. Council recorded its sincere regret in the passing of this good friend of the Institute.

Councillor Currie presented President Hayes' greetings and his regrets that he was unable to be in Montreal for this meeting. Within the last two weeks he had returned from his trip to London, England, and had to attend to many duties. The president had asked Mr. Currie to inform the members in this area that he was eagerly looking forward to his official visit to the various branches in November.

Community Planning: Mr. Trudel reminded Council that at the September meeting authorization had been given for the Institute to participate in the newly established Community Planning Association of Canada and Messrs. R. L. Dobbin, N. B. MacRostie and L. Austin Wright had been appointed as the Institute's representatives on the provisional board. A meeting of the provisional board had been held in Ottawa last week, at which Mr. MacRostie had been present. Although no official report had been received, it had been noticed in the newspapers that provisional officers had been elected as follows: Acting-president, R. E. G. Davis, of Ottawa; Vice-President, John M. Kitchen; Executive Councillor, Norman B. MacRostie; Secretary-Treasurer, Alan H. Armstrong. A report from the Association and from the Institute's representatives will no doubt be received in due course. In the meantime this progress report was accepted.

Engineers' Council for Professional Development: Immediately following the last meeting of Council a request had been received from the Engineers' Council for a nominee to replace Dean C. R. Young as the Institute's representative on the Committee on Professional Training. Following consultation with Dean Young, the General Secretary had been in touch with Professor R. DeL. French, at McGill University, who had tentatively accepted the appointment, subject to confirmation by Council. Professor French had attended the recent annual meeting of E.C.P.D. in New York. It was unanimously agreed that this appointment be confirmed.

Budget—Tariff item 180e: The assistant secretary reviewed the developments that had taken place since the Digby meeting when Council's attention had been called to the fact that the duty had been removed from engineers' plans entering Canada. He had been in touch with Dr. Surveyer who had undertaken to discuss with Mr. R. D. Harkness, M.E.I.C., vice-president of the Canadian Chamber of Commerce, whether it would be appropriate for that body to join with the Institute in making representations to the government. Mr. Harkness had been away at the annual meeting of the Chamber and it had not been possible for Dr. Surveyer to contact him. In the meantime Dr. Surveyer had written the Minister of Finance in his own name and had protested the action taken by the government.

Additional representations had been made to the Institute by members since the last Council meeting, and instances cited where the removal of duty might work to the disadvantage of Canadian engineers. One case in point was the $8,000,000.00 plant which Lever Brothers were planning to erect in Toronto and for which they had retained the services of a firm of engineers from Boston.

A communication had been received from the Canadian Construction Association inviting the Institute to express an opinion on a draft resolution that had been prepared by the Association for submission to the government.

Mr. Stirling, as a member of the management committee of the C.C.A., pointed out that the Association was much concerned over this development and was prepared to join with other groups in making emphatic representations for the repeal of the legislation. The Association felt, however, that the action should be initiated by the engineering organizations and it would like to see them take a strong stand in this respect.

A long discussion followed which was entered into by Messrs. Lalonde, Peachey, Flitton, Jones, Eadie and Poitras. It was pointed out that the Minister had promised in the House that the legislation would be reviewed in six months if it proved detrimental to Canadian engineers. It was therefore important that strong evidence be accumulated in the course of the next month or so and that other interested groups be invited to join with the Institute in protesting the government's action. The opinion was expressed that it might be advisable to ask these other groups to send resolutions of their own along the lines of the Institute's resolution but couched in different words.

On the motion of Mr. Poitras, seconded by Mr. Lalonde, it was accordingly resolved that the Committee on Professional interests of the Institute be empowered to set up a sub-committee for the purpose of thoroughly investigating the situation and drafting an appropriate resolution to be approved by Council at its November meeting and subsequently sent to the government, the resolution to be sent to all branches of the Institute, to the provincial associations of professional engineers and other interested groups for their consideration and support.

Canadian Scientific Film Association: At the September meeting of Council, authorization had been given for the Institute to become a charter member of the Canadian Scientific Film Association. In accordance with Council's directions, Mr. Trudel had attended the inaugural meeting in Ottawa on September 18th, at which the draft constitution had been discussed and finally approved. The Institute has direct representation on the Council of the Association. The first meeting of the new Council had been held in Ottawa recently but Mr. Trudel had been unable to attend.

In response to Mr. Layne's inquiry, Mr. Trudel stated that the Association proposed to prepare catalogues with appraisals of films available, and planned eventually to offer a service to groups such as the Institute for the routing and scheduling of films throughout the branches.

Shore Erosion on the Great Lakes: At the last meeting of the Council the question of shore erosion on the Great Lakes had been discussed, with the suggestion that it might be possible for the Institute to undertake a scientific study of the problem. By direction of Council the matter had been referred to the Toronto branch executive with the recommendation that they examine the situation in relationship to the Toronto area and make recommendations to Council as to action which might be taken by the Institute to bring this problem to the attention of the proper authorities. The following reply had been received from the Toronto Branch secretary:

> "After considerable discussion, I was directed to report that while the Toronto branch executive regards the problem sympathetically, we feel that the time and attention required for such a review, on top of the

full daily programme of the members, and in addition to the preparations for the Diamond Jubilee National Meeting, could not be properly spared, and would request that the matter be referred to the Hamilton and Niagara Peninsula branches, whose areas are at least as directly affected."

Mr. Armstrong suggested that perhaps this was not so much a Toronto problem as an Ontario district problem as most of the Ontario branches were in affected areas. Considerable discussion followed, during which Mr. Buss and Mr. Armstrong described conditions in certain localities. Finally, on the motion of Mr. Jones, seconded by Mr. Buss, it was unanimously resolved that the project of investigating shore erosion on the Great Lakes be referred to the Ontario branches with the suggestion that the subject be discussed at branch meetings to develop interest and consciousness, preliminary to possible later action by the Ontario provincial division, if established.

Diamond Jubilee Meeting 1947: Mr. Trudel reported that Mr. E. A. Cross chairman of the Toronto Branch, had been appointed chairman of the Diamond Jubilee Committee. In accordance with a suggestion received from the committee, on the motion of Mr. Lalonde, seconded by Mr. Layne, it was unanimously resolved that an invitation be extended by Council to His Excellency the Governor General to be the Institute's guest at the banquet to be held at the Diamond Jubilee Meeting in Toronto in May 1947.

Honours for Dean Adrien Pouliot, M.E.I.C.: During the past summer, Dean Adrien Pouliot, of the Faculty of Applied Science at Laval University, Quebec, has been visiting various universities in France, and was invited to deliver a lecture at the Sorbonne on October 10th, under the auspices of the Association des Ingénieurs-Docteurs de France, which had taken this opportunity to confer upon Dean Pouliot its Medal of Honour. Mr. Trudel read a telegram of congratulations which had been sent on behalf of Council through the Canadian Ambassador, together with a reply which had been received. Council noted with appreciation the great honour which had been conferred upon Dean Pouliot as a distinguished Canadian engineer and educator.

Harry Bennett Memorial Fund: On behalf of Mr. Vance, chairman of the Committee on the Bennett Memorial Fund, Mr. R. E. Heartz, a member of the committee, presented a detailed report on the returns to date from the various branches. Seven of the branches had passed their objective, but some had not yet started their campaign. The figures indicated that the subscriptions were very good from those who had given but the percentage of those canvassed was relatively low. The committee hopes that the campaign will be cleared up by Christmas. A meeting of the committee was held recently and up to date information has been sent to the division chairmen who will all be contacted by telephone within the next week. The committee urges all councillors to do everything they can to further this campaign by contacting the members in the various branches. The committee is confident that it will reach its objective but it will take considerably longer than at first anticipated. This progress report was noted.

Committee on Employment Conditions: Mr. Heartz reported that his committee was still gathering information on the proposed economic survey of the engineering profession in Canada, similar to that already under way by the Engineers' Joint Council in the United States. He hoped to be able to present a complete report to the December meeting of Council.

Mr. Heartz reminded Council that one of the resolutions passed at the Students' Conference in February of this year had recommended that the Institute establish an employment bureau in each of its local branches whose purpose it would be to prepare lists of positions available for student engineers. This resolution had been referred by Council to the Committee on Employment Conditions which now recommends to Council that employment committees be set up at the various branches of the Institute to report to and to be under the direction of Headquarters.

The committee is of the opinion that in the case of the larger branches the need for such committees is relatively small as existing facilities already give excellent service to student and junior engineers. In the case of the smaller branches the situation is quite different, and with a close tie-in with Headquarters these branches can be of service to young men seeking employment.

On the motion of Mr. Eadie, seconded by Mr. Jones, it was unanimously resolved that this report be accepted.

The meeting adjourned for lunch at twelve thirty and reconvened at two thirty p.m. with Vice-President Armstrong in the chair.

Student Section at Laval University: A letter was presented from the secretary of the Quebec Branch advising that approval had been given by the branch to the establishment of a Student Section at Laval University. It was hoped that the section could be inaugurated during the forthcoming visit of President Hayes to the branch. Council was gratified to note this activity among the students in Quebec.

It was noted that the next meeting of Council would be held at the Hotel Cornwallis, Cornwall, Ontario, at ten o'clock a.m., on Saturday, November 23rd, 1946. The Council rose at four o'clock p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered and the following elections and transfers were effected:

Members

Best, Gordon Livingstone, Graduate, R.M.C.; W/C., R.A.F., Chief Engr. Officer, Aero. Engr., H.Q. No. 45 (Transport) Group, Dorval, Que.

Bishop, Joseph William, Colonel, R.C.E.M.E., Director of Mechanical Engrg., Dept. National Defence, Ottawa, Ont.

Brooking, Donald Charles, B.Sc. (Elect.), Manitoba, distribution engr., Canadian General Electric Co., Ltd., Winnipeg, Man.

Coombes, Robert Arthur, B.Sc. (Elect. Engrg.), New Brunswick, switchgear engr., English Electric Co., Ltd., St. Catharines, Ont.

Covey, Douglas Elliot, B.Sc. (Chem. Engrg.), Sask., asst. mech. engr., Wayagamack Divn., Consolidated Paper Corp., Ltd., Three Rivers, Que.

Davis, John Caswell, B.Sc. (Mech. Engrg.), McGill, president and mgr., J. C. Davis Limited, Winnipeg, Man.

Drummond, George D., B.Sc. (Mining), McGill, president, Drummond & Co., Ltd., Montreal, Que.

Grant, James Andrew, B.A.Sc. (Mining), Toronto, 342 Linsmore Crescent, Toronto, Ont.

Harrop, Alan Cameron, B.A.Sc., Toronto, genl. supt., Montreal East refinery, Imperial Oil Limited, Montreal, Que.

Lake, George William Charles, Graduate, R.M.C., 30 Brant St., Orillia, Ont.

Lyons, Manson Ainslie, S.B. (Civil Engr.), M.I.T., Deputy Minister of Public Works, St. James, Man.

MacMillan, Donald C., B.Sc. (Civil), Queen's, Major, Camp Engineer, Barriefield Military Camp, Ont.

Magill, Edward Stairs, B.Sc. (Civil), Manitoba, Asst. Professor, Civil Engrg., Univ. of Manitoba, Winnipeg, Man.

Mayberry, Frederic Coates, asst. mgr., dept. of works, Canadian National Exhibition, Toronto, Ont.

Nickerson, Harold Waite, B.Sc. (Civil), B.Sc. (Elect.), New Brunswick, plant engr., Canadian Cottons Limited, Cornwall, Ont.

Paquette, Norman Onesime, S.B. (Arch.), M.I.T., chief engr., Pacific Coast, Stevenson & Kellogg Ltd., Vancouver, B.C.

Ross, John William, B.A.Sc., Toronto, development engr., Dominion Oxygen Co., Toronto, Ont.

Stephanson, Barney Thorvardur, B.Sc. (Agric.), Sask., sessional instructor, Dept. of Agricultural Engrg., Univ. of Alberta, Edmonton, Alta.

Waldock, Donald Albert George, Major, B.Sc., London Univ., R.C.A., N.D.H.Q., Ottawa, Ont.

Yates, Bert T., B.Sc. (Civil), Queen's, president, H. Yates & Co. Ltd., Cornwall, Ont.

Juniors

Clarke, James Murdoch, B.Eng. (Mech.), McGill, Building Products Limited, Ville La Salle, Que.

Davies, Clifford Lorne, B.Sc. (Civil), Manitoba, tech. officer, reconstrn., Department of Public Works, Selkirk, Man.

Murphy, Bernard Ross, B.A.Sc. (Mech.), Toronto, design engr., H.E.P.C. of Ontario, Toronto, Ont.
Scrimes, Walter Robert, B.Sc. (Elect.), Manitoba, asst. engr., Winnipeg Electric Co., Winnipeg, Man.

Affiliate

Szwarc, Aleksander, Ph.D. (Chemistry), Univ. of Posnan, Poland, consultg. chemist, Howard Smith Paper Mills, Montreal, Que.

Transferred from the class of Junior to that of Member

Biesenthal, Clarence Gordon, B.Sc. (Mech.), Queen's, chief engr., Alex. Fleck Limited, Ottawa, Ont.
Kennedy, Dorwin Elmore, B.A.Sc. (Civil), Toronto, forest products engr., Forest Products Laboratories, Dept. of Mines & Resources, Ottawa, Ont.
Sadler, Robert F., B.Sc. (Civil), New Brunswick, asst. engr., mtce. of way, St. Lawrence Divn., Canadian National Railways, Montreal. Que.
Shaw, Frederick W. B., B.Eng., McGill, elect. engr., Canadian International Paper Co., Hawkesbury, Ont.
Wallis, W. Herbert C., B.Sc. (Civil), New Brunswick, project engr., Canadair, Cartierville, Que.

Transferred from the class of Student to that of Member

Estabrook, Howard Albert, B.Sc. (Met. Engrg.), supt., time study and efficiency dept., Aluminum Co. of Canada, Ltd., Arvida, Que.
Goodfellow, Hodgson, Major, R.C.E.M.E., B.Sc. (Mech.), Saskatchewan, District Elect. and Mechanical Engr., Military District No. 10, N.D.H.Q., Ottawa, Ont.
Thompson, George Wilbert, B.Sc. (Chem.), Queen's, Major, R.C.E.M.E., D.M.E., N.D.H.Q., Ottawa, Ont.

Admitted as Students

Baldwin, Willard Harold Cody, B.Sc. (Elect.), New Brunswick, engrg. asst., Bell Telephone Co. of Canada, Quebec, Que.
Campbell, Gunner Alvin Edgar, B.Sc. (Elect.), Alberta, 42 Government Insurance Bldg., Regina, Sask.
Gray, Robert Vernon (British Columbia), 447 West 19th Avenue, Vancouver, B.C.
Gummer, Ernest M., B.Eng. (Elect.), N.S.T.C., transmission, Maritime Telegraph & Telephone Co., Ltd. Halifax, N.S.
Lee, Thomas Bing-Kven, B.Sc. (Mech.), Queen's, 1162 St. Urbain St., Montreal, Que.
Narduzzi, Enzo D. (Queen's), 340 Albert St., Kingston, Ont.
Smythe, J. F. S. (Queen's), Kingston, Ont.

Students at McGill University

G. H. Balcome	L. A. Issen	D. M. McKim
R. R. Bernard	J. R. F. Keely	C. N. McPherson
A. Blauer	S. Levine	T. M. Medzwiecki
J. A. Delaney	H. H. Lochhead	C. B. Pilgrim
F. C. Fisher	W. K. Manson-Hing	E. M. Peto
J. W. Fraser	H. McClymont	

Students at University of Toronto

W. Bobbie	B. P. Dolmont	R. D. Morrison
W. M. E. Clarkson	E. D. Fedryk	R. S. Morden
E. L. Davies	R. J. Hallawell	R. W. Vollett

Students at University of New Brunswick

L. F. Fiander	C. F. Mallory	P. C. Toft
H. K. Larsen	R. Otsuki	

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

ALBERTA

Members

Gould, Edward Christopher Seymour, B.Sc., Queen's, geologist, with N. W. Byrne, consultg. engr., Yellowknife, N.W.T.
Livingstone, Robert Donald, B.Sc. (Mining), Alberta, mining engr., Lethbridge Collieries Ltd. Lethbridge, Alta.
Richardson, Allyn St. Clair, B.A.Sc., British Columbia, sr. sanitary engr., Dept. National Health & Welfare, Edmonton, Alta.
Russell, Bernard Elliot, inspecting engr., Snare River Hydro, Yellowknife, N.W.T.
Watson, John Gordon, B.Sc. (Civil), Saskatchewan, asst. hydraulic engr., P.F.R.A., Cardston, Alta.

Junior to Member

Lawrence, Norman Alexander, B.Sc. (Civil), Alberta, dftsman., City of Edmonton Power House, Edmonton, Alta.
Willson, Bruce Franklin, B.Sc. (Civil), Alberta, jr. engr., Northwestern Utilities Ltd., Edmonton, Alta.

NEW BRUNSWICK

Member

Dickson, Henry Ewen, B.Eng. (Mining), N.S.T.C., sales engr. and branch mgr., Wm. Stairs, Son & Morrow Ltd. Saint John, N.B.

Junior to Member

Marshall, Herbert Ansley, B.Eng. (Mech.), N.S.T.C., industrial lubrication engr., Maritime Division, Imperial Oil Limited, Saint John, N.B.

Student to Member

MacArthur, Jack Llewellyn, B.A.Sc. (Civil), Toronto, engrg. dept., N.B. International Paper Co., Dalhousie, N.B.

QUEBEC

Members

Brisset des Nos, Andre, B.A.Sc., C.E., Poly., asst. division engr., aqueduct section, City of Montreal, Que.
Leslie, Clarence Arthur, B.Sc. (Elect.), Tri-State College; B.Sc. (Civil), Michigan State College, elect. and mech. supt., Malartic Gold Fields, Halet, Que.
Szczeniowski, Boleslaw, Ms. Mech. Engrg. and Dr. Tech. Sciences, Warsaw Institute of Technology, Warsaw, Poland, Agrégé Professor, Ecole Polytechnique, Montreal, Que.
Zbinden, Ernest, Mech. Engr., Univ. of Lausanne, Switzerland, engr., aqueduct section, engrg. divn., Public Works Dept., Montreal, Que.

Juniors

Brennan, John Thomas, B.A.Sc. (Elect.), Toronto, equipt. engr., Bell Telephone Co. of Canada, Montreal, Que.
Hill, David Humphrey, B.Sc. (Met.), Queen's, sales engr., Williams & Wilson, Ltd., Montreal, Que.

Junior to Member

de Witt, George Harding, B.Eng. (Elect.), McGill, asst. to supt., repair dept., Shawinigan Water & Power Co., Three Rivers, Que.

Personals

News of the Personal Activities of members of the Institute

Baron Boris de Hueck, M.E.I.C., has been appointed to complete the current term as councillor of the new Cornwall Branch of the Institute. He was born at St. Petersburg, Russia, and studied at the Polytechnic Institute of Riga, receiving a B.Sc. degree 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 army, 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 Canadian Cottons Limited, Montreal as chief engineer in 1934. In that position he is now located at Cornwall, Ont.

F. T. Boutilier, M.E.I.C., is the newly elected chairman of the Saguenay Branch of the Institute. Born in Sydney, N.S., he graduated from the Nova Scotia Technical College, Halifax, in 1928 with a B.Sc. in mechanical engineering. He immediately entered the employ of the Dominion Steel and Coal Corporation, Sydney, as assistant to the steam engineer, remaining until 1929 when he joined the Aluminum Company of Canada. Located at Arvida, Que., he was at first technical assistant in the mechanical department and later transferred to the aluminum plant in the same capacity. He was made general foreman of the remelting and alloy department in 1932, and was appointed to his present position as assistant to the aluminum plant superintendent in 1935.

J. E. Dyck, M.E.I.C., has recently been appointed secretary-treasurer of the Saguenay Branch of the Institute. He graduated from the University of Saskatchewan with a B.Sc. in mechanical engineering in 1930. He remained at the university as an instructor for the next two years, going in 1934 to Harris, Sask., where he was principal of the high school and teacher of mathematics and sciences. He then became associated with the International Nickel Company, located at Copper Cliff, Ont., and in 1941 he came to Montreal as senior draughtsman and designer on reinforced concrete, heating, ventilation and plumbing for the Aluminum Company of Canada Limited. He was transferred in 1944 to Arvida, Que., where he is statistician for the industrial engineering department of the company.

Hector Cimon, M.E.I.C., secretary of Price Brothers and Company Ltd., Quebec, has received the additional appointment of vice-president of the company. He joined his company on graduation from Ecole Polytechnique, Montreal, in 1916, being employed successively on special survey work, on design and supervision of construction, and on engineering. He became secretary of the company in 1939.

Ernest Davis, M.E.I.C., has retired as comptroller of water rights British Columbia Department of Lands and Forests, Victoria. He had been in that post since 1939 when he was promoted from the position of assistant comptroller of water rights and chief engineer. His service with the department dates from 1910 when he entered it as an engineer on hydrographic work.

R. C. Farrow, M.E.I.C., is the newly appointed comptroller of water rights for the Department of Lands and Forests of British Columbia. He was with the water rights branch as district engineer prior to his service from 1940 to 1946 with the R.C.E. and the R.C.A. Returning to the department this year he was appointed chief hydraulic engineer.

Colonel E. C. Thorne, M.E.I.C., R.C.E., director of engineer development at National Defence Headquarters, Ottawa, was awarded the Legion of Merit, degree of officer, by the United States Government with a citation for exceptionally meritorious service from October 1943 to January 1946 in connection with the work of the Engineer Board. "As director of equipment, Canadian Army, he fostered the closest relationships of mutual helpfulness between research and development agencies of the Canadian and United States Armies. Through his expert technical knowledge and loyal cooperation, Colonel Thorne greatly furthered the combined war effort of Canada and the United States".

John Stephen Keenan, M.E.I.C., manager of the supply department of Canadian General Electric Company, Toronto, Ont., was elected president of the Canadian Electrical Manufacturers Association at its recent annual meeting.

John Morse, M.E.I.C., vice-president in charge of operation of the Shawinigan Water and Power Company, has been appointed the Canadian member of the International Executive Committee of the C.I.G.R.E. (the International Conference on Large Electric High-Tension Systems), Paris, France. This Committee originally had five members, one each from France, England, Switzerland, the United States and Russia, and its membership has been increased to seven by the addition of one member each from Canada and Sweden. Mr. Morse, is also president of the Canadian National Committee of the C.I.G.R.E.

M. D. Young, M.E.I.C., has received the appointment of general superintendent in charge of distribution for the City of Winnipeg Hydro Electric System. He is a graduate in electrical engineering of the University of Manitoba. He joined the staff of Winnipeg Hydro the year following his graduation, 1926, and in 1930 was made distribution engineer. He became assistant superintendent of distribution in 1938.

J. H. Fox, M.E.I.C., has recently been appointed by the Minneapolis-Honeywell Regulator Company Limited, Toronto, as sales manager of the commercial controls division. He has been with the company since 1934 and obtained wide experience as sales engineer in the Modutrol Division. He joined the Army in September 1939, took the 2nd Base Workshop to the continent shortly after D-Day and retired with the rank of lieutenant-colonel in February of this year.

Valmore Denis, M.E.I.C., who is as the Ottawa Headquarters of the Department of Public Works of Canada will retire from the service in April, 1947. He began his career with the Department in 1901.

M. D. Bleaken, M.E.I.C., is now associated with the time study and standards department of the Canadian General Rubber Company, Galt, Ont. He had been employed previously by Canadian Car and Foundry in the aircraft division at Fort William, Ont., as mechanical engineer for hydraulic equipment in aircraft.

S. A. Craig, M.E.I.C., is with the Dominion Bridge Company Ltd., Lachine, Que. He was formerly in charge of the production department of Wartime Shipbuilding Limited, Montreal.

H. L. Eberts, M.E.I.C., who was with Stevenson and Kellogg Limited, Montreal, is now factory manager with the Federal Electric Manufacturing Co. Ltd., Montreal.

Henry Howard, M.E.I.C., has recently been appointed professor of mineral dressing in the department of mining and metallurgy of the University of British Columbia. He had been employed since 1942 by Eldorado Mining and Refining, first at Port Hope, Ont., on special research, and later at Great Bear Lake, N.W.T., as mill superintendent. After three years research he and Mrs. Howard succeeded in developing a method for the quantitative assaying of pitchblende ores by means of the Geiger counter. This was an original development at Great Bear Lake, although the counter had previously been in use for qualitative assaying. Mr. Howard intends to carry on at the university with his investigations concerning the treatment and assaying of radioactive ores.

D. D. Reeve, M.E.I.C., has accepted the position of resident engineer with the Abitibi Power and Paper Company Limited at Fort William, Ont. He was previously employed by the Aluminum Company of Canada Ltd., Montreal, as a mechanical engineer in the general engineering department.

F. Valiquette, M.E.I.C., is the new city manager of St. Jerome, Que., He was previously located at Bourlamaque, Que., as town manager.

J. Edouard Prevost, M.E.I.C., formerly with the Montreal Laboratory of the National Research Council is now employed by the Hydro-Electric Commission of Quebec as designing and development engineer at the Beauharnois power plant. Mr. Prevost graduated with honours from the Ecole Polytechnique in the class of 1921 and has since had extensive experience in the construction field.

Wm. B. White, M.E.I.C., is an assistant engineer with the Canadian National Railways, western region, with headquarters at Winnipeg. He joined the company after receiving his discharge from the R.C.E. with the rank of captain in July this year.

A. R. Crookshank, M.E.I.C., who was assistant engineer in the Saint John district of the Department of Public Works of Canada, has been promoted to the position of senior assistant engineer.

S. C. Anderson, M.E.I.C., was recently appointed chief engineer for the Dominion Road Machinery Company of Goderich, Ont. He was formerly sales engineer for Sawyer Massey Limited, Hamilton, Ont.

J. W. Tarbox, M.E.I.C., is in Ottawa, Ont., with the National Research Council as a junior research engineer in the department of electrical engineering and radio. He was previously with the Hydro Electric Power Commission of Ontario, Toronto.

A. M. Toye, M.E.I.C., who has been attached to the Inspection Board of the United Kingdom and Canada since 1942, on leave of absence from the Department of Highways of Ontario, has returned to the Department. He will be in the office of the bridge engineer at Toronto, Ont.

Charles Farstad, JR.E.I.C., has recently been appointed mechanical superintendent for Burns and Company Limited at Edmonton, Alta. He was in Grand'Mère, Que., since 1941, as assistant engineer with the Consolidated Paper Corporation Limited, returning to Calgary, Alta., early this year.

H. I. Hamilton, JR.E.I.C., is in Brazil, South America, in the employ of the Sao Paulo Light Heat and Power Company. He was previously with the Demerara Bauxite Company, Mackenzie, British Guiana, S.A.

Murray Zides, JR.E.I.C., is studying traffic engineering at the graduate school of Yale University, New Haven, Conn. He had been with the highway division of the Department of Public Works of New Brunswick at Fredericton, N.B., since his graduation from the University of New Brunswick in 1944.

R. F. Shapcotte, JR.E.I.C., is now employed by L. Y. McIntosh, architect, Fort William, Ont., on supervising, estimating, and mechanical design. On his release from the R.C.E. in 1945 he was employed as an engineer by the Department of Public Works, Ottawa.

J. A. Tod, JR.E.I.C., who was discharged from the R.C.E. in May with the rank of lieutenant, is now with the Bell Telephone Company at London, Ont.

W. D. Harkness, JR.E.I.C., has returned to Canada from Mexico, where he was with the Cia. Industrial de Atenquique, in Jalisco. He is now at Port Arthur, Ont., with the Marathon Paper Mills of Canada Limited.

J. A. K. Leger, JR.E.I.C., is at present resident in England and is teaching mathematics at the Hampton Grammar School, Hampton Court. Until his recent demobilization he was actively engaged in the development and planning of the telecommunication network in France, Belgium, Holland, and Germany as a staff officer for the chief signal officer of HQ. 21 Army Gp.

G. E. McDougall, JR.E.I.C., has gone to Whitehorse, Yukon, as a bridge engineer for the Department of National Defence on the Northwest Highway System. He was previously with the Public Roads Administration in Edmonton, Alta.

L. M. Nadeau, JR.E.I.C., is the new assistant registrar at Montreal for the Corporation of Professional Engineers of Quebec. He was formerly engineer inspector for the Canadian Underwriters' Association at Montreal.

W. J. Ives, JR.E.I.C., of Winnipeg, Man., received the degree of master of engineering (electrical), at the fall convocation of McGill University.

J. L. deStein, Jr.E.I.C., received his master of engineering degree (civil), from McGill University at the fall convocation. He obtained a B.Sc. degree at the University of Saskatchewan in 1939, and has been with the Aluminum Company of Canada in Montreal since 1940.

William Tkacz, Jr.E.I.C., is at the University of Michigan, where he is following a graduate mechanical engineering course leading to the degree of Master of Science. He expects to be at the university until September 1947.

G. V. Bourbonnais, Jr.E.I.C., who was overseas with the R.C.E., for over three years is now employed by Zachée Langlais, consulting engineer, Quebec. Following his discharge he accepted the position of assistant superintendent, St. Malo Shops, Dominion Arsenal, Que.

Geo. S. Baldry, Jr.E.I.C., is in Rutland, Mass., where he is a pathologist at the Rutland State Sanatorium. He had been practising privately as an industrial hygienist before entering the R.C.A.M.C. in 1944. He became director of the division of industrial hygiene for the city of Winnipeg, Man., in 1942 after studying at the School of Public Health, at Harvard University.

Pierre Duchostel, Jr.E.I.C., was appointed on August 1st as electrical engineer with the Quebec Power Company, Quebec. He joined the company in April of this year, when he severed connections with the Ferranti Electric, Montreal. He entered the latter company in 1943. going on loan to the National Research Council, Ottawa, that year, as a junior research engineer, and returning in 1945.

F. W. Davidson, S.E.I.C., is in Boston, Mass., where he is studying at the Harvard Graduate School of Business Administration. He had been with the Bell Telephone Company of Canada, Montreal, while studying at McGill University toward a master of engineering degree.

P. J. Robinson, S.E.I.C., of Calgary, Alta., received the degree of bachelor of engineering (mechanical), at the fall convocation of McGill University, Montreal.

Norman Epstein, S.E.I.C., of Outremont, Que., received the degree of master of engineering (chemical), at the fall convocation of McGill University, Montreal.

J. M. Carrol, S.E.I.C., is employed by Aluminium Laboratories Ltd., at Arvida. Que., on research in the development of spectroscopy and spectrographic analysis, in compliance with his course in engineering physics at Queens University, Kingston, Ont. He will return to the university in April or September 1947.

Eric Bergenstein, S.E.I.C., was the victim of a serious accident a few weeks ago. He was severely burned and has been hospitalized. An active student member, he was the University of Manitoba representative at the Students' Conference held in connection with the annual meeting this year.

R. J. Blezard, S.E.I.C., is with the Canadian Gypsum Company as plant engineer at Hagersville, Ont. He had been a junior engineer with Link Belt Limited at Toronto, Ont., since his graduation in mechanical engineering from the University of Saskatchewan in 1944.

E. R. Heuser, S.E.I.C., is at Hawkesbury, Ont., where he is employed as a chemist for the Canadian International Paper Company. He graduated in 1945 from McGill University, Montreal, as a bachelor of engineering.

A. C. Noel, S.E.I.C., who graduated from the Nova Scotia Technical College in 1946 as a B. Eng., is with the Bell Telephone Company of Canada at Quebec. He is a junior engineer in the plant engineering department, eastern district.

Charles Metherell, S.E.I.C., who graduated this year from the University of Toronto, is employed by Price Brothers as a junior chemical engineer and is located at Kenogami, Que.

Edmond M. Tuff, S.E.I.C., who served with the R.C.N.V.R. since his graduation in 1945 from the Nova Scotia Technical College, is now located at Hamilton, Ont. He is employed by the Otis-Fensom Elevator Company and is taking the student training course.

Louis Malkin, S.E.I.C., who graduated last May as a B.Sc. from Mount Allison University, Sackville, N.B., is now demonstrating in chemistry at the Ajax division of the University of Toronto.

R. A. Zurowski, S.E.I.C., is instructing in the engineering department of the University of Saskatchewan. He graduated as a B.Sc. in electrical engineering from the University of Manitoba in 1945.

John Stonehewer, S.E.I.C., is with Proctor, Redfern and Laughlin, consulting engineers, Toronto, Ont. He graduated in civil engineering from McGill University, Montreal, this year.

Donald M. Venton, S.E.I.C., is employed by Armstrong, Anderson and Company, consulting engineers of Toronto, Ont. He had previously been connected with the Pigott Construction Company at Aylmer, Ont.

Obituaries

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

Augustus Griffin, M.E.I.C., manager of the department of natural resources of the Canadian Pacific Railway in Calgary, Alta., died suddenly at his home on October 13th, 1946.

He was born in Visalia, California, in 1883, and attended the University of California, graduating in 1906 with a B.Sc. in civil engineering, specializing in irrigation. He then spent six years, as engineer of the Modesto irrigation district in Modesto, Calif., and in 1913 he was superintendent of irrigation for the Truckee Carson (now Newland) project of the United States Bureau of Reclamation. Two years later he became chief engineer for the South San Joaquin irrigation district, Manteca, Calif., and he came to Canada in 1918 as superintendent of operation and maintenance for the Canadian Pacific Railway's eastern section irrigation project at Brooks, Alta. He was appointed chief engineer of the company's Department of Natural Resources in 1932, and moved in 1935 to Strathmore, Alta., where he supervised the operation of the western section irrigation project of the C.P.R. Accepting the position of assistant manager of the Department in 1941, with headquarters in Calgary, Alta., he became manager in 1942.

He is credited with important contributions to the promotion of fruit growth in Alberta and was tendered a resolution of appreciation in 1940 by the Great Plains Section of the American Horticultural Association. He was a member of the Association of Professional Engineers of Alberta and of the American Society of Civil Engineers, serving for two years as chairman of the irrigation division of the latter society. He joined the Institute as a Member in 1925, and has been a valuable member of the Committee on Prairie Water Problems for the last few years.

Lieutenant-Colonel H. B. Stuart, M.E.I.C., of Hamilton, Ont., died on October 14th, 1946, at the R.C.A.F. Hospital at Rockcliffe, Ont.

He was born at Mitchell, Ont., in 1889, and attended the University of Toronto, graduating in 1909 with a B.A.Sc. degree. He immediately entered the Hamilton Bridge Co. As field engineer for the company since 1921 he was noted as an expert on the construction of bascule bridges and helped design the one over the Burlington Beach Ship Canal..

His civil engineering career was interrupted by service in the R.C.E. in World War I. He was connected with the Hamilton Garrison at the outbreak of World War II, and in 1940 he was appointed officer commanding the 1st Field Squadron, R.C.E. His overseas service merited him the M.B.E. in 1943, and he returned to Canada in 1944 with the rank of major. The next year he was promoted to the rank of lieutenant-colonel and was made head of the bridging section of the directorate of engineer development in Ottawa. At the time of his death he was serving on the directorate of works and construction there.

Lieut.-Col. Stuart joined the Institute in 1920 as an Associate Member, becoming a Member in 1935.

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*

At a general meeting held on October 17th, the Calgary Branch was addressed by V. A. Newhall, M.E.I.C., city commissioner of Calgary, on the subject of **Urban Transportation.**

Mr. Newhall reviewed the reports and recommendations of W. K. Furlong and Norman D. Wilson who had been consulted regarding the modernization of the Calgary Transit System. He then went on to give the relative advantages and disadvantages of modern transportation vehicles, including the P.C.C. streetcar, gasoline buses, diesel buses, and trolley coaches.

By means of a graph it was shown that each vehicle would operate more cheaply than the others under certain peak loads. For the load conditions encountered on most routes in this city the trolley coach appears to have the advantage of low operating cost. In comparing the initial costs of various types of vehicles, they must first be reduced to a "per seat" basis. To this comparative initial cost is added the amount required for amortisation. Mr. Newhall demonstrated that this capital cost of the trolley coach is lower than other types of vehicles, even when the cost of overhead wiring is included. A comparison of maintenance costs and out-of-service times showed that due to the long period between overhauls on a trolley coach, it is relatively cheaper to maintain.

Mr. Newhall pointed out that either gas buses or diesel buses were needed to operate on newly established lines and on lines which had low peak loads. These vehicles also have the advantage of flexibility.

At the conclusion of his talk the speaker answered numerous questions and R. A. Brown thanked him for his very interesting and timely address.

LETHBRIDGE BRANCH

H. T. Miard, M.E.I.C. - *Secretary-Treasurer*
E. A. Lawrence, S.E.I.C. - *Branch News Editor*

The Farmer in a Program of Reconstruction, was the subject of an address given by E. E. Eisenhauer, M.E.I.C., deputy minister of reconstruction of Saskatchewan, at a dinner meeting of the Lethbridge Branch at the Marquis Hotel on Saturday evening, October 19th.

Mr. Eisenhauer related the efforts of the federal and provincial governments to bring rehabilitation to the farmers of Saskatchewan and to the war veterans settling on the land. He gave an interesting account of the work of the Saskatchewan Department of Reconstruction.

The history of the plains has been one of good crops interspersed with lean years. There have been three great droughts in Saskatchewan since 1838; the last, from 1929 to 1937 was firmly impressed on the minds of all the residents. The program of reconstruction must encourage and assist the farmers to protect themselves against such calamities by carrying supplies of feed and seed from good years into periods of drought.

Agriculture is the main industry of Saskatchewan and the production of agriculture is based on a wheat economy, because in the period from 1920 to 1945, 70% of the gross income from Saskatchewan agriculture was from wheat. In that period, yields varied from 2.6 to 23.3 bushels per acre. These extreme fluctuations must be given careful consideration in a programme of reconstruction. Export markets with reasonable prices are also necessary to give security to the farmer.

Saskatchewan has 33½ million acres of arable land. There are 1,135,000 acres of vacant and abandoned land and seven million other acres of ranch land where development of water supplies would greatly increase the production of livestock. Twenty-seven million acres of submarginal land and three million acres of grey soil are arable if economic units are set up and the necessary development undertaken.

Some of the ways in which the above aims can be realized are by conservation of water resources, irrigation, proper land utilization, such benefits as the Prairie Farm Assistance Act, the P.F.R.A., and assurance of markets with reasonable prices, increased research in agriculture and in the industrial use of agricultural products.

Irrigation is a very important method of guaranteeing crops. There are two types—large systems necessitating construction of dams and reservoirs to store spring freshets, and canals; and small individual systems, such as construction of small inexpensive dams on individual farms to serve a small area of the farm. If a farmer has enough water to irrigate a few acres for food and seed, he is prepared for drought. Large irrigation schemes are, of course, of more value to industry and towns.

The Department of Reconstruction is also interested in establishing returning war veterans. Since 1939, all good crown land was reserved for veterans and can be obtained in economic farm units. Already 764 units are settled. The speaker gave details of the efforts and ingenuity of many of these settlers.

Forty sections of twice burned over land are being prepared for agriculture by the Department with equipment built in its machine shop. In all this development, the Province obtains federal co-operation.

Rural housing is another concern of Mr. Eisenhauer's Department. A farm home is both the office and residence of the farmer, and a committee has studied the problem and presented a report on the design of a home for a farm. These homes should have the amenities of the city—electricity, water and sewerage and should be painted.

A. G. Donaldson expressed the meeting's appreciation to the speaker. This meeting was a "Ladies' Night" with an attendance of sixty-four. The head table guests were Mr. Eisenhauer, Branch Chairman and Mrs. R. S. Lawrence, Mr. and Mrs. P. M. Sauder, Councillor and Mrs. C. S. Clendening, Mr. and Mrs. G. S. Brown and Mr. and Mrs. C. S. Donaldson.

MONTREAL BRANCH

E. M. Van Koughnet, M.E.I.C. - *Secretary-Treasurer*
Hyman Schwartz, S.E.I.C. }
Eli L. Ilovitch, S.E.I.C. } *Branch News Editors*

"The first factor in industry is top management," Mr. Frank L. Sweetser told the members of this branch when speaking on **Industrial Engineering and Profit Control** at a regular meeting held on Thursday evening, October 24th. The speaker then went on to explain that if the management is good, that is to say if the men in the leading positions are in good physical health, have the executive ability and the proper authority for the responsibilities they hold, then the company will run smoothly.

In controlling profits and preventing losses it is necessary to plan the production and establish a budget before work actually begins on any project. The budget should show what the given item *should cost,* the number of articles that can be sold, and whether the project pays. The budget is prepared with the aid of charts and graphs, the most important of which is the Profit vs. Volume diagram. Ordinary accounting, on the other hand, records the past and consequently often fails to indicate trends in time for corrective action. Nevertheless accounting should be a check on production. The speaker then suggested that someone in authority be made responsible for the differences in the planned and the actual production. The talk was illustrated with lantern slides. R. S. Eadie was chairman of the meeting.

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In an auditorium so overcrowded that many listened from the corridors, Mr. John I. Yellot delivered a paper on the development of **Coal Burning Gas Turbines for Locomotive Use.** This was on Thursday evening October 31st.

Mr. Yellot, who is chairman of the Power Test Code Committee on Gas Turbine Power Plants of the American Society of Mechanical Engineers, explained that the new Diesel-electric locomotives have been continually replacing the familiar steam locomotives for both short and long distance runs. In fact there are now 3000 Diesel-electrics on order in the United States and only 35 steam engines.

The coal operators whose income depends largely on the sale of coal to the railroads, realizing the danger to their business have backed research on prime movers which would use coal instead of oil as a fuel. The speaker then went on to explain why it is theoretically and actually impossible to greatly improve the efficiency of modern reciprocating steam locomotives which is about 10%. He then showed that gas turbines, because they can operate at high temperatures due to recent metallurgical developments in heat resisting alloys, result in great economies which outdo the diesels.

At present there is under construction in the U.S. a coal burning gas turbine locomotive, which is essentially similar to the oil burning gas turbines manufactured by the Swiss. (See "The Application of the Gas Turbine to Railway Locomotives" by A. K. Leuthold, *The Engineering Journal,* August, 1946)

The machinery of the new locomotive consists of an axial flow multi stage compressor, a preheater using exhaust gases, a single cylindrical burner, a multi stage turbine and conventional electrical drives. The additional equipment required to handle the solid fuel consists of a helical screw conveyor, a crusher to reduce the coal to pieces ¼ in. diameter, a dryer, a venturi type coal pulverizer for reducing the coal to a powder so fine that nearly 90% passes through a 300 mesh screen, i.e. finer than a silk handkerchief, and an "Aerotech" fly ash separator. The last item is a special type high temperature cyclone and is located between the burner and the turbine.

The new locomotive, because it burns coal which costs less than a third for corresponding fuel oil, because of its high overall efficiency—between 25 and 30%—and relatively few moving parts will make this type of prime mover the leader in the locomotive field. In addition it will consume practically no lubricating oil, will be noiseless, smokeless, easy to operate and simple to maintain.

At the conclusion of the discussion period H. F. Finnemore thanked the speaker. W. A. Newman was in the chair.

OTTAWA BRANCH

C. G. Biesenthal, jr.e.i.c. - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - - - *Branch News Editor*

The first evening meeting of the fall season was held on Wednesday evening, October 16, at the auditorium of the National Museum. Sir Donald Bailey, O.B.E., superintendent of the Bridging Wing of the British Military Engineering Establishment, spoke on the **Development of the Bailey Bridge,** after which two films were shown which displayed the various uses to which the Bailey Bridge could be adapted. Sir Donald agreed to answer any questions and a number of the engineers present availed themselves of this opportunity of securing desired information.

Chairman J. H. Irvine in introducing the speaker, pointed out that Sir Donald has been associated with the design of every British Military Bridge produced in the last eighteen years. His outstanding achievement was the design in 1940 of the Bailey Bridge, which played such a notable part in World War II.

Sir Donald compared the problems involved in designing a military bridge with the building of an ordinary bridge for peacetime purposes. He pointed out that military bridges must be adaptable to heavy loads, they must function in any kind of territory, and be erected in much shorter time than is the case with ordinary bridges. A feature of the Bailey Bridge is that it has only eight basic units, the heaviest of which can be carried by six men.

After describing the method of constructing and launching the bridge at the site, he revealed some of the problems which hampered the British engineers and manufacturers. He told how a new steel alloy had to be devised when the increasing proportion of scrap in the first one chosen led to its abandonment. Stating that 696,000 panels, the basic units of the Bailey Bridge, were made in the United Kingdom, he recalled the steps taken to test every one.

The speaker stated that 500,000 tons of building material were produced by 300 British firms, this amount being sufficient for 240 miles of double-trussed, double-tiered bridging.

* * *

At an evening meeting held at the National Museum Lecture Hall, Nov. 1st, John I. Yellott, of Baltimore, Md., gave a talk on the use of **Cool Burning Gas Turbines in Locomotives.** Mr. Yellott is director of research for the Bituminous Coal Research Locomotive Development Committee. He has had a distinguished career on the engineering staffs of the University of Rochester, the Stevens Institute, and the Illinois Institute of Technology.

The speaker pointed out that one-third of the coal requirements in Canada are used by the railroad systems of the Dominion. In the United States, the corresponding fraction is one-fifth. Research operations have been underway for some time in the development of an internal combustion engine which could be fed cheaply by abundant coal instead of gasoline or oil.

His talk was illustrated by lantern slides and included an explanation of jet propulsion elements and other features, as well as the processing of "atomized" coal, needed for the latest turbine.

J. H. Irvine, chairman of the branch, presided at the meeting.

ST. MAURICE VALLEY BRANCH

W. M. Mackay, m.e.i.c. - *Secretary-Treasurer*

The inaugural meeting of the fall season of the St. Maurice Valley Branch was held in the Cascade Inn, Shawinigan Falls, on Tuesday, October 22nd. A. W. Peters, branch chairman, introduced the speaker of the evening, G. M. McHenry of the Canadian General Electric Company.

The title of Mr. McHenry's paper was **Industrial Power Distribution.** He compared the economics of power distribution at 575 volts, from a single substation, and distribution at a higher voltage by making use of unit substations at load centers throughout the plant. He showed typical feeder layouts for the various degrees of flexibility and dependability which may be required, and the protective equipment which may be necessary in each case. The talk was illustrated by slides.

Following the address, there was a short discussion period, after which J. Dupuis thanked the speaker for his very well-presented paper. Fifty members of the branch attended the meeting.

SASKATCHEWAN BRANCH

D. W. Houston, m.e.i.c. - *Secretary-Treasurer*
L. A. Dokken, m.e.i.c. - - *Branch News Editor*

The regular monthly meeting of the Saskatchewan Branch was held in the Kitchener Hotel, Regina, Saskatchewan, on Friday, October 25th, 1946. The attendance was forty-eight, including a few members from Saskatoon and Moose Jaw, who were introduced by Chairman F. E. Estlin.

Guest speaker of the evening was Mr. W. H. Prevey, application engineer of the supply department, Canadian General Electric Co., Toronto. Mr. Prevey spoke on **Fault Selective Protection on Distribution Systems,** which dealt with the automatic features used in protecting an average electrical transmission system. Such features as instantaneous and time delay fuses, cutout relays, and indicating fuse box types were dealt with in detail, as well as common methods used in calculating the magnitude of probable short-circuit currents at all locations in a given system. The time-short circuit current, characteristic fuse graphs were explained to the members and in conjunction with these charts, it was shown how the characteristics of the "high-surge" type fuse was developed. This fuse was developed by combining two high amperage fuses, in order to retain the high amperage feature for resisting high surges of short duration with a suitable heat storing solder to give normal line protection.

The working of the various protective elements in a distribution system was then explained diagrammatically, with an assumption a fault in a certain location, and a careful follow-up by the speaker of the "teamwork" features of the various protective devices. A practical demonstration was then given showing the blowing of the instantaneous and time delay fuses, as well as the indicating fuse box types, featuring both the drop-down and drop-out doors easily spotted by "trouble men".

A discussion period followed in which considerable interest was shown, particularly in the field of adapting such automatic equipment to our climatic conditions.

R. W. Jickling, of the Saskatchewan Power Commission, in thanking the speaker, gave examples of how such equipment has led to higher service maintenance records and fewer minute "outages" and gave high praise to those men who have developed the features described.

TORONTO BRANCH

E. G. Tallman, m.e.i.c. - *Secretary-Treasurer*
E. R. Graydon, m.e.i.c. - *Branch News Editor*

A joint meeting of the Toronto Branch of the Institute and the Toronto Chapter of the Ontario Association of Architects was held on October 24th in University College. About 150 architects and engineers heard and participated in a lively discussion on **Community Planning.**

In the panel discussion, architects were represented by Messrs. Anthony Adamson, P. Alan Deacon and John Layng; engineers by Messrs. Ross Dobbin, J. F. MacLaren and Hew Scott. A general discussion followed in which many of those present joined. Many points of interest arose during the evening. Organization of a Toronto Branch of the Community Planning Association, the need for student courses in the subject, and the Ontario Town Planning Act were all discussed. Many national and provincial examples of successful municipal planning, which have contributed greatly to better living, were cited.

The meeting served to clear up many misconceptions about the subject, and offered concrete evidence of the co-operation of architects and engineers in this field of general concern.

VANCOUVER BRANCH

A. M. Eyre, s.e.i.c. - - *Secretary-Treasurer*
P. B. Stroyan, m.e.i.c. - *Branch News Editor*

Some one hundred and twenty members of the Vancouver Branch of the Institute and the Professional Engineers' Association attended a joint meeting in the Hotel Vancouver on October 25th to hear Professor Frank Forward, Head of the Department of Mining and Metallurgy at the University of British Columbia. The speaker had just returned from a trip to the Far East as consultant to the National Resources Commission of the Chinese Government and took as his subject **Some Engineering and Industrial Aspects of Present Day China and Formosa.** The twenty thousand mile trip taken by Professor Forward included Guam, Iwo Jima, Tokyo, Yokohama, Hiroshima, Iwo Cuni, Shanghai, Pekin and Formosa. Impressions of a visit to a war-crime trial in Tokyo and some observations on the effects of the atom bomb on Hiroshima proved extremely interesting, and examples of the prices of commodities in Shanghai gave an idea of the terribly inflated conditions in that city.

A most depressing account of the general chaos existing in those parts of China visited by the speaker, the poor health and extreme indifference of the people, indicated that the economic and industrial prospects of the country would not have a chance of showing much improvement unless the outlook of the Chinese could be drastically changed. Any help which can be given by other nations could not be expected to improve conditions materially without a complete change in the national attitude.

The picture of Formosa was a little brighter and the natural resources, including coal, oil and natural gas, limestone, fishing and forest products, hold a reasonable possibility of a return to a sound economy for the two and a half million inhabitants. Formosa has been for the past fifty years under Jap control and the natives speak Japanese and Amoy with little inclination to switch their sympathies to the Chinese. The Japs had installed power stations with a combined output of some 350,000 K.V.A., furnishing cheap power throughout the island by a comprehensive network of transmission lines. The power plants were demolished by American bombers but about 100,000 K.V.A. has been restored.

Professor Forward was thanked for a most interesting and instructive address by R. C. Pybus, branch chairman, and by W. O. Scott, president of the Association of Professional Engineers of British Columbia.

W. H. Powell reported briefly on the Maritime Professional Meeting held in September at Digby, Nova Scotia.

THE ANSWER

To Quiz on page 693

Isambard Kingdom Brunel, 1806-1859, English engineer, was born in Portsmouth, studied in Paris at Collège Henri Quatre, and in 1823 entered his father's office as assistant engineer. Early assignments included the post of resident engineer of the Thames Tunnel project, and the design and engineering of the suspension bridge over the Avon at Clifton. At 27 he was engineer of the new Great Western Railway, contributed famous projects to the line, and introduced to it the broad (7-ft.) gauge. He resigned that office in 1846, and the Royal Albert Bridge on the Tamar at Saltash was his last and greatest railway project.

The *Great Western,* of Brunel's design and construction, was the first steamship built to make regular voyages across the Atlantic. The larger ships *Great Britain* and *Great Eastern* were also his design, the latter launched in 1858. Other interests included the construction of docks and piers, the improvement of large guns, the design of hospital buildings, the promotion of the Great Exhibition in 1851.

Elected a Fellow of the Royal Society in 1830, he declined the presidency of the Institution of Civil Engineers through ill health. He received a D.C.L. degree from Oxford in 1857. He died at his home in Westminster in 1859.

(Condensed from Encyclopaedia Britannica.)

Library Notes

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

BOOK REVIEW

THEORY OF STRUCTURES

S. Timoshenko and D. H. Young. New York, McGraw-Hill; Toronto, Embassy, 1945. 488 pp., illus., 9 x 6¼ in., cloth, $6.00 (in Canada).
Reviewed by I. F. Morrison, M.E.I.C.*

It would seem that new text books in a field already so over-crowded as The Theory of Structures, now coming to be called Structural Analysis, could not help being superfluous. However, in spite of the large number already available, new ones appear from time to time and among the new arrivals occasionally one stands out as a distinctly better book than any of its contemporaries. The Theory of Structures by Timoshenko and Young is just such a book and for that reason a brief review may perhaps be of some value to those interested in the subject.

For the purposes of this review, the book might be considered as made up of four parts, which may be designated briefly as dealing with 1. plane statics, and three-dimensional statics, which deals with space frames, 2. influence lines, 3. statically indeterminate systems.

Of the first part, little need be said. It is concerned with the usual, elementary, well-known theorems of plane statics, including a brief treatment of the principle of virtual work. This part is obviously intended as a review of first principles. The authors are to be commended on the careful treatment given to "critical forms" and complex trusses; a topic usually overlooked in texts on structural analysis but which, none-the-less, is of fundamental importance in a thorough treatment of the subject.

Chapter IV, on statically determinate space structures, which belongs to the first part, fulfills a long standing requirement in elementary texts on the Theory of Structures and is, in itself, of sufficient importance to place this book ahead of similar texts. A number of cases of three dimensional trusses are worked out. The chapter includes an excellent section on the General Theory of Statically Determinate Space Trusses and also a section on Henneberg's method of analysis which is not to be found in most texts on the Theory of Structures.

Although it makes but little difference as regards the use of the text for teaching purposes, Chapter III, which deals with influence lines and moving loads, might well have followed the Chapter IV on space structures, in the general arrangement of the book, as a second part. This subject is adequately treated for statically determinate girders and trusses both with and without floor systems, and lays a foundation for further treatment of indeterminate cases.

These first four chapters occupy about one half of the entire book and would be found suitable for a senior course of one term. The 180 problems, inserted in groups, following each main topic throughout these chapters, offer a wide choice of assignment by the instructor.

The second half of the book, which constitutes the third part referred to above, concerns itself with indeterminate structures and Chapter V deals with general theorems relating to elastic systems. The principle of superposition, Castigliano's two theorems, the reciprocal theorem of Maxwell and the Williot diagram form the bulk of it. More space should perhaps have been given to the subject of virtual work, the basis for which is established in the First chapter under the heading of virtual displacements. The general form of "The Work Equation" is not given. Structural analysis is tending more towards this method than towards an application of Castigliano's Theorems. Perhaps the authors feel that a greater interest in these valuable theorems should be revived but it is still obvious that the Theory of Virtual Work is the broader fundamental principle and, therefore, perhaps the more important from a teaching standpoint. To be sure, the method of fictitious loading is mentioned but it is not given sufficient attention to attract the student.

The deflection of pin-jointed trusses is dealt with at some length in Chapter VI. As is customary, this work is given as an example of the application of the theorems of the preceeding chapter and also serves as an introduction to the analysis of indeterminate structures. More detail might well have been devoted to the change of slope of beams and rotation of truss joints, which topics are now generally included in the term "deflection". This deficiency, however, is partly overcome in a subsequent chapter on the Slope-deflection method.

Statically indeterminate structures are treated by the customary methods. This work is given in Chapters VII and VIII, which deal with trusses and frames, including continuous beams, respectively. These chapters include influence-lines for trusses with redundant members and reactions, and also a brief treatment of the method of successive approximations, often called The Hardy Cross method. More emphasis should perhaps have been placed on the subject of side-sway, without a consideration of which, analysis by this method is generally inadequate.

The final chapter considers the analysis of arches and includes the subject of frames and rings as additional illustrative material on the application of the method of elastic centers.

These last chapters are well illustrated by numerical examples but there are fewer problems than in the first half of the book. The problems are naturally more difficult. It is always easy for an instructor to secure satisfactory problems in these topics but for those who wish to make a close study of indeterminate structures without instructional assistance more problems would perhaps be desirable.

The reader will realize from the preceeding comments that this book does not pretend to be a complete treatise on The Theory of Structures. A number of topics have been either very briefly treated or omitted altogether. On account of the reputation of the authors, who have produced several excellent texts, one hardly need add that as an elementary text, the book is fundamentally sound and will make an excellent first course in the subject for senior students.

Professor of Applied Mechanics, University of Alberta, Edmonton, Alta.

ERRATUM

Lincoln's Incentive System, by J. F. Lincoln, was reviewed by E. D. Graham, Vice-President, Stevenson & Kellogg Ltd., Montreal, and not by E. D. Kellogg, as stated in the October 1946 issue of The Engineering Journal, Page 593.

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Charles F. Foell and M. E. Thompson. New York, Diesel Publications, c1946. 680 pp., illus., cloth.

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Radar, What it is:
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. . . Control and Planning of Maintenance with an Incentive Bonus Scheme, R. Talbot and G. F. Satow.
. . . The Application of Cyclone Theories to Centrifugal Spray Nozzles for Outputs up to 1,800 Gallons Per Hour, S. M. Doble and E. M. Halton.
. . . The Development of Gas Turbine Power Plants for Traction Purposes in Germany, R. H. Bright.
. . . An Electrical Potential Analyser, S. C. Redshaw.
. . . Experiments on the Reproducibility of Engine Conditions for Ring-Sticking Tests in a Single-Cylinder Petrol Engine, G. S. Cantle.
. . . The Prospects of the Steam Cycle in The Central Power Station, G. H. Martin.
. . . The Thirty-Second Thomas Hawksley Lecture—The Scientist in War Time, Edward Appleton.
. . . An X-Ray Method of Measuring Poisson's Ratio, R. F. Hanstock and E. H. Lloyd.

Philips' Gloeilampenfabrieken, N.V., Laboratoria, *(Philips' Industries Ltd.) Eindhoven (Holland)* **Separaat:**

1509—Die Herstellung von metallen nach den verfahren der sintermetallurgie und der zersetzungsmetallurgie by J. D. Fast.—1510—Berechnung der von einer halbwallen—langeantenne oberhalb einer evenen erde in einem bestimmten punkte hervorgebrachten elektrsichen feldstarke als funktion der antenne samtlich pro sekunde zuge-fuhrten energie I by K. F. Niessen.—1511—On the Effective Length of a Small Barkhausen Discontinuity by J. L. Snoek.—1512—Bestimmung der Magnetischen Permeabilitat aus widerstandsmessungen an eisendrahten verschiedener struktur bei frequenzen der grossenordnung 108 hertz im zusammenhang mit der grosse der weissenchen elementarbezirke by M. J. O. Strutt and K. S. Knol.—1515—The Potential curve of the Alkali Halide Molecules by E. J. W. Verwey and J. H. De Boer.—1516—Atomic Distances in Small Graphite Crystals and the Nature of the Bond by J. H. De Boer.—1518—The Residue and the Mechanism of Hearing by J. F. Schouten.—1524—Die Schmelzzeit von Schmelzsicherungen III by J. A. M. Van Liempt and J. A. de Vriend.—1525—Elektrische Feldstarke als Funktion der durch die antenne verbrauchten energie II by K. F. Niessen.—1526—Pupillenmessungen bei monochromatischem licht by J. A. M. Van Liempt and J. A. de Vriend.—1528—Diffusie van Gassen Door Metalen by J. D. Fast.—1529—Methodenzurkompensierung der Wirkungen Verschiedener arten von schroteffekt in elektronenrohren und angeschlossenen stromkreisen by M. J. O. Strutt and A. Van der Ziel.—1530—Fluctuations and Electron Inertia by C. J. Bakker.—1531—Die folgen einiger elektronent ragheitseffekte in elektronenrohren I. Theoretische Erlauterungen by M. J. O. Strutt and A. Van der Ziel.—1533—Physical Properties of Glasses I, by J. M. Stevels.—1534—Adsorption phenomena on massive metal surfaces measured by means of electrical contact resistances by J. J. Went.—1535—On some properties of electrical networks by W. Ninenhuis and F. L. Stumpers.—1537—Die Massanalytische bestimmung des titans by A. Claassen and J. Visser.—1538—Uber das akustische analogon der sommerfeldschen oberflachenwelle by K. F. Niessen.—1539—The determining factors of permeability by J. L. Snoek.

Queen's University. Department of Industrial Relations:

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Statens Skeppsprovningsanstalt. [Meddelande]. *(Publications of the Swedish State Shipbuilding Experimental Tank). [Goteborg]: No. 1, 1942—Statens Skeppsprovningsanstalt.—No. 2, 1943—Forsok Med Fiskebatsmodeller.—No. 3, 1944—Experiments with Bulbous Bows by Anders Lindblad.—No. 4, 1945—Propellers with Adjustable Blades; Results of Model Experiments by H. F. Nordstrom.—No. 5, 1945—Nogle Praktiske og Teoretiske Undersogelser om Modelpropellere by Jorgen Marstrand.*

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Report BMS106—Laboratory Observations of Condensation in Wall Specimens by Richard S. Dill and Herman V. Cottony.

PAMPHLETS, ETC.

Field Inspection and Testing Methods for the Maintenance of Power Lines and Insulators: A Series of Power Company Reports:

Reprinted from O-B Hi-Tension News.

Fundaciones de Los Edificios Asismicos:

Juan Kulik. Buenos Aires, Revista del Centro Argentino de Ingenieros y Union Argentina de Asociaciones de Ingenieros, 1946.

Hydraulic Machinery:

London, Hydraulic Association, (n.d.)

Institution of Mechanical Engineers which reaches its Centenary in 1947 (Its History & Works):

Alfred R. Stock. Practical Engineering, August 23, 1946.

Manpower and Material Requirements for a Housing Program in Canada:

Department of Reconstruction and Supply. Ottawa, King's Printer, 1946.

Mexican-American Conference on Industrial Research, Proceedings:

Sponsored by Armour Research Foundation of Illinois Institute of Technology. Chicago, September 30—October 6, 1945.

High Voltage and Heavy Current Research Laboratories of the Machinenfabrik Oerlikon near Zurich 1941:

H. Puppikofer. National Research Council of Canada, Ottawa, 1945. (Translated from Association Suisse des Electriciens Bulletin 33:34-44. 1942.)

High Voltage Equipment in the Ampere Laboratory of the General Electro-Ceramic Society at Ivry France:

R. Ruedy. National Research Council of Canada, Ottawa, 1945. (Translated from Revue Generale de l'Electricite: 14: 1923. 17: 1925. 37: 1935.)

Short Circuit and High Voltage Testing Laboratory of the Swedish General Electric Company (ASEA) at Ludvika (Sweden) 1934:

R. Kempo. National Research Council of Canada, Ottawa, 1945. (Translated from Revue Generale de l'Electricite 37: 1935.)

Organic Nitrogen Compounds:

Carbide and Carbon Chemicals Corporation. New York, c1946.

Post War Development of Road Motor Transport:

Section 1—Roads, H. E. Aldington; Section 2—Progress of Motor Vehicle Design and Construction, E. Guy Beaumont; Section 3—Traffic, J. S. Nicholl. Institution of Automobile Engineers, London, June 1945.

Reynolds' Number; Its Meaning and Significance:

J. Jennings. Emmott, London, 1946 (Mechanical World Monographs, 20.)

Soho Foundry:

W. K. V. Gale. Birmingham, W. & T. Avery Ltd., c1946.

Telling the Age of a U.S. Patent, Reissue, Design, or Trademark by its Number:

Invention, Inc. Washington, D.C.

Webster Baseboard Heating Technical Information:

Darling Brothers Ltd. Montreal, c1946.

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.

Date Book for Civil Engineers, Vol. 2. SPECIFICATIONS and COSTS:

E. E. Seelye. John Wiley & Sons, New York; Chapman and Hall,
(Continued on page 705)

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

Nov. 13th, 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 aksed 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 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 circumstance warrant such extension.

A **Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent ot 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

AMBROSE—HOWARD GEORGE, of London, Ont. Born at Toronto, April 21, 1918. Educ.: B.A.Sc. (Mining), Toronto, 1942; R.P.E., Ontario; 1937-38-40-41 (summers), with gold mining companies in Quebec and Northern Ontario; 1942-46, Lieut., R.C.E.M.E., O/C 31 & 36 Light Aid Detachments; and at present, instru'man., Canadian National Railways, London, Ont.

References: J. Ferguson, H. E. T. Haultain, J. R. Cockburn, W. J. T. Wright, W. S. Wilson, J. R. W. Ambrose.

BARRON—WILLIAM DONALD, of Montreal, Que. Born at Harriston, Ont., Sept. 12th, 1920. Educ.: B.Sc. (Mining), Queen's, 1943; 1938-39-40-41 and 42 (summers), various mines in Northern Ontario, underground work and asst. on engrg. staff; 1943-46, Lieut., R.C.E., Reinforcement Officer, Works Officer; and at present, inspector, sprinkler risk dept., Canadian Underwriters Association, Montreal, Que.

References: D. S. Ellis, R. A. Low, A. Jackson, V. R. Currie, J. J. Lefebvre, P. C. Ahearn.

CODE—ROBERT GEORGE, of 866 Richmond St., London, Ont. Born at Windsor, Ont., June 6th, 1919. Educ.: B.Sc. (Civil), Queen's, 1943; R.P.E., Ontario; O.L.S.; 1932-39 (summers), rodman, chainman, instru'man., asst. surveyor, with Crown Lands Dept.; Great Lakes Coastline Surveys; 1939-40 (summers), asst. surveyor, transmission line surveys, radial railway lands, roads and reservoirs, H.E.P.C. of Ontario; 1943-45, Lieut., R.C.E. (Army); at present, civil engr. and O.L.S. (private practice), London, Ont.

References: W. M. Veitch, E. V. Buchanan, G. N. Scroggie, R. Garret.

GREASON—JAMES W., of Riverside, Ont. Born at Sarnia, Ont., July 26th, 1916. Educ.: B.A.Sc., Toronto, 1939; R.P.E., Ontario; with Ford Motor Co. of Canada, as follows: 1937-38 (summers), millwright and power house depts., 1940-43, sr. dftsman., engrg. dept., design, layout and mtce. of foundry equipt., under divisional supervision, foundry dvn.; 1943-45, R.C.N.V.R., I/C Heat Treat. Dept., H.M.C. Dockyard, Halifax (7 mos.), I/C Machinery, H.M.C.S. Kapuskasing (4 mos.), Second I/C of Engrg. Dfting., R.C.N. Depot (7 mos.), with rank of Lieut. (E); 1946 to date, designing engr., engrg. dept., Ford Motor Co. of Canada, Ltd., Windsor, Ont.

References: A. D. Harris, G. Lusby, H. Lillie, V. W. MacIsaac, E. Chorolsky, C. Krassov.

HEAPS—JOHN MORTON, of Trail, B.C. Born at Vancouver, B.C., Feb. 7th, 1911. Educ.: 1928-30, Univ. of B.C.; R.P.E., British Columbia (by exam.); 1930-38, shop work, jr. dftsman., Heaps Engineering Co., Ltd., New Westminster, B.C.; 1938-40, dftsman and designer, i/c designing equipt. and preparing layouts during extensive reconstrn. of sawmill, Hammond Cedar Co., Ltd., Pt. Hammond, B.C.; 1940 to date, dftsman and designer, designing equipt. and preparing layouts for various additions and alterations to chemical and metall. plants and mines, Consolidated Mining & Smelting Co. of Canada, Ltd. Trail, B.C.

References: E. Mason, J. V. Rogers, A. C. Ridgers, S. C. Montgomery, G. H. Bancroft, T. W. Lazenby.

HUNT—THOMAS RICHARD, of Montreal, Que. Born at Moose Jaw, Sask., Jan. 21st, 1922. Educ.: B.Sc. (Chem. Engrg.), Sask., 1945; with British American Oil Refinery, as follows: 1945-46, asst. chemist, Moose Jaw, 1946 to date, asst. engr., Montreal East refinery.

References: R. A. Spencer, E. K. Phillips, . M. Fraser, R. F. A. Smith, S. Henry,

MACKENZIE—BRUCE HUGH, of Sarnia, Ont. Born at New Toronto, Ont., March 10th, 1916. Educ.: B.A.Sc., Toronto, 1938; R.P.E., Ontario; 1938-39, study of plant operations, lab. analyses and synthesis, Jordan Wire Co., Ltd.; 1939-40, chem. engr., chem. and mech. operations and research, new processes and control of existing operations; with Imperial Oil Limited, Sarnia, as follows: 1940-41, dftsman., 1941-43, inspector, refinery equipt., 1943-44, loaned by I.O.L. to St. Clair Processing Corp., to set up inspection organization as chief inspector involving study of corrosion problems, supvr., constrn. and design of new pressure equipt. and routine inspecn. of plant equipt. and fire protection facilities, and at present, development engr.

References: T. Montgomery, G. L. MacPherson, C. P. Warkentin, F. F. Dyer, W. A. Williams.

MACPHERSON—IAN JAMES, of Cornwall, Ont. Born at North Ronaldshay, Orkney Islands, July 2nd, 1897. Educ.: 1919-24, apprentice, British Electric; with Dryden Paper Co., Ltd., as follows: 1924-28, electrical mtce., 1928-30, dfting, paper mill extensions, barking drums, diffusers, trusses, 1930-40, mech. supt. i/c constrn. mtce., power, hydro and steam; 1940-46, Otis Fensom Elevator Co., Ltd., Hamilton, plant engr., instln. of machine tools, bldg. alterations, mtce. machine tools, fire protection, power—hydro and steam, estimating for improvements; at present, engr. planning and supervising extensions to mill, Howard Smith Paper Mills, Cornwall, Ont.

References: E. G. Wyckoff, W. J. W. Reid, W. D. Black, J. S. Wilson, A. R. Hannaford.

MENS—JOHN RODERICK, 21 Admiral Road, Toronto, Ont. Born at Toronto, Ont., Nov. 8th, 1917. Educ.: B.A.Sc. (Mech.), Toronto, 1944; 1941-42 (summers), Canadian General Electric, foundry; Canada Packers Ltd.; with Canadian Kodak Co., Ltd., Toronto, as follows: 1943 (summer), 1945 to date, mech. engr., design dfting. and instln., engrg. and mtce. dept.

References: H. H. Tate, G. R. Lord.

NASH—CHARLES WOODS, of Vancouver, B.C. Born at Spokane, Wash., October 6th, 1901. Educ.: B.Sc. (Civil Engrg.), Washington State Coll., Pullman, Wash., 1923 (accredited E.C.P.D.); R.P.E., B.C.; Member, A.S.C.E.; 1928-29, bridge engr., State of Calif.; 1929-31, genl. supt., bridge constrn., Portland, Oregon, Gilpin Constrn. Co.; 1931-39, locating and constrn. engr., bridges and highways, State of Wash.; 1939-41, consultg. engrg. practice, State of Wash.; 1941-42, project engr., U.S.N. and U.S. Army on Alaska Defences; 1942, engr. i/c project U.S. Army, Prince Rupert, B.C., and Annette Island, Alaska; 1943 to date, managing-dir., Highway Construction Co., Ltd., Vancouver, B.C.

References: N. D. Lambert, H. C. Anderson.

ROCHESTER—DONALD HARVEY, Major, R.C.E., of Kingston, Ont. Born at Toronto, Ont., Aug. 26th, 1917. Educ.: B.A.Sc., Toronto, 1941; R.P.E., Ontario; 1937-38 (summers), asst. geologist and geologist, Canadian Nepheline Ltd.; 1939 (summer), jr. engr., International Nickel Ltd., Levack, Ont.; 1940 (summer), miner, Coniarum Mines, Schumacher, Ont.; with R.C.E., as follows: 1941-42, Instructor, Petawawa, 1942-43, 2nd in Com., 24th Field Co., 1943-45, O/C 24th Field Co., 1945-46, Command Fire Protection Officer, Pacific Command, and at present, Major (Permanent Force), attending Staff College of Canada, Royal Military College, Kingston, Ont.

References: W. G. Swan, N. C. Sherman, C. N. Mitchell, A. J. Kerry, W. Scales, H. H. Minshall.

SANDBROOK—KENNETH JAMES, Capt., R.C.E., of C.M.H.Q., London, England. Born at Weston-super-Mare, Somerset, Eng., Nov. 9th, 1902. Educ.: Westminster Tech. Institute, London, Eng., 1920-22; Polytechnic, Regent St., London, 1922-25; Avery School of Architecture, Columbia Univ., New York, 1927-28; Associate, Royal Institute of British Architects (A.R.I.B.A.); various advanced engrg. courses during 5½ yrs. service with R.C.E.; 1921-24, engrg.tech. asst., Kleine Pat. Fire-Resisting Constrn. Synd., London; 1924-25, engrg. and arch. dftsman., Woolworth Constrn. Co.; 1925-27, engrg. and arch. dftsman., H.M. Office of Works (Civil Service); 1927, arch., dftsman., Raymond Hood, Godley & Fouilhoux, N.Y. City; 1928, arch. dftsman, York & Sawyer, N.Y. City; 1921-31, sr. arch. dftsman., Ross & Macdonald, Montreal; 1931-32, sr. arch. and engrg. dftsman., Terminal Architects & Engrs.; Hugh G. Jones; Monsarrat & Pratley; 1932,33, engrg. asst., deGaspe Beaubien, Montreal; 1934-36, sr. arch. asst., William & Edward Hunt, London; 1936, office mgr. and tech. asst., Alister MacDonald; 1936-40, asst. arch., National & Prov. Bank. Ltd.; 1940-46, worked on all types of constrn. work in supervisory capacity, this includes 3 yrs. with No. 5 Canadian Artizan Works Coy., R.C.E., Section Officer I/C many large military engrg. undertakings, at present, Staff Officer, Canadian Military H.Q., London, Eng.

References: deG. Beaubien, P. L. Pratley, L. P. Baker, E. V. Collier, M. J. Spratt.

SHOPSOWITZ—DAVID, 149 Pendrith St., Toronto, Ont. Born at Toronto, Jan. 10th, 1915. Educ.: B.A.Sc. (Elect.), Toronto, 1946; 1936-46 (summer months), supervision of power plant at Monteith Inn, Rosseau, Ont., considerable engrg. experience in not only elect. mtce., but hydraulic mech. and sanitary engrg.; Inn has its own A.C. and D.C. plants, steam plant with H.P. boiler, water supply systems involving use of both centrifugal and reciprocating pumps, complete high capacity sewage system, new and additional improvements, applicant's design (owner of Inn); winter months, demonstrator elect. engrg., Univ. of Toronto.

References: C. R. Young, W. S. Wilson, R. F. Legget, C. F. Morrison, G. R. Lord.

SKENE—ALEXANDER WILBERT, of East Calgary, Alta. Born at Calgary, Alta., Dec. 6th, 1921. Educ.: B.A.Sc., British Columbia, 1946; 1940, (summer) rodman, Dept. of Transport; with Imperial Oil Limited, as follows: 1941-42-43-44 (summers), dfting., 1945 (summer), jr. engr., and at present, sr. engr., Calgary Refinery, East Calgary, Alta.

References: W. D. Suitor, F. C. Tempest, J. Hanna, J. N. Ford, T. D. Stanley.

SVENNINGSON—FREEMAN, 3495 Stanley St., Montreal, Que. Born at Montreal, July 1st, 1914. Educ.: Mech. Engr., Cornell, Ithaca, N.Y., 1938 (accredited E.C.P.D.); 1938-41, dftsman., Shawinigan Engrg. Co., Ltd., Montreal; with R.C.N., Engr. Officer, Designing, as follows: 1942, Watchkeeping Officer, H.M.S. Devonshire, 1943, Engr. Training Officer—Staff Capt. D, Halifax, for ships working up, 1944-45, Sr. Engine Room Watchkeeping Officer and Damage Control Officer, H.M.C.S. Uganda; at present, designing dftsman., Shawinigan Engineering Co., Ltd., Montreal.

References: J. A. McCrory, A. L. Patterson, R. E. Heartz, J. B. Macphail, W. Sharples, L. A. Duchastel.

WOLF—SUMER, of Port of Spain, Trinidad, B.W.I. Born at Patrauti, p.S., Bucovina, Roumania, March 3rd, 1913. Educ.: Engineer (Dipl.), German Technical University, Bruenn, Czechoslovakia, 1935; British subject by naturalization; 1936-38, Elec. engr., Drexler Constrn. Co., Bucharest, Roumania, i/c, (a) part of electrical erection work of the "Metrom" (Metalurgica Romana), an armament factory, at the time under constrn. in Brasov, Transylvania; (b) erection elect. equipt. for "Distributia" Oil Co. of Ploesti, Roumania; (c) elect. workshops of the co.; for short period after graduation worked as elect. engr. at Western Moravian Elect. Power Stn., Czechoslovakia; 1938-43, chief engr., i/c mtce. work in boiler plant, processing and refinery plants, supervised erection, running and mtce. of Diesel elect. power plant and remote-controlled pumping stn., erected and maintained 2 cold-storage plants, supervised erection bldgs. and machinery of tinplant, Coconut Growers' Assn. & Trinidad Packages Ltd.; also, erected Diesel plant and some machinery of Cooperative Lime Growers' Assn., Tobago; (1940-46, lecturer, workshop processes and materials and engrg. drawing at Board of Industrial Training of Trinidad, training apprentices); with Trinidad Government Railways, Port of Spain, Trinidad, as follows: 1944 (4 mos.), works mgr., 1944 to date, mech. engr., responsible to genl. mgr. for tech. and administrative part of loco. dept., preparation repair programmes, boiler inspecn., statistics, estimates, etc.

References: J. H. Reid, F. G. Wrigley, P. R. Gransaull, L. R. Gransaull.

FOR TRANSFER FROM JUNIOR

BARTLETT—EWART H., of St. John's, Nfld. Born at Millertown, Nfld., March 29th, 1919. Educ.: B.Eng. (Elec.), N.S. Tech., 1939; 1939-40, test course, Can. Gen. Elec. Co., Peterboro; with Calgary Power Co. as follows: 1940-42, operator, hydro electric plant; 1942-43, construction storage dam; 1943-44, transmission and distribution design; 1944 to date, engineer, designing and supervising renewal of some city feeders, new lighting circuits for City Council, new constrn. for Housing Corporation Village for Nfld. Light & Power Co. (St. 1939, Jr. 1946)

References: L. M. Howe, E. Dickinson, H. B. LeBourveau, J. N. Ford, W. R. Davis, T. D. Stanley.

BRICELAND—EMMETT V., 15 Grassmere Road, Toronto. Born at Wolfe Island, Ont., March 25th, 1913. Educ.: B.Sc. (Mech.), Queen's, 1937; R.P.E., Ont.; with Can. Gen. Elec., as follows: 1937-38, test course; 1938-39, departmental plan course; 1939-41, asst. wiring device engr.; 1941-43, test engr., Canadian Kodak Co. Ltd.; 1943 to date, managing engr. i/c design constr. and mech. and elect. mtce., Elevator Specialty Co. Ltd. (St. 1937, Jr. 1946)

References: D. S. Ellis, C. E. Sisson, W. Cruthers, G. R. Langley, E. F. Good, L. Christie.

DUMARESQ—JAMES PHILIP, of Windsor, N.S. Born at Halifax, N.S., Dec. 4th, 1916. Educ.: B.Eng., N.S.T.C., 1939; M.Sc. (Civil Engrg.), M.I.T., 1946, (accredited E.C.P.D.); 1936-37, dftsman., S. P. Dumaresq., architect; 1937 (3 mos.), dftsman., Dominion Bridge Co., Lachine; 1937-38, genl. arch.'s asst., responsible for supvr. small jobs, drawing plans and specifications; 1939 (5 mos.), asst. field engr. responsible for lines and grades, checking forms and reinforcing, weekly estimates of work completed, Foundation Co. of Canada, Arvida, Que.; 1939-45, Major, R.C. Artillery; at present, reinf. concrete project engr., responsible for design and instln. of approx. 4,000 yds. of concrete, Canadian Gypsum Co., Windsor, N.S. (St. 1939, Jr. 1946)

References: W. H. Noonan, F. H. Sexton, I. P. MacNab, P. A. Lovett, A. P. Foulis, R. B. Paul, J. B. C. Proctor.

FRASER—CAMPBELL, of Stratford, Ont. Born at Fitch Bay, Que., July 10th, 1909. Educ.: B.Sc. (Civil), Queen's, 1934; R.P.E., Ontario; with Dept. of Highways, as follows: 1934-37, instrumn. and rodman; 1937-38, asst. div. engr. i/c constrn. 1939-45, Royal Canadian Engineers, rank of Captain, subsequently Major, doing mech. equipt. advisory work; 1945 to date, asst. div. engr., Dept. of Highways, Ontario. (Jr. 1936)

References: D. S. Ellis, W. L. Saunders, A. A. Smith, T. F. Francis, S. T. McCavour.

HOPKINS—PETER McMILLAN, of Montreal. Born at Stroud, England, Feb. 16th, 1918. Educ.: Graduate, R.M.C., 1938; 1938-39 (summers), underground work, Hard Rock Gold Mines, Geraldton, Ont., mining engrg., Lamaque Mine, Bourlamaque, Que.; 1939-45, Lieut. subsequently Major, R.C.O.C.; 1944-45 (overseas), Commanding 2nd Can. Div. Ordnance Field Park during invasion of the Continent; to date, transm. and R/W Division, Quebec Hydro-Elec. Comm. Montreal. (St. 1939, Jr. 1946)

References: R. N. Coke, R. W. Farmer, G. J. Dodd, L. F. Grant, R. DeL. French, G. Molleur, L. O'Sullivan.

LOVE—JOHN GORDON, 321 Bloor St., Toronto. Born at Toronto, Nov. 14th, 1920. Educ.: B.A.Sc. (Civil), Toronto, 1943; R.P.E., Ont.; 1941-42 (summers), dftsman. and asst. engr., Peterboro Utilities Commission; student testing engr., H.E.P.C. of Ont.; 1943-46, Lieut., R.C.E., as follows: 6 mos. Mtce. Officer, Motor Transport Coy., Petawawa, Ont.; 10 mos. O/C Bomb Disposal Squad., H.Q. Pacific Command; 6 mos. Area Engineer Officer, i/c mtce. of all Canadian Army Instalns. in Prince Rupert, B.C.; to date, research asst. Dept. of Civil Engrg. Univ. of Toronto. (St. 1941, Jr. 1946)

References: R. F. Legget, R. L. Dobbin, W. P. Dobson, C. F. Morrison, H. C. Ross.

McNAUGHTON—ANDREW ROBERT LESLIE, 160 Laurier Ave., Ottawa. Born at Guilford, England, July 21st, 1916. Graduate, R.M.C., 1938; partial course on science and arts for one year, McGill; 1939-46, Officer Commanding, R.C.A.F., doing test and developt. establishment work at Rockcliffe, Ont.; at present, President of Norcan Ltd. ,Ottawa, exporters and importers of engrg. equipt. (St. 1937, Jr. 1946)

References: L. G. Grant, E. C. Perley.

NADEAU—LEOPOLD M., of Outremont, Que. Born at Montreal, Nov. 29th, 1913. Educ.: B.A.Sc., C.E., Ecole Poly., 1936; R.P.E., Quebec; 1936, Res. Engr., Quebec Roads Dept.; 1937 to date, as follows: engineer, Canadian Underwriters' Association; asst. registrar, Corporation of Professional Engineers of Quebec. (St. 1936, Jr. 1946)

References: M. Boyer, J. B. Stirling, L. Trudel, E. A. Ryan, A. J. Wise.

SEIFERT—HAROLD LORNE BAIN, of Kapuskasing, Ont. Born at Quebec City, March 22nd, 1915. Educ.: B.Eng. (Chem), McGill, 1937; 1937, Kimberley Clark Corp., Niagara Falls, Ont.; 1938-40, Canadian Cellucotton Products Co. Ltd., Niagara Falls; 1941-45, Welland Chemical Works, Niagara Falls; 1945 to date, tech. supt., Spruce Falls Power & Paper Co. Ltd., Kapuskasing. (St. 1936, Jr. 1946)

References: R. Del. French, C. W. Boast, J. A. Ferrier. R. S. Walker, G. M. Minard, L. A. Wright.

SCOTT—WALTER BARRETT, of Baie Comeau, Que. Born at Toronto, Ont. July 10th, 1917. Educ.: B.Eng. (Civil), McGill, 1944; R.P.E., Quebec; 1939-41-42, (summers), machine tool fixture design, Union Twist Drill Co., Rock Island, Que.; with Howard Smith Paper Mills, as follows: 1943 (6 mos.), design and layout work, surveying and constrn. with barking plant; 1944-45, same work, plastics mfg. plant; 1945-46 (15 mos.), Royal Canadian Engineers; at present, woods engr. and party chief., misc. survey and constrn. work, Quebec North Shore Paper Co., Baie Comeau, Que. (St. 1941, Jr. 1946)

References: R. Del. French. H. E. Meadd, E. Brown. A. L. Farnsworth, G. J. Dodd, H. Kennedy.

SIMPSON—JACK LLOYD, of Winnipeg, Man. Born at Saskatoon, Sask., Feb. 20th, 1920. Educ.: B.Sc. (Civil), Alberta, 1943; 1940-41 (summers), rodman, highway location and constrn., Dept. of Highways, Alberta; seismographic survey, Imperial Oil Ltd.; with Alaska Highways, as follows: 1942 (summer), instrumn; 1943 (4 mos.), Jr. highways engr., U.S.P.R.A.; 1943-46, Lieut., R.C.E., Engrg. Works Officer, building and constrn. mtce., Calgary, Alta.; 1946 (6 mos.), sessional instructor and lecturer in concrete and surveying, Univ. of Alberta; 1946 to date, mgr., Insulation Industries (Man.) Ltd., cold storage projects, lightweight concrete roof deck, acoustical jobs, Winnipeg, Man. (St. 1943, Jr. 1945)

References: R. S. L. Wilson, R. M. Hardy, I. F. Morrison.

STEIMAN—MORRIS IRVIN, of Winnipeg, Man. Born at Winnipeg, Sept. 26th, 1918. Educ.: B.Sc. (Civil), Manitoba, 1941; 1941 (7 mos.), asst. engr. on constrn. of shell filling plant, Carter Halls Aldinger Ltd.; 1942, Lieut., R.C.E.; 1946 technical officer, reconstruction, Public Works of Canada, Winnipeg, Man. (St. 1939, Jr. 1946)

References: P. E. Doncaster, E. V. Gilbert, G. H. Herriot, A. E. Macdonald, V. C Hamilton.

TAYLOR—BRUCE SMITH, of Winnipeg, Man. Born at Dundee, Scotland, June 1st, 1908. Educ.: B.Sc. (Chem. Eng.), Queen's, 1929; with Bell Telephone Co., as follows: 1930-33, facilities engrg., Quebec district traffic dept.; 1933-35, facilities and budget engrg. as asst. to divn. supervisor; 1935-39, equipt. engrg. cost studies, general traffic dept., eastern area; 1939-45, leave of absence, war service; 1946, Industrial Development Bank as investigating engr., examine and report on land, buildings, machinery and process of industrial concerns in connection with their applications for financial assistance, Winnipeg, Man. (St. 1929, Jr. 1946)

References: C. L. Brooks, L. D. McGee, H. Bush, J. Clark, G. F. Taylor.

WOODHALL—THOMAS LATIMER, of Winnipeg, Man. Born at Winnipeg, Jan. 29th, 1908. Educ.: B.Sc. (Elec.), Manitoba, 1930, and M.Sc., Manitoba, 1934; R.P.E., Man.; 1930, test course, Can. Gen. Elec. Co., Peterboro; 1931-33, demonstrator, eng. lab., Univ. of Man.; 1934-35, elec. design, Northwood & Chivers, Archs.; 1935-38, asst. mech. supt., Winnipeg Free Press; with Manitoba Power Commission, as follows: 1938-40, Chief dftsman.; 1940 to date, elect. and design engr. (St. 1930, Jr. 1946)

References: E. P. Fetherstonhaugh, L. Mackay, J. W. Tomlinson, T. E. Storey, E. V. Caton, J. W. Sanger, D. A. McCuaig, D. Hunter.

FOR TRANSFER FROM STUDENT

ILLASZEWICZ—JERZY, of Parent, Que. Born at St. Petersburg, Russia, Nov. 2, 1911. Educ.: Scientific study at Lwow Univ., Poland, 1932-38; B.A.Sc. (Mech.), Toronto, 1946; 1938-39, Airforce Research Institute, technical supervising of test flights, Poland; 1940, Olaer Camp, Paris, France, i/c of tests of hydraulic equipt. for aircraft; 1941-42, engr. and stress analyst, Ministry of Education, France, doing designing of gliders and repairs and mtce. of transport equipt.; 1944, asst. plant superintendent and general foreman of Canadian Wooden Aircraft Ltd., Toronto, Ont.; 1944-46, mech. engr. with E. B. Eddy, doing all kinds of engrg. jobs, chiefly in civil, design, of bridges, and constrn. of roads, Parent, Que.

References: W. Czerwinski, E. A. Allcut, R. C. Wiren, J. Pawlikowski, G. R. Lord.

LIBRARY NOTES *(Continued from page 703)*

London, 1946. 325 pp., diagrs., charts, tables, 12 x 9¼ in., fabrikoid, $6.75.

Under the following headings this volume presents typical specifications to serve as a guide for the practising engineer; structural specifications, airports, roads, railroads, bridges, docks, dams, drainage, sewers, sewage treatment, and water. Section VIII on costs provides the engineer with a framework of relative costs of materials, equipment and labor, and by relating these costs to the Engineer News-Record cost indexes, as indicated, effective working figures may be realized. A seventy-page, classified glossary concludes the book. Vol. I of this series presented a comprehensive collection of design data. Vol. III will cover field practice.

DESIGN and CONSTRUCTION of CONCRETE ROADS:

R. A. B. Smith and T. R. Grigson. 2 ed. Concrete Publications, Ltd., 14 Dartmouth Street, London, S.W.1, England, 1946. 208 pp., illus., diagrs., charts, tables 9¼ x 6½ in., cloth, 5s.6d.

Beginning with the siting and planning of highways, this book proceeds to a full discussion of the materials and methods employed in modern highway construction. The treatment is practical throughout, including the brief design chapter. Maintenance and repair are considered, and technical data on concrete testing procedures and soil classification methods are appended.

(Continued on page 710)

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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, 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.

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, 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 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 with construction experience wanted as assistant to sales manager in a Montreal electrical supply service company. Salary according to experience. Apply to File No. 3611-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.

MECHANICAL

JUNIOR MECHANICAL ENGINEER to be trained as plant engineer and assistant to plant manager in an industrial plant in central Quebec. Must be bilingual. Salary from $225. Apply to File No. 3658-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.

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

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.

JUNIOR ENGINEERS, recent graduates up, required by an organization in Montreal for the inspection of buildings for fire hazards, etc. Bilingual preferred. Salary about $200. Apply to File No. 3651-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.

INDUSTRIAL ENGINEER with at least ten years experience required by a manufacturer in Montreal. Salary open. Apply to File No. 3662-V.

JUNIOR MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary from $175. 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.

MECHANICAL OR AERONAUTICAL ENGINEER with about five years' aeronautical experience required as service engineer at an airport in Western Canada. Salary from $200. Apply to File No. 3665-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.

SAFETY ENGINEER, preferably with considerable industrial experience, required by a brewing company with headquarters in Montreal. Salary from $375. Apply to File No. 3670-V.

CIVIL OR MECHANICAL ENGINEERS with some industrial experience required as plant engineers by a brewing company with headquarters in Montreal. Salary from $350. Apply to File No. 3670-V.

JUNIOR ENGINEERS, under 30, preferably with shop or industrial experience, required by an Ontario paper company for training as designers. Salary $200 plus board and lodging while under training. Preference to veterans. Apply to File No. 3676-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.

CIVIL OR MECHANICAL ENGINEER, age 28-35, with at least five years industrial or construction experience, required by a Montreal firm for training as branch manager for the Toronto area. Salary open. Apply to File No. 3681-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.

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

CHEMICAL

CHEMICAL ENGINEER, recent graduate up, required by a petroleum refining company in Montreal for process and design work. Salary about $200. Apply to File No. 3575-V.

CHEMICAL ENGINEERS, age 22-35, recent graduates up, are required by a Montreal firm for development work, maintenance, design and construction in explosives field. Sales and technical service representation to paper and textile industries. Salaries according to qualifications. Apply to File No. 3588-V.

CHEMICAL ENGINEER, Ph.D. or M.Sc. Specialized in physical chemistry, required by industrial organization in Montreal area as member of organic research team. Salary open. Apply to File No. 3596-V.

CHEMICAL ENGINEER, under 30, required for the patent department of a large industrial organization in Montreal. Salary from $200. Apply to File No. 3609-V.

CHEMICAL ENGINEERS OR CHEMISTS for analytical work in the laboratory of an industrial firm in Central Ontario. Salary from $175. Veteran preferred. Apply to Fil.e 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 AND RESEARCH CHEMISTS with considerable experience required by an industrial organization in the St. Maurice Valley. Salary open. Apply to File No. 3644-V.

CIVIL

TWO CIVIL ENGINEERS are required to act as senior and junior structural designers respectively with a steel company in Southern Ontario. Apply to File No. 3389-V.

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to File No. 3394-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 ENGINEER, recent graduate, required by a firm of consulting engineers in Montreal, to assist Engineer in charge of field work in Ont. Salary $175 up. Apply File No. 3518-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 ENGINEER to be superintendent of construction with a contractor in Montreal. Salary according to qualifications. Apply to File No. 3558-V.

CIVIL ENGINEER, recent graduate up, to be assistant to town engineer of a town in the Montreal area. Permanent position. Salary from $175 up. Apply to File No. 3569-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 3 or more years' experience on design of industrial buildings, equipment, supports and foundation work, is required by a Montreal firm for structural design work in steel, timber and reinforced concrete. Salary $200 up. Apply to File No. 3588-V.

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.

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 ENGINEERS, age 30 to 40. 5 to 10 years experience, for estimating design and general engineering for large public utility in Toronto area. Apply to File No. 3429-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 a junior position in the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-V.

ELECTRICAL ENGINEER DRAUGHTSMEN, preferably with pulp and paper experience, required by a paper company in Montreal. Salary open. Apply to File No. 3610-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 experience in the design of electrical circuits required by an industrial organization with headquarters in Montreal. Salary open. Apply to File No. 3644-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.

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.

STEAM PLANT SUPERVISOR—Manufacturer with several plants in Ontario and Quebec requires an active man with technical training and field experience in efficient steam plant operation. Apply to File No. 3406-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, recent graduate, for technical service and plant operation with a manufacturer in the Montreal area. Successful candidates will have two-year training course in U.S. Apply to File No. 3476-V.

MECHANICAL ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

MECHANICAL ENGINEER with at least five years' industrial experience, knowledge of plant layout, equipment design and cost estimating and preferably experience in chemical industry. Salary $275-$325. Apply to File No. 3553-V.

MECHANICAL ENGINEER with considerable experience in heating and ventilation, etc., required by a firm of consulting engineers in Montreal. Salary open Apply to File No. 3565-V.

MECHANICAL ENGINEERS with experience in heating and ventilating or the pulp and paper industry or with general mechanical layout and design work are required by a firm of consulting engineers in Montreal. Salary from $250-$350 according to experience. Apply to File No. 3568-V.

MECHANICAL ENGINEER, recent graduate, for junior position in the design department of a firm in Central Ontario making special heavy duty mobile equipment. Apply to File No. 3572-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 some electrical experience for the design department of an industrial concern in the Montreal area. Salary open. Apply to File No. 3574-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, preferably with mining experience, age 25-35, required by a manufacturer in Montreal to do estimating or design work on mining equipment and assist in sales. Salary according to experience. Apply to File No. 3589-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.

MECHANICAL ENGINEER with five to ten years industrial experience and familiar with the layout and construction of chemical plants, required by a manufacturer in the Montreal area for plant design and construction. Salary from $300. Apply to File No. 3605-V.

MECHANICAL ENGINEER with experience in the automotive business and the maintenance of all types of internal combustion engines required by an oil company in the Montreal area. Salary open. Apply to File No. 3608-V.

MECHANICAL ENGINEER with at least five years industrial experience required by a textile firm with headquarters in Montreal. Salary open. Apply to File No. 3615-V.

COMBUSTION ENGINEER, MECHANICAL, preferably with five years industrial experience, required by a textile firm with headquarters in Montreal. Salary from $300. Apply to File No. 3615-V.

MECHANICAL ENGINEER with at least five years' experience of aluminum processing, plant design and operation, etc., required for Aluminum production organization in Australia. Limited contract. Salary open. Apply to File No. 3620-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.

MECHANICAL DRAUGHTSMAN with experience in power house layouts required by an engineering firm in Toronto. Salary open. Apply to File No. 3630-V

MECHANICAL ENGINEER, bilingual, with shop or automotive experience, required for equipment maintenance by a manufacturer in the Montreal area. Salary open. Apply to File No. 3631-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 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 DRAUGHTSMEN, graduates preferred, with experience in shop and field erection, required for design of coal and oil fired heating and steam systems by an industrial firm in Montreal. Salary open. Apply to File No. 3647-V.

MECHANICAL ENGINEER with knowledge of machine tools, age about 35, required in Montreal for work in connection with purchase, design, re-conversion and sale of machinery. Salary $300-$400. Apply to File No. 3648-V.

METALLURGICAL

METALLURGIST, age 25-30, veteran, experience in Metallurgical Laboratory or Mine Assay office and Mining Mill practice decided advantage, required by a Montreal firm to be trained for Sales Representative. Salary depending on experience. Apply to File No. 3588-V.

MISCELLANEOUS

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual, with some practical experience, is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. Apply to File No. 3307-V.

CHIEF DRAUGHTSMAN to take charge of engineering department, draughting room and estimating for machinery manufacture in Sherbrooke. Apply to File No. 3430-V.

ENGINEERING DRAUGHTSMAN required by an industrial concern in Three Rivers for all round employment in a permanent position. Apply to File No. 3443-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.

ELECTRICAL OR MECHANICAL ENGINEERS interested in transportation, with experience in the transportation field or machine shop practice or automotive services, maintenance and operation. Salary according to qualifications. Apply to File No. 3456-V.

MECHANICAL OR ELECTRICAL ENGINEER under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-V.

CIVIL OR MECHANICAL ENGINEER with experience in construction required by a Montreal firm to estimate value of work done and to inspect during construction concrete and steel bldgs. Salary open. Apply to File No. 3486-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-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 qualificatons. Apply to File No. 3524-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.

CIVIL OR MECHANICAL ENGINEERS, preferably with pulp and paper experience, required for engineering and operating staff of a large Ontario corporation. Salary according to qualifications. Apply to File No. 3554-V.

CHEMICAL OR MECHANICAL ENGINEERS, age about 30, with at least five years' experience in the paper industry, required by an Ontario Company to train for executive positions. Salary open. Apply to File No. 3554-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.

CIVIL OR MECHANICAL ENGINEER with construction experience required by an Ontario firm manufacturing and installing building specialties for industrial plants. Salary open. Apply to File No. 3567-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.

MECHANICAL AND ELECTRICAL DRAUGHTSMEN required by a Montreal firm. Must have working knowledge of equipment layout, architectural, piping and design. Salary from $200 up. Apply to File No. 3588-V.

MECHANICAL AND ELECTRICAL ENGINEERS, from recent graduates up, are required for mechanical and electrical maintenance, also design phases of project engineering work, by a Montreal firm. Salaries according to qualifications. Apply to File No. 3588-V.

GRADUATE ENGINEERS required as Development Engineer and Assistant to Sales Manager by a Montreal firm. Industrial, also sales and administrative experience necessary. Salary $200 up according to experience. Apply to File No. 3588-V.

INDUSTRIAL ENGINEER, 5 years' experience industrial manufacturing or process work, required by a Montreal firm for study and co-ordination of plant work. Salary $295 up according to qualifications. Apply to File No. 3588-V.

CHIEF DRAUGHTSMAN, under 35, 5-12 years' experience in drawing office, Including year or more as squad boss, required by a Montreal firm. Salary $225 up. 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 ENGINEER, capable of assuming responsibilities of designing structures and equipment layouts of steam plants, hydro-electric developments, etc., required by an industrial corporation in Montreal. Salary from $350 according to experience. Apply to File No. 3603-V.

HYDRAULIC ENGINEER, familiar with hydraulic machinery design, installation, stream functions and runoff computations, etc., required by an industrial corporation in Montreal. Salary from $300 according to experience. Apply to File No. 3603-V.

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 DRAUGHTSMAN with experience in design and controlling a design staff required for both structural and equipment work by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-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.

GRADUATE ENGINEER, bilingual, required for senior position on the Montreal sales staff of a firm manufacturing and installing mechanical equipment in buildings of all types. Veteran preferred. Salary open. Apply to File No. 3622-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.

SALES ENGINEER to call on Industrial and Municipal engineers and executives across Canada. Returned man, under 40 with knowledge of mill pipe layout practice preferred. Position with future in nationally known firm, headquarters Toronto. Salary and expenses. Apply to File No. 3636-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, ELECTRICAL 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.

ENGINEERING DRAUGHTSMEN with survey experience for the lands department of a public utility with headquarters in Montreal. Salary open. Apply to File No. 3644-V.

EXPERIENCED INSTRUMENT MAN for field work required by an engineering company with headquarters in Montreal. Salary open. Apply to File No. 3644-V

JUNIOR ENGINEERS, recent graduates up, required by an organization in Montreal, for the inspection of buildings for fire hazards, etc. Bilingual preferred. Salary about $200. Apply to File No. 3651-V.

Situations Wanted

MECHANICAL ENGINEER, S.E.I.C., married, age 35, wants more suitable work. Experienced in Mechanical, Aeronautical, Civil and Forestry engineering, with over 7 years in responsible positions involving organization, getting along with people and fast control of new problems. Speaks several languages; has experience as Draughtsman, Foreman, Inspector, Plant Engineer, Assistant to Plant Superintendent and Designer; also in hydraulics, thermodynamics and stress analysis. Will accept responsible position anywhere with assured family accomodation near work. Prefers Airlines, Paper Industry, Mining or any expanding enterprise where technical ability in organising would be welcome. Desired salary $300 a month. Apply to File No. 140-W.

CHEMICAL ENGINEER, graduate in 1939, Jr.E.I.C., veteran, considerable experience in development and process control and quality control as well as some experience in production work, desires change. Employment since graduation, except for time in the services, has been with a large chemical manufacturing company. Montreal or Toronto areas preferred. Apply to File No. 798-W.

ELECTRICAL ENGINEER, Jr.E.I.C., age 26, B.Sc. (Man.) '42, E.M.E. Canadian Army for 4 years, in charge of workshop units engaged in the maintenance and repair of precision optical and mechanical instruments. Position of responsibility desired in research, power, traction or mechanical line. Ontario or western area preferred. Apply to File No. 1537-W.

MECHANICAL ENGINEER, M.E.I.C., P. Eng., age 28. Five years experience including plant layout and design; plant engineering and works and building maintenance; maintenance of trucks, tractors, cranes and small ships. Aircraft project and service engineer, design of modifications and failure investigation, power plant, engine, propeller, etc. Good organizer and ability to handle men. Engineering Officer, Royal Canadian Navy. Desires sales or plant engineering position in Montreal area. Available two weeks notice. Apply to File No. 1658-W.

SALES ENGINEER, Jr. E.I.C., P. Eng., Que., age 32, B. Eng. McGill in Mechanical, experience in sales, design and plant engineering. Married. Bilingual Location immaterial. Veteran. Available on short notice. Apply to File No. 1692-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, B.Sc. (Civil), M.E.I.C., services available. Thorough knowledge of building construction and fifteen years' experience in sales engineering and promotional work in connection with building products; also considerable practical experience in construction work as estimator and in field work. Recently resident engineer on large industrial project. Good connections with architectural and contracting firms, particularly in Toronto area. Apply to File No 2440-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.

ELECTRICAL ENGINEER, Jr.E.I.C., graduate McGill University 1944, age 25, single. Experience in industrial, radio communications and as Radar officer in R.C.E.M.E. Interested in a position leading to sales engineering or industrial management. Services available on one month notice or less. Apply to File No. 2649-W.

GRADUATE CHEMICAL ENGINEER, S.E.I.C., B.A.Sc., Toronto, 1946, available immediately. Interested in position with Consultant or in Production. Location preference: Hamilton, Ont. Apply to File No. 2721-W.

GRADUATE ELECTRICAL, TORONTO, 1932. M.E.I.C., P. Eng. Seeks responsible Administrative or Industrial Engineering position with Manufacturer, Supplier or User of Electrical Equipment and or Electrical or General Management, Engineering Services, preferably outside the Province of Quebec. Fourteen years' experience in Radio and Aviation Industries, including: four years radio development and manufacture, one year supervision of instruction radio trade school, six years supervision of installation, operation and maintenance of radio aids to air navigation, one year supervision of airline communications, two years equipment and sales engineering, aeronautical and railroad radio equipment. This included executive and administrative responsibility. Apply to File No. 2725-W.

GRADUATE FOREST ENGINEER, Jr. E.I.C., single, age 28, with six years' bush experience, in timber, improvement and operational surveys, operational planning and layout, construction and supervision, requires position as assistant logging superintendent or assistant logging engineer. Available immediately for service anywhere in Canada or British possessions. Details of experience and references furnished on request. Apply to File No. 2726-W.

PLANT ENGINEER, B.Eng., M.E.I.C., R.P.E. (Ont.), age 35, married, with 11 years' experience in design, construction and maintenance of electrical and mechanical installations and buildings. Aggressive, resourceful and co-operative Successful record in responsible supervisory position. Apply to File No. 2728-W.

COMMUNICATIONS ENGINEER. Engineering Physics (Hons.), Jr.E.I.C., Assoc. I.R.E., R.P.E. Ont., F.B.I.S., age 26. Summer employment with telephone manufacturer, Ontario Hydro, and as radio instructor. Three years with the Royal Navy as Radar Officer in complete charge of maintenance, installation and operation of radar equipment on board. One year field engineering with commercial FM radio equipment. Seeks position with opportunity for origina work in electronic and allied fields. Available beginning 1947. Apply to File No. 2779-W.

CIVIL ENGINEER, age 39, M.E.I.C., R.P.E., etc., used to responsibility and control in Consultative, Public Authority and Governmental fields, seeks worthwhile professional or commercial opportunity in Southern Ontario. Apply to File No. 2790-W.

MECHANICAL ENGINEER, Sask., '46, with summer experience in highway surveying, time checking, a steel rolling mill, ship wiring, job planning and cost estimating, desires work, preferably in Vancouver area. Would prefer work including time and motion studies, cost control and estimating, and job evaluation. Available on short notice. Apply to File No. 2795-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.

 (Continued from page 705)

DICTIONARY OF AERONAUTICS with Glossaries of Aerological and Navigational Terms:

By E. B. French, Mentzer, Bush & Co., Chicago, 1945. 129 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $1.00.

Words and phrases in the field of aviation and aeronautical engineering are defined in a concise manner. The illustrations are designed to identify and relate a number of terms as a group. Separate glossaries are provided for aerological and navigational terms.

ELECTRON MICROSCOPE, an Introduction to its Fundamental Principles and Applications:

By E. F. Burton and W. H. Kohl. 2 ed. Reinhold Publishing Corp., New York, 1946. 325 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $4.00.

The opening chapters cover the principles of the optical microscope, including a discussion of wave motion as a means of propagation of energy. The author proceeds to a description of electromagnetics and the electron, and then presents the physical principles upon which the operation of the electron microscope is based. Both the electrostatic and magnetic types are covered. Important practical applications of the electron microscope are considered in the last chapter. The book is well illustrated with sketches and micro-photographs, and there is a twenty-page bibliography.

ENGLISH-FRENCH and FRENCH-ENGLISH TECHNICAL DICTIONARY:

F. Cusset. Chemical Publishing Co., Brooklyn, N.Y., General Publishing Co., Toronto, 1946. 590 pp., 6¾ x 5 in., cloth, $7.00 (in Canada).

Giving both English to French and French to English translations, this dictionary, as shown on the title-page, covers metallurgy, mining, electricity, chemistry, mechanics and science. Phrases as well as words are given and in many cases appear directly under each of the important words. A few basic conversion tables appear at the end of the book.

HANDBOOK of MATERIAL TRADE NAMES (Industrial Research Services):

O. T. Zimmerman and I. Lavine. Industrial Research Service, Dover, New Hampshire, 1946. 503 pp., tables, 9¼ x 6 in., fabrikoid, $7.50.

This alphabetical list of some 5000 trade names of commercial materials gives brief information concerning compositions, properties and uses as well as the name of the manufacturer or distributor. A wide range of materials is covered, including metals, plastics, chemicals, pharmaceuticals, etc. A separate list of the manufacturers and distributors provides addresses.

MECHANICAL WORLD YEAR BOOK 1946:

Emmott & Company, Ltd., London. 360 pp., diagrs., charts, tables, 6¾ x 4 in., fabrikoid, 2s.6d.

This year book provides a pocket-size manual of information on machine-shop practices, light alloys, plastics, bearings, steam boilers, turbines, internal-combustion engines, welding, and other topics of interest to manufacturers and mechanical engineers. There is a large amount of tabular matter presenting useful mathematical and engineering data.

NEW CAREERS in INDUSTRY:

By J. M. Amiss and E. Sherman. McGraw-Hill Book Co., Whittlesey House Division, New York and London, 1946. 227 pp., illus., 8¼ x 5½ in., cloth. $2.50.

The main types of jobs available in industry are discussed from, several viewpoints. Necessarily, information is given about duties working conditions, wages and qualifications. Additionally, the authors emphasize the importance of the individual job, its place in the total pattern of industry, and opportunities for advancement. The field is covered from the machine operator to the salesman, from the supervisor of mechanical operations to the supervisor of personnel and labour relations. Suggestions are also given for planning for the necessary educational training and for the evaluation of one's own qualifications.

PERSONALITY and ENGLISH in TECHNICAL PERSONNEL.

P. B. McDonald. D. Van Nostrand Co., New York, 1946. 424 pp., 8¾ x 5½ in., cloth, $3.75.

This book emphasizes the importance of developing a definite personality, an accurate command of English, and effective methods for presenting ideas, both written and verbal, with specific suggestions for improvement in these particulars, The value of a reasonably broad cultural as well as technical background is brought out, and several chapters offer material for increasing one's general knowledge.

PRINCIPLES of Business ORGANIZATION:

W. R. Spriegel and E. C. Davies. Prentice-Hall, Inc., New York, 1946, 564 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.35.

The material presented in this book is divided into the following major sections: ownership and structural forms of a business enterprise; promotion and operation of an enterprise; financial considerations; accounts and records; the manufacturing function; the marketing function; personnel maintenance. Miscellaneous considerations such as business research, governmental controls, etc., are covered in a final section. Although an operating business is the central theme, much of the material would meet the requirements of other types of organizations.

RADAR, What It Is:

F. J. Rider and G. C. B. Rowe. John F. Rider, Publisher, Inc., New York 16, 1946. 72 pp., illus., diagrs., 11 x 8½ in., paper, $1.00.

The underlying principles of radar are explained in simple language with a description of the basic radar set. The use of radar during the war by land, sea and air forces is described, including countermeasures. A brief survey of the future of radar is added in conclusion.

REFRIGERATING DATA BOOK, Refrigeration Applications Volume, 2 ed:

American Society of Refrigerating Engineers, 40 West 40th St., New York, 1946. 683 pp., Refrigeration Classified, 190 pp, illus., diagrs., charts, tables, 9½ x 6½ in., cloth, $5.00.

Each of the seventy-six chapters of this revised manual is devoted to a specific application or closely allied subject, beginning with the fundamental principles involved and continuing with a description of the processes employed. Covering practically the entire field, these chapters are grouped under the major section headings of frozen foods, cold storage, refrigeration in food manufacture and distribution, special low temperature applications, industrial uses, and air conditioning.

REYNOLDS' NUMBER.

J. Jennings. Emmott & Co., Ltd., Manchester, England, 1946. 20 pp., charts, tables, 7¼ x 4½ in., paper, 1s.

The object of this small pamphlet is to demonstrate clearly the meaning of the Reynold's Number, to examine its structure, explain its significance, and show how it can be calculated and utilized. The pamphlet should be useful to any one concerned with any of the varied applications of the science of fluid dynamics.

Society for EXPERIMENTAL STRESS ANALYSIS, Proceedings, Vol. 3, No. 2:

Edited by C. Lipson and W. M. Murray. Published and distributed by Addison-Wesley Press, Inc., Kendell Square, Cambridge 42, Mass., 1946. 166 pp., illus., diagrs., charts, tables, 11¼ x 8½ in., cloth, $5.00.

Eleven papers on various aspects of the subject are contained in this volume, together with seven papers covering the proceedings of a panel discussion of fatigue failure of manufactured parts. The topics of the first eleven papers include the construction and use of strain gages, methods of stress analysis, and a study of the mechanical behavior of the skull and its contents under injuring blows. A list of members and the contents pages of the preceding volumes are included.

SOHO FOUNDRY:

W. K. V. Gale. W. & T. Avery, Ltd., Soho Foundry, Birmingham 40, England, 1946. 49 pp., illus., maps, diagrs., 8½ x 5½ in., paper, 5s.

This is a brief historical survey of an English manufacturing concern with which are connected three of the great industrial pioneers: Matthew Boulton, James Watt and William Murdock. Biographical sketches of the three men are interwoven with the account of the development of the works.

STEEL CASTINGS:

E. N. Simons. Paul Elek Publishers, Ltd., London, E.C.1, England, 1946. 208 pp., illus., diagrs., charts, 7½ x 5 in., cloth, 13s.

Raw materials, melting processes, patterns, foundry sands, molds and cores are dealt with in the first few chapters. Post-casting processes, heat-treatment and machining practice are subsequently covered. The steels used for castings are discussed in detail, including the types and uses of castings from these steels. Separate chapters are devoted to inspection and testing, centrifugal casting, and buying procedures on the part of the customer. A number of special castings are described at the end.

WHAT ARE COSMIC RAYS

P. Auger, translated from the French by M. M. Shapiro. University of Chicago Press, Chicago, W. J. Gage, Toronto, 1945. 128 pp., Plates 1-12, 7¾ x 5¼ in., cloth, $2.75 (in Canada).

This book presents a simple, straight-forward account of all the major cosmic-ray phenomena for the reader who lacks a technical knowledge of physics. A translation from the original French, the new edition has been revised in the light of recent new discoveries and important changes in the field of cosmic rays. The history of the development of cosmic-ray research is reviewed in the early chapters, and a number of photographs of tracks of electrified particles are collected at the back.

THE ENGINEERING JOURNAL

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CONTENTS

DEVELOPMENT OF THE CANADIAN MAGNESIUM ALLOY ASSAULT BRIDGE

COLONEL E. C. THORNE, M.E.I.C.
Director of Engineer Development, Department of National Defence, Ottawa

Early in 1944, the possibilities of jungle warfare loomed up for the Allies, and the transport of supplies through the jungle in narrow tracks and across precipitous ravines and mountain streams presented one of the major problems. Equipment could only be brought in by men on foot, or by pack animals, and trails thus formed would have to be improved after the initial advance to take jeeps and their loads.

After a series of discussions between Canadian Military Headquarters, the Ministry of Supply and the War Office in London, it was agreed that Canada, with her development facilities and knowledge of magnesium alloys, should undertake the design and construction, from magnesium, of a light infantry assault bridge to be used as a fixed span bridge over precipitous ravines or mountain streams, and also as a pontoon bridge on sluggish streams. All parts of the bridge must be suitable for transportation in one-man loads over long distances in the jungle, and it should be possible for twelve men to carry one hundred feet of completed bridge one hundred yards from the building site. The bridge should be initially capable of supporting infantry in file, and pack animals over a minimum clear fixed span of one hundred feet, and when in use as a pontoon bridge, should withstand currents of five miles an hour. Both types of bridge should be capable of being converted or strengthened to take jeep traffic.

On June 1st, 1944, the directorate of engineer development at National Defence Headquarters was assigned the task of working out the details of this problem on the recommendation of Major-General Howard Kennedy, M.E.I.C., who was then Quartermaster-General, and under whom the directorate functioned. Major-General Kennedy had long advocated the possibility of the use of magnesium alloys in military engineering, and the opportunity of experimenting in the military bridging field was especially welcome at this time.

History of the Development

In spite of the fact that enormous quantities of magnesium were being produced, magnesium was still a highly strategic material needed for aircraft construction, incendiary bombs, tracer and incendiary ammunition and flares, and as an alloying ingredient for high strength aluminum.

The immediate problem was where to obtain as quickly as possible the magnesium alloy for the prototype development. In Canada, one government-owned plant was producing magnesium metal, and a small number of privately-owned plants were converting magnesium metal into sand castings and die castings. It was apparent that no material to meet our requirements was immediately available in Canada, as the preliminary design studies indicated that the bulk of our requirements would be in the form of sheet and extrusions. Furthermore, there was the question of technical advice in solving production and design problems.

It was therefore decided to approach the best known authority in the magnesium field on the American continent, the Dow Chemical Co., of Midland, Mich. An agreement was immediately reached whereby the company undertook to fabricate three standard bays of bridge to drawings and specifications supplied by the directorate of engineer development, with the understanding that changes in design suggested by the company to suit standard shapes and extrusions and to meet particular characteristics of magnesium would be acceptable.

Fig. 1—Launching of bridge by cantilever method.

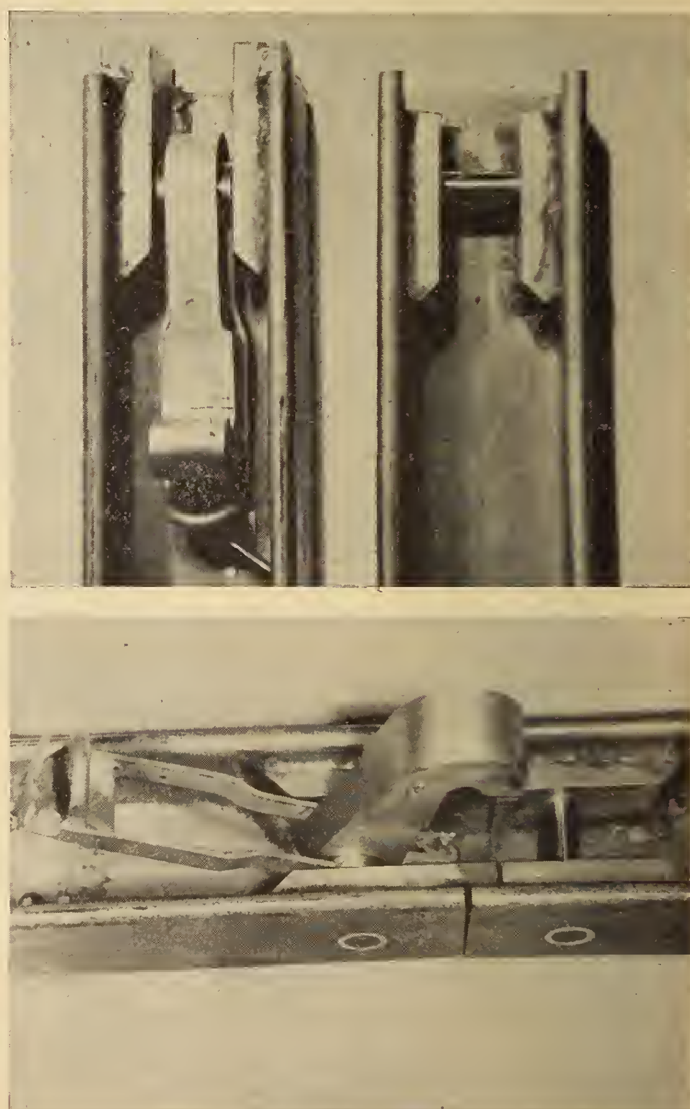


Fig. 2 A—Male and female chord connector showing pin and hook ends. B—Hook handle released from locked position and hook moving forward onto pin.

On December 8, 1944, the prototype panels of bridge were demonstrated to General A. G. L. McNaughton, Minister of National Defence, and to representatives of the General Staff at National Defence Headquarters. The Minister agreed to the furtherance of the project on the understanding that all the development work be done in Canada and all sheet and extruded sections be processed in Canada. Authority was granted to fabricate 250 ft. of bridge for test and demonstrative purposes.

Through the co-operation of the Department of Munitions and Supply, the Dominion Magnesium Company agreed to supply, in ingot form, a magnesium alloy to meet directorate of engineer development specifications and to submit samples which would be tested by the Bureau of Mines, Department of Mines and Resources. The Aluminum Company of Canada welcomed the opportunity of extruding and rolling magnesium in its Kingston plant.

Lt. Col H. B. Stuart, M.E.I.C., and Lt. Paul O. Freeman, JR.E.I.C., both officers employed in directorate of engineer development were assigned the task of preparing the structural details and drawings required for the sections to be used in the bridge. An improved chord connector was also designed by Lt. Col. H. B. Stuart which was ultimately included in the final design.

By January 1945, the problem of production of magnesium extrusions and sheets had been ironed out and dies were being made by the Aluminum Company. There remained, however, the problem of fabrication of the bridge, and owing to the nature of the development, it was considered that the fabrication should be undertaken by a firm who was familiar with light alloy construction, and it was proposed that aircraft factory facilities be utilized. Fairchild Aircraft Limited, of Longueuil, Que., undertook the fabrication of the magnesium alloy bridge. By January 8, 1945, drawings for tools and jigs were under way for the fabrication of the bridge, and it should be noted that the credit for the design of the tools and jigs as well as the making goes entirely to the engineering staff of the Fairchild Aircraft Company, whose splendid cooperation was greatly appreciated.

Specifications

The main purpose, insofar as the preliminary design was concerned, was to determine by simple tests whether a magnesium light alloy bridge would have a reasonable expectation of success. In order to find this out, it was considered essential to fabricate a full scale section of the bridge, and apply static tests. After considering the problem from all angles the following design specifications were formulated.

The bridge was to be 100 ft. long by 2½ ft. wide by 4 ft. deep, consisting of twenty-five sections. The sections were to consist of standard bays and hornbeam sections, each to be made so that it could be disassembled without loose parts, and folded up into units small enough and light enough that approximately fifty men could pack the entire bridge on their backs. It will be recalled that the original specification called for an assembled 100-ft. section to be handled by twelve men. The bridge weighed 2000 lb. when completed, and it was not beyond the possibilities for twelve men to handle this load over the distance specified. A working load of 100 lb. per lineal foot had been specified, and it was considered that this would be the maximum static and dynamic load which the bridge would have to support in service. A margin of safety of about 50 per cent was considered satisfactory in the final design. Another important load condition had to be considered in cases where the bridge was to be launched by the cantilever method, i.e., by attaching two spans together end to end and rolling or sliding the bridge into position (see Fig. 1). Under these conditions it is necessary that the bridge be able to support its own weight when cantilevered 100 ft. The provision of a special end section capable of supporting the bridge under load was also included in the design, and this would also provide end support to prevent overturning of the bridge under a wind load of 10 lb. per sq. ft., acting on the side of the bridge. Sufficient reinforcing was included under the decking for the use of spans side by side for jeep traffic, as under these conditions the decking is the critical item, and has to be capable of supporting the wheel load of a jeep, which amounts to 850 lb. spread over an area of 15.4 sq. in.

Fig. 3—A standard bay.

It was the intention to use welded construction throughout, and helium welding equipment was installed, and helium gas obtained, but because of difficulties in obtaining sufficient quantities of helium, argon was later substituted. Because of the thin sections of the components, welding of the bulb stem to the underside of the decking caused considerable warping, and it was necessary to resort to rivetted design. No difficulty, however, was experienced in welding the extruded sections, and tests on the welds in the top and bottom chord channels withstood pulls in excess of design requirements without any signs of weakness. It is interesting to note that all the welding was done without any of the magnesium alloy burning.

Design Features

The design follows that of the common deck plate girder bridge. The structure is sub-divided into bays 4 ft. long

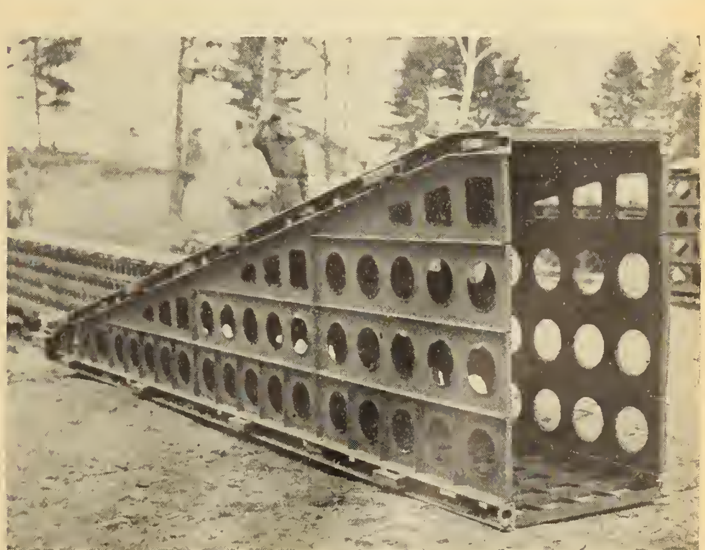


Fig. 4—16 ft. Hornbeam section (4 bays) assembled, ready for attaching to standard bay.

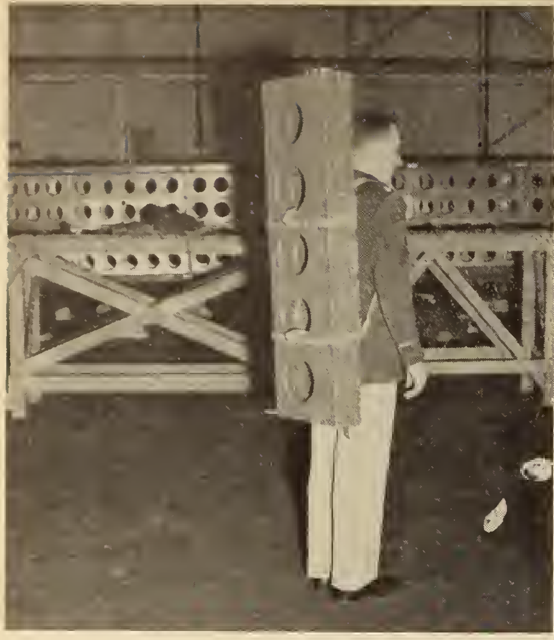


Fig. 5—The component parts may be folded up for carrying in a pack on a man's back.

and 27 in. wide, which dimensions were determined to facilitate man carriage. A span of 100 ft. is capable of supporting a live load of 100 lb. per lineal foot, which is approximately one infantry man after another, each wearing full battle equipment, and well closed up. When two bridges are used abreast, a live load consisting of a jeep towing a 6 pounder gun is capable of crossing the 100-ft. span.

The dead load for design purposes is 20-lb per lineal foot. It is observed that magnesium weighs .065 lb. per cu. in., whereas aluminum alloy weighs .1 and steel .283 lb. per cu. in. Impact was not considered in the calculations, it having been felt that, for design purposes, the combined dead and live load of 120 lb. per lineal foot uniformly distributed, kept in view the basic loading, and could more readily be compared with the yield points of the materials tried in the initial computations.

The deck panels are 27 in. wide by 4 ft. long, and are combined with the transverse vertical brace frames, and

Fig. 6—The side panels comprise four hinged panelettes.

fold into a load slightly in excess of 27 lb. This load is folded into four, the deck being doubled, likewise the brace frame, and the two meet in a common hinge. The deck is of a hard rolled plate, while the side panels and bracing frames are made of a soft alloy to permit forming. The sides or webs are 4 ft. long and 4 ft. deep, and fold, likewise four times into a pack about 1 ft. wide and 4 ft. long, each side weighing 27 lb.

Each 4-ft. section is fastened together by a chord connector which consists of a hook, eccentric and pin, thus eliminating the use of bolts and nuts (Fig. 2a and b). Although this hook is simple in conception, it should be noted that it must withstand a stress of some 20,000 lb. In the original tests carried out on the prototype panels, it was found that when the bridge is loaded to 150 lb. per lin. ft., the maximum load that must be carried through the fitting is 25,000 lb., and it was believed that some eccentricity was introduced at the joint due to the fact that the chord channel was not sufficiently deep to permit the tie bolt to lie along the centre line of the chords. This defect has been overcome in the new design.

Fig. 7—Final stage in assembly of a standard bay. Dzus fasteners are locked in position throughout.

General Description and Tests

One hundred feet of bridge comprises seventeen standard bays, such as the one shown in Fig. 3, equal to 68 ft., and two hornbeam sections, (Fig. 4) each 16 ft. made up in increments of four feet. The hornbeam section is decked top and bottom to permit its use as a ramp if necessary. Standard bays are decked only on top, the bottom of the bay being braced by a frame. A standard bay is made from four component parts all of which are standard and interchangeable. No component part weighs more than 27 lb., and it may be folded up so that it can be carried quite comfortably in a pack on a man's back (Fig. 5).

The top deck and vertical brace frame are combined in a hinged assembly; when in the open position the deck is 4 ft. long and 27 in. wide, and the vertical brace frame the same. For pack carrying, the deck folds into two, the vertical brace frame likewise. Finally the folded top deck and folded vertical brace frame fold one under the other by means of a hinged assembly, forming a component, 2 ft. by 27 in., by 4 in. thick; this is one component of a standard bay and weighs 27 lb. The side panels (Fig. 6) (two for each bay) comprise four hinged panelettes, the top and bottom panelette terminating on the chord channels. When open, the side panel extends 4 ft. in length and depth; when folded it is reduced to 4 ft. in length by one foot in depth, and 4 in. thick. The bottom brace is similar to the vertical brace and consists of two hinged sections.

To assemble a standard bay, the two sides are laid on end, and the top deck and vertical brace are fitted. This is done by aligning and inserting shear lugs, found on the underside of the decking, into holes in the chord channel, and locking down with Dzus fasteners (Fig.7). The bottom brace is fitted in the same manner, and the bay is now assembled and may be turned up into its correct position for joining onto another bay. Hornbeam sections are built in a similar manner, the only difference being that a bottom deck replaces the bottom brace frame. Assembled bays are hooked together by means of the hook and pin built into the chord channel. Each end of a chord channel has an alternate male and female coupling, and corresponding alternate hook and pin assembly. The hook itself is actuated by an eccentric, and is in its fully extended position when the handle and hook are both forward. When two chord channel assemblies are fitted together the hook is put forward and just clears the pin, the handle is then swung back, at the same time the hook takes up on the pin, and the handle is locked back into the chord channel to insure that the hook remains closed. Chord channels are joined in this manner top and bottom. It should be noted that the entire assembly operation has been effected with only the use of a screwdriver

Fig. 9—Timber decking being placed on four fifty-foot bridge assemblies.

Fig. 8—View along the decks of the 100 ft. span showing double bridge brace frames in position.

to cinch the Dzus fasteners. No other tools are required to build this bridge, and even the screwdriver may be dispensed with in an emergency as a knife or a dime will cinch the Dzus fasteners equally as well. The normal time required to assemble a standard bay is 59 seconds.

Launching the bridge over a dry gap of 100 ft. or less is performed by the cantilever method. Rollers are placed on the near shore bank seat and the bridge rolled forward. Counterweight on the back end is provided by additional bridge structure which is held in position by a " C " clamp which fits into the top and bottom chord channels. Figure 1 shows one hundred feet of bridge being launched by the cantilever method.

A single girder structure across the gap is capable of carrying 100 lb. per lin. ft., equal to infantry men with equipment spaced at two feet intervals. Hand rails are provided to guide troops across during darkness. This in effect fulfilled the first requirement for the bridge.

The next stage of the development was to consider the problem of the jeep load. A jeep weighs approximately 3600 lb. and it would be required to tow equipment weighing approximately 2800 lb. An additional problem presented itself at this stage due to the fact that the wheel gauges for the various towed vehicles varied considerably from that of the jeep. This would not have been a very serious difficulty had the bridge been decked down. It should be remembered, however, that the specifications precluded any consideration of decking due to the additional bulk and man power carrying requirement that would have resulted.

The roadway, therefore, would have to be provided by the top deck of a single bridge, and all that was necessary to determine was the optimum spacing between two single bridges to allow for a safety margin both inside and outside for the various wheel gauges. A double bridge brace frame was then made which acted as a spacer between the two bridges. It fits onto the hand rail brackets, which are on the inside of the two structures when they are placed side by side, by shear lugs, and is held by Dzus fasteners. The bridge assembled in this manner provided means for jeep and jeep-towed loads to cross a maximum span of 100 ft. (Fig. 8).

So far the only addition to the bridge over and above the standard component parts has been the double bridge brace frame. They only weigh 7 lb., and could still be included in the man pack loads within the specified limits.

Demonstration

At this stage of the development, the bridge met the original design specifications, and it was decided to demonstrate the bridge to United Kingdom, United States of America and Canadian observers. This was done on

Fig. 10—Fully loaded three-ton truck weighing 16,000 lb. towing a 3,100 lb. gun. Total live load of 19,000 lb.

Fig. 11—Long spans supported on pontoons.

May 7, 1945. While preparing for the demonstration we were asked to consider additional applications for the bridge and its adaption to shorter spans for higher load classifications, and long wet gap crossings employing intermediate pontoon supports. The latter had already been considered to the extent that the bridge could be easily supported at its extremities on pontoons equally as well as on fixed bank seats. The introduction of considerably longer wet gap spans, however, would mean a change in the build up of the bridge, in that considerably more standard bays would be required than hornbeam sections, therefore articulation would have to be provided within the standard bay section for every hundred feet of bridge in the cases where the maximum spans were being floated, and at suitable locations where intermediate supports were inside the maximum span.

To increase the load capacity by shortening the span, immediately introduced the problem of decking down, not only to provide for the varying widths of vehicles to be catered for, but also to take care of the distribution of load over the supporting members.

Owing to the improvised nature of these additional requirements, and the short time for preparation before the demonstration date, field expedients had to be resorted to, to meet the deadline. Four 50-ft. bridge assemblies were placed side by side, and decked down with timber decking made up of 2 by 5 in. British Columbia fir cut into eleven foot lengths, and spaced with two inch blocking. In order to simplify the decking down during the demonstration, decking units were prepared ahead of time. One deck section comprised approximately 5 lengths of 2 in. by 5 in. by 11 ft. lumber with 2-in. spacing blocks approximately 12 in. long at each end and in the centre, the whole bolted together to form a rigid assembly (Fig. 9).

Over this bridge was passed a jeep, followed by a universal carrier weighing 9500 lb., and a fully loaded three-ton truck weighing 16,000 lb. towing a gun weighing 3,100 lb., making a total load of 19,100 lb. (Fig. 10).

The resulting deflections on the bridge assemblies were roughly checked and found to be very small, and it was felt that a bigger load could have been handled. However, without a strain gauge check it was not considered wise to do so, and the additional capabilities of the bridge and its versatility had been demonstrated far beyond what was expected. If heavier loads were to be handled, a number of changes in design would be necessary.

The last phase of the demonstration dealt with a long floating span supported on pontoons (Fig. 11). No articulating connector had been designed or made ready for the demonstration, with the result that field improvisation was necessary. Sacrificing one of the spare bays to provide the chord channels and hook assemblies, and utilizing angle iron and scrap steel plate, a rough and ready articulating connector was made up in the field workshop. This articulating connector was ultimately used as a basis for design for additional light alloy articulating connectors which were made up at a later date.

As a result of the demonstration, a request was received from United States War Department for additional bridges to carry out further trials. At this time, minor changes in design details were effected to simplify production, and all welding was eliminated. On this occasion the bridge was fabricated by the Ottawa Car and Aircraft, Limited, Ottawa, Ont.

Conclusion

The development of the Canadian magnesium alloy assault bridge has proved conclusively that there are probably many interesting characteristics of magnesium which will make themselves known only as wider experience in fabrication and more varied applications uncover them. Full and true information about magnesium has not been easy to acquire because magnesium is in a period of rapid growth, and misinformation about magnesium is almost as prevalent as correct information. The future use of magnesium and magnesium alloy, therefore, will depend entirely on progress made by fundamental research into the nature and properties of magnesium and the technological problems of producing its various forms.

WELDED-BOILER LOCOMOTIVES ON C.P.R. LINES

Since early this year, two locomotives with welded boilers have been in operation on the Canadian Pacific Railway lines between Montreal and Toronto, and Winnipeg and Regina. This development is part of the company's programme for adoption of the latest devices in the field of transportation.

The operating performance of the engines is being carefully followed, and the following advantages are expected to result from the use of welded as compared to rivetted boilers. It will:

1. Eliminate cracks due to intergranular corrosion and high stress concentration in rivet holes.
2. Increase joint efficiency as compared to rivetting.
3. Reduce weight by the elimination of lap joints, inside and outside welts and rivets.
4. Eliminate the possibilities of age-hardening of cold worked plates by final thermal stress-relief heat-treatment.
5. Eliminate high stresses around rivet holes due to rivetting operations.
6. Eliminate stress risers due to abrupt change in section, such as the excess thickness at girth and longitudinal seams of the rivetted boiler.
7. With the more uniform contour of the interior and exterior of the welded boiler, permit ease of application of brackets and facilitate cleaning the interior, due to the absence of welts and rivet heads.
8. Eliminate damage due to caulking of rivets and joints in the rivetted construction.
9. Result in a more economical method of fabricating.

Work carried out by the mechanical engineering department of the C.P.R. resulted in the fitting by the Montreal Locomotive Company of two new "1200" class engines (4-6-2 wheel arrangement) with the new boilers, built by the American Locomotive Company of Schenectady, N.Y. They are the first locomotives of this type to operate on Canadian lines, and are being run in regular service under varying operating conditions.

Decision to try them was prompted by the good service obtained from fusion welding in other instances, including a welded-boiler locomotive now in service on the Delaware and Hudson. Permission of the Board of Transport Commissioners of Canada was necessary for installation of the boilers.

General Description

The boilers were built to operate at a working pressure of 250 lb. per sq. in. with a factor of safety of five and an allowable joint efficiency of 90 per cent. They differ from the Delaware and Hudson Railroad Company's boiler in that the barrel portion consists of three barrel courses butt-welded together, and that a man-hole opening is provided in the third course to facilitate internal inspection in place of the conventional steam dome. The foundation rings are cast steel with single rivet construction, with the caulking edges of the inside and outside firebox sheets seal welded.

Fig. 2—Preparation of longitudinal seam, showing draw bolts and tack welds.

The smoke box is fastened to the first course by rivetting to facilitate renewing the smoke box which is done three to four times during the life of a locomotive boiler.

The wrapper sheet consists of a three plate construction which permits using a heavier sheet over the crown, thus eliminating the need for the liner generally used to stiffen the crown of one-piece wrapper sheets.

The man-hole is flanged from 1 in. plate and has a 17 in. dia. opening, with an overall diameter of 34½ in. fitted into the third course and attached with double-welded butt-weld. The boiler shell opening at the man hole is reinforced with a liner 1⅛ in. thick 25 in. inside dia. by 40 in. outside dia. which is attached to the manhole flange and boiler shell by fillet welds at the inside and outside edges of the liner.

Pads for top check, washout opening, bracket attachments for dry pipes and other internal and external fittings are fillet welded to the boiler shells prior to the stress relieving heat treatment.

All washout plug bushings and flexible staybolt sleeves are seal welded to the backhead, wrapper sheet and throat sheet after the boiler has been stress relieved.

The firebox door opening is formed in the usual manner, by flanging the outside back head inward and the inside back head outward. The two edges are joined together by a single welded butt-weld.

The front tube sheet is of the same design as that used in the Delaware & Hudson all-welded boiler. It consists of a circular ring 1¼ in. thick by 4⅜ in. wide, with a recess at the water side in which the tube sheet is fitted and fillet welded both sides. The complete tube sheet assembly is then fitted and fillet welded to the first course. The ring is provided with slots at the top and bottom centres in order that the tube sheet may be renewed

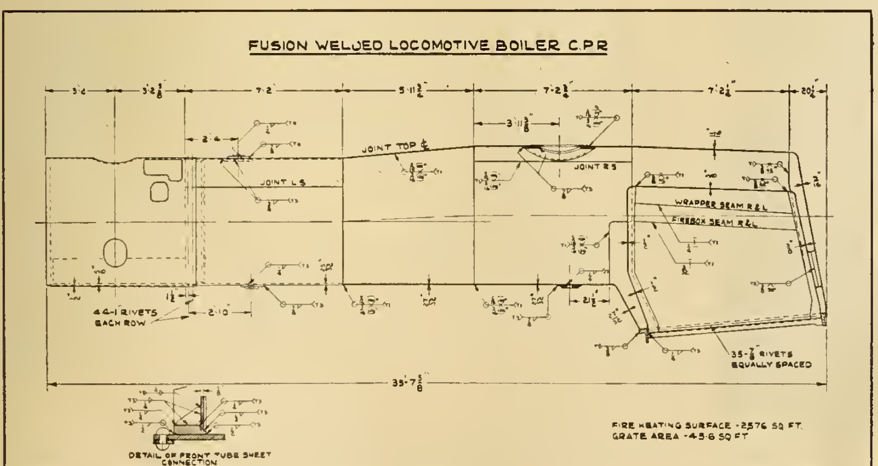


Fig. 1—Showing general dimensions of boiler and location of welded seams.

Fig. 3—Welded longitudinal seam showing starting tab and test plate.

without cutting any of the welds except those directly attaching the tube sheet to the circular ring.

Material

Plates used in the boiler shells were carbon steel to A.S.T.M. specification A-201, Grade A, killed for automatic submerged melt welding. The inside firebox sheets were carbon steel firebox quality to the railway company's specification No. 5.

Joint Preparation

The girth and longitudinal seams of the barrel courses were prepared for automatic submerged melt welding on a plate planer, prior to rolling and forming. The inside and outside back head, throat sheet, back tube sheet and fire door hole were prepared for manual welding by chipping and grinding. A tolerance of .015 in. was permitted in the gap between the plate edges which were automatic submerged melt welded and a ⅛ in. gap between joints that were welded manually. To obtain the tolerance required for automatic welding it was found necessary to grind the butting faces prior to pulling them together. Large nuts were tack-welded to each side of the seams inside the boiler through which draw bolts were applied to hold the seams in line and for pulling the butting edges together. After each seam was properly lined up the plates were tack welded on the inside to maintain a good fit during welding on the outside. Clean-up grinding of the plate edges was also done in order to remove all dirt and scale which might have otherwise caused defects in the weld metal.

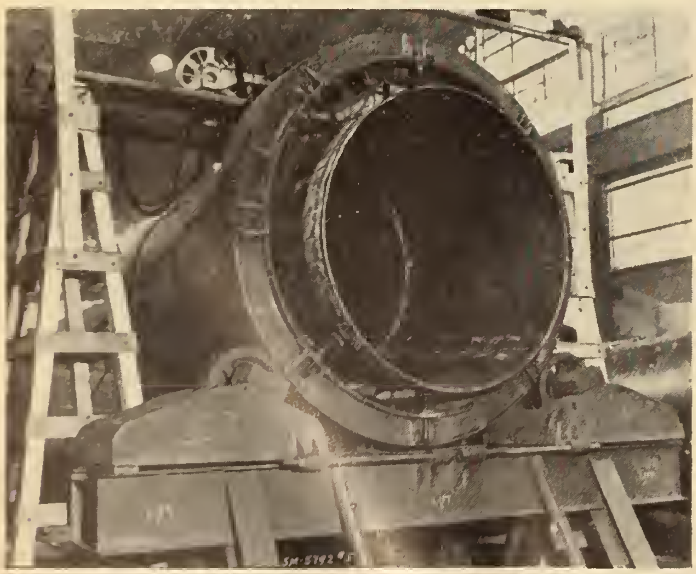


Fig. 4—Welding outside of girth seam between first and second courses and large auxiliary ring used to compensate for eccentric course.

After the outside welds were completed, the draw bolts, nuts and tack welds were removed and the inside of the seam made ready for welding.

Welding Procedure

All welding was in accordance with the A.S.M.E. Locomotive Boiler Code. Procedure qualification and operator's qualification tests were made to determine the suitability of the welding technique employed, welding apparatus, electrodes, plate material and welding operator's ability to produce sound welds, under conditions similar to those used during erection of the boilers.

The procedure qualification tests consisted of welding joints similar to those required for erection of the boilers, using the welding and rotating equipment employed during construction. A record of all qualification tests was kept for future reference.

Fig. 5—Welding third course to wrapper sheet and throat sheet.

The automatic submerged melt welding process was used to weld all longitudinal and girth seams where practical. Test plates were attached to the longitudinal seams of each barrel course and welded continuously with the seam.

Marks were placed on each test plate so that they could be identified in relation to the course from which they were taken. Test plates were stress relieved with the boilers and then given the physical test required. The test showed the joint to be superior to the parent metal in all cases.

The total length of fillet and butt-welds required was:

Fillet Welds	Butt Welds
¼ in.: 658 in.	⅜ in.: 586 in.
⅜ in.: 713 in.	½ in.: 206 in.
½ in.: 730 in.	9/16 in.: 113 in.
⅞ in.: 318 in.	25/32 in.: 299 in.
	27/32 in.: 775 in.

All fillet welds and a small percentage of the irregular butt welds were made with the manual arc, using A.W.S. E-6011 electrodes.

X-Ray Inspection

X-ray inspection was carried out in accordance with the A.S.M.E. Locomotive Boiler Code requirements.

(Continued on page 723)

MODERN PRACTICE IN ACTIVATED CARBON SOLVENT RECOVERY PLANTS

GUY F. DOWDING AND STANLEY G. WARD
The Nicholson-Dowding Co., London, Eng.

Introduction

Industries using solvents in large quantities in their processes and those producing solvents as a by-product are faced with the problem of recovering that portion of the solvent carried as a vapour through the medium of air or other gas. Typical industries are:

Municipal gas	Coke oven
Rubber spreading	Artificial silk
Leather cloth	Photogravure
Asbestos	Edible oil
Film casting	Dry cleaning

Solvents in the form of vapour at normal temperatures cannot be recovered by means of condensers, and the use of equipment incorporating oil or water traps is not satisfactory. Modern practice utilizes the properties of activated carbon. Whereas the properties of activated carbon were known in 1790, little use was made of this material in bulk until the introduction of poison gas warfare. Activated carbon is now produced on a large commercial scale by a special process with an adsorbing power seven to eight times that of the charcoal previously used. After some months of use the adsorbing power is reduced to such an extent that it is necessary to re-actify it. This process is cheaply carried out, the spent carbon being normally bought back for re-activating.

The method employed to extract the solvent is to pass the vapour-laden gas through activated carbon. Afterwards the solvent is driven from the carbon by passing steam through the carbon and then into a condenser, thereby recovering the solvent as an aqueous mixture. In the case of non-miscible solvents, such as benzol, the distillate is automatically decanted. In the case of miscible solvents the aqueous condensate is fractionally distilled.

After the steaming process, the activated carbon is dried by passing through it re-heated gases from which the solvent has already been removed. In the case of solvents of very low boiling point, the carbon is also further cooled as well as dried. The cycle of adsorbing, steaming and drying of the carbon is now repeated until such a time as it is necessary to re-activate the carbon. Modern plant operating on this principle is completely automatic and recovery is practically one hundred per cent.

Typical Recovery Plant

A typical recovery plant consists of two adsorbers, a condenser, a gas cooler, recirculating fan, gas heater, separator or condensate receiver and automatic valve control mechanism. In the case of non-miscible solvents the separator delivers the recovered solvent ready for use. Miscible solvents are passed from the receiver to a fractionating condenser.

The solvent laden gases are taken from the ducts leading either from drying chambers, extractor hoods, or, in the case of the gas industry, from the gas main immediately before it enters the container. It is almost always necessary to cool the gas and a gas cooler of tubular design is incorporated. Two adsorber units are supplied to each plant, one adsorber receives the vapour laden gas from the ducts while the other is being steamed and dried. After the carbon in the receiving adsorber is fully saturated, automatic pneumatically operated mushroom valves effect the change over from the one adsorber to the other. The adsorbers vary in size according to the amount of gas treated. They are cylindrical units and are approximately two and a half feet in height and diameter for treating a quarter of a million cubic feet a day, while for treating three million cubic feet a day the size is some five feet in diameter by seven and a half feet in height. The carbon is contained in an annular zone about the centre line of the cylinder, the gas passing from the outside through the carbon layer to the inside. The steam passes in the reverse direction. The loose carbon charge is easily changed by means of removable plates at the top and bottom of the cylinder.

The automatic valve control mechanism is essentially an electrical timing device with appropriate pumps and switches which may be easily adjusted according to the age of the carbon in use. A typical cycle will be twenty minutes while one unit is adsorbing, during which time steam has been passing through the second solvent-laden unit for ten minutes, and ten minutes will have been allowed for drying and cooling. Valves are now automatically operated and the two units are interchanged.

The condenser is of tubular design. The arrangement is novel in that no valves intervene between the condenser and the adsorbers.

The recirculating fan passes a portion of the solvent-free gas through the carbon after the steaming period for purposes of drying and cooling. This gas is re-heated by a small gilled-type heater. In some cases, air is used instead of the treated gas.

The complete plant is compact and, whereas some arrangement of units is permissible to meet special cases, a unit treating a quarter of a million cubic feet a day is some ten feet high by about eight feet by ten feet. One with a capacity of three million cubic feet a day is some twenty feet high by twenty-four feet by seventeen feet. There is no obvious limit to the quantity of gas a day that can be treated. The equipment is clean, automatic and extremely economical in running costs. The solvent recovered is of the highest grade of purity and there are no waste products since the spent carbon may be re-purchased for treatment. The pressure drop across the plant is as low as three inches.

Application to Specific Industries

The principal industries in Great Britain in which plant of the type described is in use are municipal gas, dry cleaning, artificial silk, rubber spreading, leather cloth, asbestos, film casting, photogravure and edible oil. Hydrogen sulphide should not pass through the adsorbers and so the equipment has not yet been employed in conjunction with coke ovens, but active research and development has been carried out. Suitable equipment is in the final stage of development and there is no doubt whatsoever that the general principle can be adapted to this industry. The method is not limited to these fields alone, but a short description of the technique as applied to these industries will indicate the scope.

Municipal Gas Industry

A special plant has been designed for use in the gas industry for the extraction of crude benzol. It differs from the usual type of active carbon recovery system in that the whole unit forms an enclosed system, the gas main being connected directly to one end of the plant and the gas holder to the other. The plant is very similar to that used in other industries. Drying of the carbon is effected by returning a portion of the treated gas through the adsorber after steaming.

Many benzol plants of this type have been erected in Great Britain and supplied to municipal authorities such as Manchester and Swansea. All these are entirely automatically operated and require very little attention. The plants are manufactured in standard sizes, the smallest at the moment treating a quarter of a million cubic feet of gas per day. There is no limit to the quantity of gas that can be treated, but the largest plant which has been installed treats up to eight million cubic feet of gas per day.

The benzol, with a content of some fifty to sixty per cent benzene, is delivered from the equipment water white and ready for use. Recoveries of one hundred per cent have been recorded. In addition, the process completely removes naphthalene and reduces the content of organic sulphur compounds in the gas.

This method has definitely displaced the older oil absorption system and, since this plant has been put on the market, at least ninety per cent of the orders which have been placed in Great Britain have been for activated carbon plants. It is believed that eventually they will displace existing oil wash plants.

It is difficult in general to give actual figures of costs of benzol production, but the following data is summarized from a recently compiled authoritative statement, purposely intended to include on a very comprehensive scale every possible contingency of expenditure. The data is based upon 1944 costs in Great Britain and may be taken as an indication of the financial aspect.

	Pence per gal. of crude Benzol
Net thermal replacement costs (coal, less coke and tar)	5.0
Operating costs (including steam, water, replacement of adsorbent, labour, etc.	3.0
Capital costs—benzol plant (and maintenance)	1.5
Capital charge for extra carbonising plant required	1.8
Repairs and maintenance of extra carbonising plant	0.7
Total costs debited to benzol recovery	12.0
Selling price of crude benzol	17.0
Profit per gallon of benzol	5.0

Coke Oven Industry

As has been mentioned above, sulphuretted hydrogen must be removed from gases before they are passed into the adsorbers. On this account no equipment has been previously offered to the coke oven industry. However, suitable equipment is now in a finalized form, as a result of considerable research and development to the end of simplifying the coal gas purification.

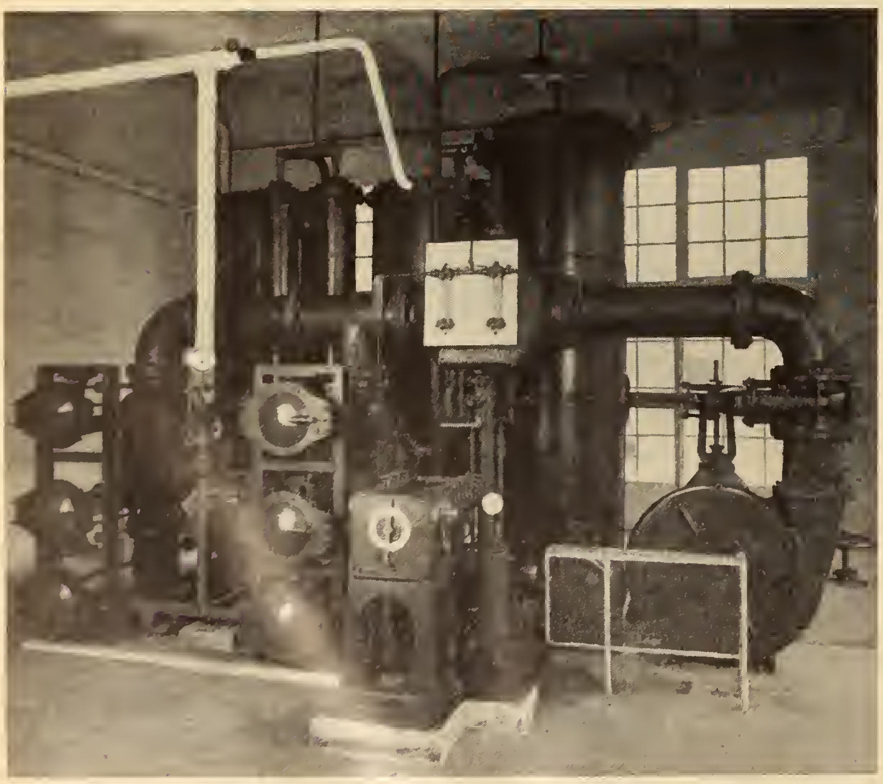
There is no doubt that the general principle of the activated carbon recovery system can be applied to this industry and it is hoped that such equipment will be offered at an early date. In this case it is strongly believed that the activated carbon plant will definitely displace the oil wash method. These plants will be of very considerable capacity and are likely to influence the lay-out of new coke oven installations.

Dry Cleaning Industry

Various solvents are used in this industry of which the principal ones are petroleum white spirit, trichlorethylene and perchlorethylene.

The clothes are washed in the spirit, then centrifuged and transferred to the dryers, where most of the spirit is evaporated and recovery is effected. The air from these machines is connected to the recovery plant. It is cooled and filtered from fluff and dust before being passed to the adsorbers.

Plants using chlorinated solvents must be of a different design to those using white spirit, since, although there is no danger from fire or explosion, the toxicity of the solvents necessitates the machines being fully enclosed. The total enclosing of the machines enables a higher efficiency of recovery to be effected in the case of chlorinated solvents, where some ninety per cent is recovered. In the case of white spirit the efficiency of recovery is between fifty and sixty per cent.



A typical small capacity benzole recovery plant. Capacity of gas works—½ million cu. ft. per day. Output of benzole—100-120 gallons per day.

With a view to obtaining the highest efficiency in recovery of the solvent and to simplify the dry cleaning process, a completely new dry-cleaning machine has been designed which is coupled to a solvent recovery plant. It has been found possible to wash, centrifuge and dry the clothes in one machine. Naturally this makes an extremely compact and efficient unit which, being directly connected with the recovery plant operates with practically no solvent loss. There is considerable time-saving by eliminating the transference of clothes from one machine to the other. Clearly such a machine has a wider application than the dry cleaning of clothes and is of interest to all industries applying a cleaning process to yarns, fabrics and similar materials.

Artificial Silk Industry

This industry was developed very rapidly in Great Britain as in most countries, but before the general development of the activated carbon recovery system. Consequently, the industry adopted the then only known system of recovery; that is, by solution of the vapours in water at low temperature and then fractionating the solvent from the water. The water, however, will only absorb to a concentration of one or two per cent, beyond which the efficiency of recovery is impaired. The operation, therefore, of this type of plant is expensive and somewhat delicate.

The activated carbon system is undoubtedly replacing the water wash system in Great Britain. In the application of this system, the silk is spun in enclosed cabinets, sufficient air being drawn through the cabinets to bring away the whole of the solvent, usually acetone. The air has a temperature of some 50 or 60 deg. C. and contains up to one per cent of acetone. The acetone-laden air must be cooled to approximately atmospheric temperature and filtered. Rather greater care is taken in the recovery than is necessary for higher boiling solvents.

It is advisable in the case of acetone to cool as well as dry the carbon after steaming it before again passing the solvent-laden air. This is effected by passing clean, unheated air through the carbon after drying.

The recovered acetone is mixed with the aqueous condensate, but the concentration is about 30 per cent and the treatment of this condensate is much less costly than of the one per cent concentration obtained by the water wash system. Steam is, of course, consumed in driving the solvent out of the carbon, but in actual practice the overall steam consumption is somewhat similar for the two systems. In the case of the water wash system there is also the extra cost of refrigeration.

It appears that the activated carbon system will eventually replace the water wash system in Great Britain and it is believed that no more water wash systems will be installed there.

Rubber Spreading Industry

In this industry, fabric is coated with a thin layer of rubber for the purposes of making its impervious to water and air. This application of activated carbon for solvent recovery is most popular in Great Britain.

The raw plantation rubber is usually fairly clean. It is broken down and worked into a dough with the admixture of fillers. This process is carried out in the dry mixing machine by two rollers revolving at different speeds. The rubber is then passed through the wet mixer which again is a roller machine incorporating naphtha with the rubber on the rolls. The colours are usually added at this stage and the material is reduced to such a consistency that it will spread on to the fabric.

The wet mixers should be hooded as closely as possible, so that the naphtha which is evaporated may be collected by passing air through the hood to the recovery unit. The main source of recovery is from the spreading machine where the rubber dough is spread over the cloth which is then passed over steam-heated chests some 18 ft. long in order to evaporate the spirit. The spreading machine should be carefully and thoroughly hooded. Sufficient air is passed through the hood efficiently to collect the whole of the spirit and to keep the concentration of naphtha vapour well below the explosive limit. A series of spreading machines may be connected through ducts to a common main leading to the recovery plant. Approximately a thousand cubic feet of air per minute is sufficient for each machine which is actually spreading. The total air from the mixing and spreading machines is passed to the recovery plant which extracts the whole of the solvent and delivers it ready for re-use.

Leather Cloth Industry

The process in this industry is very similar to that of rubber spreading, except that cellulose, dissolved in acetone, benzene and alcohol, is used instead of rubber. The recovery technique for the two industries is therefore very similar.

The recovered solvent, however, is obtained partly in aqueous solution and partly mixed with the non-miscible benzene. It is usually unnecessary to separate the benzene mixture, but it is necessary to distil the acetone and alcohol from the aqueous solution by means of a copper fractionating column.

Film Casting Industry

The processes in this industry also bear some resemblance to those of the rubber spreading industry. There is, of course, no fabric medium onto which the film is spread. Cellulose acetate dissolved in acetone is run onto a heated dryer, the thickness and form of the film being defined by a spreading blade. The acetone is recovered by hooding the machines and passing the solvent-laden air to the recovery plant. The recovered acetone must be fractionated from the aqueous solution.

Photogravure Industry

Large quantities of solvent, principally petroleum, are used in this industry. The hooding of the Rota must be very carefully effected. In some cases the hood is provided by the manufacturers of the machines, in which case this ventilating system is utilized and connected to the recovery plant.

Asbestos Industry

In the manufacture of asbestos jointing, asbestos is the main constituent. This is bound together with rubber. The two constituents are normally mixed with naphtha which is dried off in a calender or a sheeting machine. The machine is thoroughly hooded and vapours are drawn through and delivered to the recovery plant.

Edible Oil Industry

There is normally a considerable loss of the solvent used for extraction in this industry. The extractor vessels are partially filled with the meal to be treated and the solvent, usually a low boiling petroleum hydro-carbon, is mixed in with heated stirrers. The air in the vessels is constantly being displaced by the solvent. When saturated it carries away considerable amounts of solvent through the condenser and vents.

Recovery is effected at the end of the condensers. Since the concentration of the solvent in the air is very high it is advisable to dilute it with more air before passing through the active carbon. This dilution is automatically effected in the plant.

Recapitulation

Activated carbon recovery plants have well proved their worth in British industry. These recovery plants are operating in every industry where solvents are used, as in the manufacture of rubber goods, leather cloth, rubber or balata belting, transparent paper, artificial silk, films, cables, edible oil, in dry cleaning and in other industries. In the dry cleaning industry, a consideration of the problems has led to the designing of a single machine for the processes involved. The benzol recovery plants in the gas industry are a most valuable source of benzol and result also in complete extraction of naphthalene and a considerable reduction of organic sulphur compounds in the treated gas. The use of these plants results in many millions of gallons of solvents being recovered and used over and over again instead of being lost by diffusion into the atmosphere and subsequent pollution.

DEVELOPING PROFESSIONAL ATTITUDES AMONGST UNDERGRADUATES

C. R. YOUNG, M.E.I.C.
Dean, Faculty of Applied Science and Engineering, University of Toronto

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A Present Need

Upon every engineering school that undertakes to give a scholastic preparation for professional life there rests the implied obligation of imparting to young men a high conception of their future calling. Educational institutions that confine their efforts solely to the communication of scientific principles, techniques, and procedures are under no such obligation. They belong to the vocational school or technical institute group; their product is the technician or the technologist. But a university or degree-granting college is bound by the traditions of higher education to fit men for life in its broad aspects and not merely for the more efficient discharge of certain scientific or technological duties.

Engineering colleges have much to learn in this respect from the medical schools. A student in the latter, from the time that he enters as a freshman until he graduates, is constantly subjected to indoctrination calculated to render him highly conscious of the dignity of the profession that he is about to enter and fully on his guard against any attitude or act that would bring that profession into disrepute. Teachers in the engineering schools have heretofore left such matters very much to the professional organizations and have led their classes deeper and deeper into technological intricacies—into the realm of matter and force rather than that of men.

In this course they have been abetted by the highly vocational and materialistic attitude of the average engineering freshman or sophomore. Only too often the young man enters college in the hope that he is done forever with liberal study and that now, at long last, he can get on with the mastery of techniques that will quickly give him superiority and the ability to make a comfortable livelihood, with little relation to the fortunes of the members of his own or any other calling.

Few engineering teachers have made it their business to point out with force and insistence that every graduate of an institution of higher learning should first of all be a citizen and after that a competent worker in some field that is not incompatible with the public welfare. There is no room in a democratic state for those who would pursue courses of action that are at variance with enlightened and constructive citizenship.

Curricular Devices

Something may be done to remedy the situation by curricular inclusions or adjustments. Long courses, devoted to professional attitudes and obligations, would in all probability defeat their own ends. The characteristic resistance of students to being intensively "preached at" would lessen receptiveness and absorption. Much better results may be expected from less obvious and less direct measures. In education, as in war, a flank attack is generally more effective and less costly than one directed obstinately against a guarded front.

For this reason, short inclusions or incidental references in courses ostensibly directed to another purpose than an exposition of the merits and obligations of the engineering profession, are often particularly stimulating. They afford a relieving aside from the main current of what may be a somewhat exacting technical subject and suggest spontaneity and consuming personal interest in professional matters on the part of the teacher. Who of us does not remember the illuminating and inspiring digressions of a great professor of mathematics, or mechanics, or geology?

A short course of lectures on the professional status, perhaps not more than six, may be found useful and practicable, but, the less formal scheduling there is, the better. Greater value is likely to be derived from incidental, but repeated, references to the topic in subjects that bear an unsuspected title. While these may be scientific or technological subjects, it is best to utilize the non-technical ones, either of the humanistic-social or of the tool variety, in that they offer more fluidity and opportunity for diversions. Attractive by-paths open out readily enough in English, Engineering and Society, Economics, Political Science, History, Philosophy, Psychology, Management, Engineering Law, Business, or Statistics. Digressions in the direction of the philosophy of the profession will, however, be profitable only if the teacher can speak with the authority that comes from personal experience and conviction. One who lacks the professional point-of-view himself can scarcely succeed in imparting it to others.

Of what nature should the incidental references to the professional life be? Engineering students being what they are, these should avoid the formal ethical or philosophic approach and should be associated with the personalities of those who have added lustre to the profession. They should be largely biographical or historical in character.

Young men of spirit can scarcely fail to derive benefit from reflecting, for example, on the classical attitude of John Smeaton, the first man to be generally designated as a "civil engineer." Limiting his professional employment in order to devote a portion of his time to scientific investigation and personal development, he adhered steadfastly to the maxim, "the abilities of the individual are a debt due to the common stock of public well-being."

Nor should characteristic examples of high integrity exhibited by the engineering masters in the course of their practice be overlooked. It would be useful to recall the historic declining by Thomas Telford of the post of chief engineer to the Liverpool and Manchester Railway on the ground that it might prejudicially affect the interests of his many canal company clients; or of George Stephenson refusing to use his own patented cast iron rail on the Stockton and Darlington Railway; of Sir John Aird, contractor for the Asyut barrage in Egypt, when unforeseen conditions made the cancellation of the contract necessary, leaving the whole question of profit to Sir Benjamin Baker, the consulting engineer; of Alfred Noble resolutely declining lucrative engagements for the sole reason that he could not give them the study and the attention which they demanded.

The moral, as well as the physical, courage that distinguished the great engineers and made of them illustrious leaders of the profession should in some incidental manner be brought to the attention of every young man in our engineering schools.

It required plenty of the stuff of which backbone is made for Alfred Noble to dissent from the majority report of the International Commission of Engineers appointed by President Theodore Roosevelt and frame the minority report which settled the difficult question as to whether a lock canal or one at sea level should be built at Panama.

Sir John Fowler, although an admirer and staunch friend of the younger Brunel and his successor as consulting engineer to the Great Western Railway, nevertheless resolutely urged the directors to face the loss of entirely abandoning the broad gauge.

The bridled tongue, the fixed resolve to assist worthy fellow practitioners rather than to hamper them through hint or significant silence is a trait that merits mention in any group of young engineers. The practice of the medical profession in this respect serves as a convenient illustration.

Instances of outstanding public or social leadership on the part of engineers may be cited with attendant vitalization of whatever is said in praise of the profession. The war years afforded plenty of them.

Extra-Curricular Aids

However much the engineering teacher may be able to do in inculcating professional ideals in the minds of undergraduates, he should be realistic enough to appreciate the advantage that is enjoyed by the outside practitioner in undertaking a similar task. The student is less disposed to view what is said by the outsider as propaganda than he is when it is said by a member of the teaching staff. There is, too, an added force to the views of men who are in the rough and tumble of professional practice. In consequence, the engineering teacher should do whatever may be possible in organizing meetings, conferences, or seminars at which practising engineers may express their opinions freely on professional questions. In all probability they will say no more than the teacher would have said on the subject, and perhaps say it not quite so well, but there is glamour attaching to the remarks of those who come into college halls from the busy outside world.

Not only is it possible to further the desired objectives by occasional lectures or discussions in which non-academic persons take part, but there is a pronounced value in the distribution of printed articles and papers by outside engineers amongst students, particularly of the upper years. Several notable reprints of this type have been circulated under the auspices of the Engineers' Council for Professional Development. The effect has been good and an extension of the plan is desirable. Busy as undergraduate students are during the academic year, they nevertheless should be urged to attend meetings of engineering organizations outside the university or college. Direct impressions of what prominent professional men say, do, or look like may there be obtained. A particular value attaches to personal contacts, for even the comparatively mature student is in some measure imitative. It is often true that more can be conveyed by example than by precept.

WELDED-BOILER LOCOMOTIVES ON C.P.R. LINES

(Continued from page 718)

To facilitate locating possible defects, lead numbers were attached to a cloth strip at 2 in. intervals. The cloth was then attached to the boiler, close enough to the weld so that the lead numbers would show on a 4½ by 17 in. X-ray negative. The numbers started at the front of each longitudinal seam and at the front longitudinal seam running counter-clockwise when x-raying the girth seams. Light centre punch marks were also made alongside each seam at 10 in. intervals, to which lead arrows pointed, serving as a permanent means of locating defects. When, for example, a defect was found on an x-ray negative, the negative itself was placed on the boiler and positioned exactly by placing the centre punch marks on the negative over those on the boiler, thereby eliminating any possible mistakes in locating defects.

Stress-Relieving Heat Treatment

The American Locomotive Company installed, in 1945, at its Schenectady plant, a wagon-bottom indirect heating stress-relieving furnace, which is fully automatic in its heating, soaking and cooling cycles.

Before placing a boiler in the stress relieving furnace, the foundation ring was bolted in place and the back head, wrapper sheet, throat sheet and boiler shell were thoroughly braced to prevent distortion. After the boiler was mounted on the furnace base, thermo-couples were attached at various locations of the boiler for control of heat input to the light and heavy sections during the stress-relieving operation. The stress-relieving temperature was raised 100 deg. per hour until a maximum temperature of 1175 deg. was reached, the furnace was held at this temperature for two and one half hours and cooled 100 deg. per hour until a furnace temperature of 200 deg. was reached before the boiler was removed from the furnace.

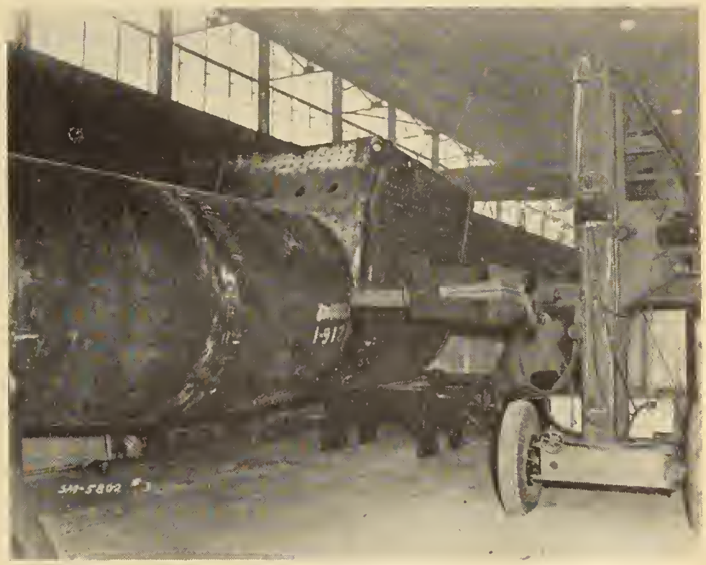

Fig. 6—Boiler seams under X-ray.

The stress-relieving heat treatment was accomplished without any change in contour.

After the stress-relieving heat treatment, the firebox, staybolts, flexible staybolts, tube, flues, stay rods and other internal fittings were applied.

Hydrostatic Test

The boilers were hydrostaticly tested to one and one-half times the maximum allowable working pressure, and while under this pressure all unstayed seams were hammer tested by striking each side of the seams at 6 in. intervals. The boilers were then given the usual final steam test for locomotive boilers.

CHANGES IN ANNUAL FEES

By the time this *Journal* reaches the membership it is likely the account for 1947 fees will have been received. For Members, Juniors and Affiliates the amount has been increased in accordance with the change in by-laws authorized by ballot last spring. The purpose of this article is to recall the circumstances that made these changes desirable, to the end that the increased account will be received in the same spirit which resulted in the overwhelming vote in favour of the change.

It was recognized that the Institute had grown in membership, responsibilities and capacity, to the point that the former income from fees was inadequate to meet its responsibilities and to give to the profession and public the service now demanded. The Institute has reached mature stature and the membership desires to keep it there, without special appeals such as were issued in 1945 and 1946 to establish and maintain the rehabilitation service. The Branches also require the additional funds which accrue to them from these increases.

Elsewhere in this *Journal* is an announcement of Council's proposal to meet the expressed wishes of the membership. Plans are being made to fill new posts for a Field Secretary and Technical Editor for the Journal. These appointments will mean better services to the members and branches, and will be made possible by the increased income from fees.

It should be remembered that eighty per cent of the membership approved the increases in fees. Prompt payment will expedite the inauguration of those things desired by the membership.

EMPLOYMENT OPPORTUNITIES AT HEADQUARTERS

Members will recall that one of the reasons for an increase in annual fees was the desirability of adding to the Institute staff a field secretary and a technical editor. At the November meeting of Council, authority was given to advertise these openings to the membership. Members who may be interested are asked to communicate with the general secretary either to make application or to secure additional information. All applications will be submitted to the Finance Committee for selection and recommendation to Council. It is hoped that decisions may be announced early in the new year.

Field Secretary

The field of work envisaged for this officer may be described briefly in commercial language as "contact man" between headquarters and branches. His time will be spent principally with the officers of the branches, studying their problems, aiding their plans, helping with papers programmes and meetings, establishing contacts between branches, keeping them informed of Headquarters and committee activities, and generally representing Headquarters in the field. His interest will be primarily the welfare of the branches, although it will be necessary for him to spend at Headquarters sufficient time to keep himself familiar with activities and policy of Council and committees.

This will require that he be able to meet people easily, both members and public, to speak in public, to work without regard to time or place, and be thoroughly self-reliant. It may not be necessary for him to reside in Montreal.

Technical Editor

His duties will be to take full charge and responsibility, under the Publication Committee, for all material in the *Journal,* with the exception of editorials and advertising. He will be required to appraise and edit manuscripts, to prepare articles from detail material submitted, and to seek out suitable papers that might not otherwise be obtained. It is expected that a certain amount of travel will be necessary in order to secure the most up to date material.

It is possible that consideration would be given to a part time appointment if a suitable person is not available on a full time basis.

General

Because of the wide variation in qualifications that the committee is prepared to consider, no scale of salaries is being advertised at present, but it is planned to pay enough to attract to the openings persons who are well qualified for the work. In applying, please give in detail all experience that would indicate a familiarity with or an aptitude for the work.

In each instance, preference will be given to a member of the Institute, particularly in appointing the field secretary. All inquiries and applications will be treated as confidential.

TARIFF CHANGE

In the October *Journal* mention was made of the protest offered by the Institute to the Minister of Finance relative to the change in customs tariff whereby certain engineering plans made in the United States would enter Canada duty free. Since then, further action has been taken by many organizations and individuals. As no satisfactory reply was received by the Institute, a formal resolution was passed at the November meeting of Council, which is reproduced herewith along with the covering letter.

December 12th, 1946.

Hon. D. C. Abbott, K.C.,
Minister of Finance,
Ottawa, Ont.

Dear Mr. Abbott:

Commencing with a letter dated July 25, addressed to Mr. Ilsley, the Engineering Institute of Canada has sent to Ottawa several communications dealing with the change made in the tariff regulations whereby plans for engineering work would enter Canada duty free (section 180e). Up to the present no adequate reply has been received.

You wrote to us on August 9, but did not give the information which we were seeking. In reply we wrote you on August 12th, repeating our question, but there has been no reply of any kind to that communication.

We believe the subject is of such importance and the Institute's interest in it sufficiently justified that the communications should not be ignored. Failure to receive a satisfactory reply has forced us to again bring the whole subject to the attention of the Council. At a largely attended meeting, on November 23rd, the following resolution was passed unanimously and I was instructed to forward it to you and to send copies to all our twenty-eight branches across Canada, as well as to the public press. It will also appear in our own *Engineering Journal* which reaches all our 8,000 members.

We are still desirous of discovering why this change was made and why the engineers were not consulted about it. To us it seems a strange policy that such a change would be made without studying the effect on the parties most concerned. There is no evidence that engineers or engineering organizations were even consulted. We would like to know also the likelihood of the change being reconsidered at an early date as suggested in your letter.

Herewith is the resolution:

RE: TARIFF ON ENGINEERS' PLANS ENTERING CANADA

WHEREAS the Council of the Engineering Institute of Canada meeting in Cornwall on Saturday, November 23rd, 1946, has been informed of the change in the customs tariff (item 180e), whereby certain important types of engineers' plans now enter Canada duty free, and

WHEREAS it is the opinion of this Council that such changes are detrimental to the country and to the profession for the following reasons:

(1) Plans made in the United States by American engineers are likely to specify American made machinery, materials and equipment, thereby depriving Canadian industry of what should be its legitimate business;

(2) Work of this kind done in the United States will provide employment for American engineers, draughtsmen and technicians instead of Canadian;

(3) The tendency for American engineers to engage American contractors (in many instances they are the same or interlocking companies) will deprive Canadian contractors of work which is essential to them.

(4) The profession of engineering in Canada cannot develop as it should in these specialized industrial fields unless such work is done in Canada. It will become necessary in many instances for the engineer to move to the United States if he desires such work. Canada cannot afford to lose any more of its engineering talents to the United States. The government should be bent on assisting them to stay here, rather than encouraging them to go elsewhere.

(5) As the United States does not give similar exemption to engineering plans made in Canada, the action of our government places the profession in Canada in an inferior and humiliating position.

THEREFORE BE IT RESOLVED that this Council urges strongly that the government reconsider and repeal item 180e of the Customs Tariff and restore the duty on engineers' plans, drawings or blueprints of machines, etc., to that rate which was in effect immediately prior to June 28th, 1946.

Yours sincerely,

(*Signed*) L. AUSTIN WRIGHT,
General Secretary.

THE SIXTY-FIRST 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 1947 will be convened at Headquarters at eight o'clock p.m. on Thursday, January 30th, 1947, for the transaction of the necessary formal business, including the appointment of scrutineers for the officers' ballot, and will then be adjourned to reconvene at the Royal York Hotel, Toronto, Ontario, at nine thirty a.m. on Thursday, May 8th, 1947.

MORE ABOUT SALARIES

The pattern of change in professional life in the United States frequently is an indication of developments to come in Canada. Therefore the recently issued scale of salaries for civil engineers in the Federal services and the new scale recommended in an interim report by the Committee on Salaries of the American Society of Civil Engineers are interesting to Canadians. In the November issue of *Civil Engineering* the two proposals are placed side by side for purposes of comparison. With the permission of the Society, the *Journal* reproduces herewith an abridgment of the report.

First the various grades are described. It is impossible to set up classifications that will fit into all businesses, but it is the hope of all salary committees that the grades described will be sufficiently appropriate that they can be accepted as a standard from which to start. These grade descriptions are much more general and therefore will be more useful than many that have been used in the past.

Engineers employed with federal or provincial governments in Canada will perceive with envy the salaries now being paid by the Government of the United States. It will be noticed too that the interim scale recommended by the A.S.C.E. committee is still higher than the Government schedule.

Following is the abridgment.

GRADE I

Grade I includes all positions which involve, under immediate supervision, the performance of simple and elementary civil engineering duties requiring professional training, but little or no experience.

GRADE II

Grade II includes all positions which involve, under immediate or general supervision, individually or with a small number of subordinates, the performance of civil engineering duties requiring professional training, previous experience, and to a limited extent the exercise of independent judgment.

GRADE III

Grade III includes all positions which involve, under general supervision, individually or with a number of subordinates, the performance of civil engineering duties of substantial difficulty and responsibility, requiring professional training, previous experience, and independent judgment.

GRADE IV

Grade IV includes all positions which involve, under general supervision, individually or with a number of subordinates, the performance of difficult civil engineering duties or the supervision of a subdivision of an engineering organization, requiring professional training, previous experience, recognized leadership, and independent judgment.

GRADE V

Grade V includes all positions which involve, under general supervision, individually or with a number of subordinates, the performance of difficult civil engineering duties or the supervision of a division of an engineering organization, or the direction of a staff on investigative studies, research and testing, design, or construction, requiring professional training, previous experience, recognized leadership, and independent judgment.

GRADE VI

Grade VI includes all positions which involve, under general direction, individually or with a number of subordinates, the performance of difficult civil engineering duties or the supervision of a division of an engineering organization, or acting as the principal assistant to the head of a division of a large engineering organization or the direction of a staff on investigative studies, design or construction requiring professional training, successful experience in engineering work.

Grade VII

Grade VII includes all positions which involve, under general direction, individually or with a number of subordinates, the performance of important civil engineering duties or the supervision of a division of a large engineering organization, or the direction of a staff on investigative studies, design or construction, requiring professional training, extensive successful experience in engineering work with demonstrated aptitude and capacity for increased responsibilities in managerial and executive functions.

Grade VIII

Grade VIII includes all positions, such as:

(a) the assistant to the technical and administrative head of an important engineering organization; or

(b) the technical and administrative head of a lesser engineering organization; or

(c) positions involving the development, analysis, and evaluation, for final executive action of difficult and complex engineering projects with respect to their feasibility, cost, economic justification, and public necessity or convenience.

Grade IX

Grade IX includes all positions:

(a) such as, the administrative and professional head of an important engineering organization with full authority and responsibility for conceiving and executing all the plans and functions of the organization, directing an administrative and professional engineering staff engaged in varied important projects; or

(b) positions requiring highly specialized professional engineering or scientific ability.

Comparison Of A.S.C.E. Proposal With Recently Established Scale for United States Federal Employees

In the last two years, two increases have brought the Federal employees' schedule up to the following:

Here are the salaries ASCE now recommends as an interim measure, pending further study, to bring salaries more nearly in line with existing conditions:

Federal Prof. Grades	Federal Rates, Eff. July 1, 1946	ASCE Grades Oct. 1946	ASCE Rates Oct. 1946
P-1	$ 2,645- 3,400	I	$ 2,700- 3,400
P-2	3,400- 4,150	II	3,400- 4,200
P-3	4,150- 4,902	III	4,200- 5,100
P-4	4,902- 5,905	IV	5,100- 6,100
P-5	5,905- 7,102	V	6,100- 7,250
P-6	7,102- 8,180	VI	7,250- 8,600
P-7	8,180- 9,975	VII	8,600-10,350
P-8	9,975-10,000	VIII	10,350-12,600
P-9	10,000 and up	IX	12,600 and up

STARTLING PROPOSALS IN SASKATCHEWAN

It has taken the western province of Saskatchewan to give professional groups the shock of the year. The government there is investigating the advisability of taking away from the professions and from other privileged groups the right to register, control and discipline their own members. The move came as a result of a resolution passed at the last session of the legislature, which recommended that the Law Amendments Committee review the professional acts and suggest such amendments as may seem " expedient and advisable ".

In one newspaper clipping that has reached the *Journal* it says " Nineteen different professions and practices ranging from medical men to engineers would be affected."

Presumably, the review of the professions is to discover whether or not they are exercising their government granted privileges " in the public interest ". Such a motive is a worthy one. Every government should be certain that these privileges are being used solely for that purpose, and no profession or other licensed group should object to such a study, providing the motivating spirit of the investigators is also solely in the public interest. The possibility of it being political is not too remote.

The action of the Saskatchewan government is of wide interest. The whole basis of licensing is being challenged. It is to be hoped that all the facts are written into the record of the reviewers in Saskatchewan, because if such is the case it will be found that at least as far as the profession of engineering is concerned the present system has been operated " in the public interest ", and doubtless the same will be true of the other professions.

The following paragraphs are taken from the *Leader Post* of November 30th:

" Transfer of disciplinary powers now held by professional societies in Saskatchewan to special administration boards to be set up by the government is proposed under legislation now being considered by the continuing committee of the law amendments committee of the legislature.

" Among specific recommendations contained in the resolution was that the committee study the professional acts for the purpose of ascertaining the powers and duties given to the various professions or practices under the acts; determining whether the exercise of such powers and the discharge of such duties by professional societies is in the public interest; the securing of such uniformity in the provisions and administrations of the acts as may be found possible, and recommending such amendments as might seem expedient and advisable.

" Nineteen different professions and practices, ranging from medical men to engineers, would be affected.

" These are: Legal, medical, surveyors, chartered accountants, agrologists, architects, veterinarians, engineers, chiropodists, dentists, physical therapists, pharmacists, music teachers, osteopaths, registered nurses, chiropractors, druggists, embalmers, and optometrists.

" Should the proposed legislation be approved by the legislature, it would mean the appointment of 19 government boards—one for each of the professions and practices—to deal with disciplinary measures, the setting of maximum fees to be charged for services, the licencing of the various professional people, examinations, and other regulations now held by the professions or practices under special acts.

Improper Conduct

" With regard to the disciplinary measures, it is understood that persons who might be charged with improper conduct or a breach of any of the regulations or of the code of ethics prescribed would have the right of appeal. If the appeal were lost, the person's name would be struck from the register. Provision would also be made for reinstatement at a later date.

"Under these acts, the professions now have sweeping powers by which they can deal with the disciplining of their own members, licencing, fees, qualifications for practicing in Saskatchewan, examinations and other matters pertaining to the various professions or practices.

"The professional people would be prohibited from practicing in the province after Dec. 31, 1947, unless licenced by the special administration boards to be set up by the government.

"It was learned that these administration boards would each be comprised of three members. Two of them would be appointed by the cabinet, the other by the profession affected.

"According to unofficial sources, the continuing committee has held several meetings since the last session of the legislature to deal with the proposed legislation. After a final draft is approved, it would be reported to the entire law amendments committee of 40 members.

"It is understood that the proposals stipulate that where professional people fail to register with their respective administration board and hold a license to practice issued by the board, a fine of not more than $500 could be levied following prosecution.

"All professional and other people covered by the 19 acts would be required to apply to the administration board for a licence authorizing them to practice after Jan. 1, 1948. This would be mandatory."

PRAIRIE WATER PROBLEMS

Institute's Recommendations Implemented

Considerable time was allotted a few years ago at annual professional meetings of the Institute to the study of prairie water problems. As a more or less direct result of these discussions, the Prairie Farm Rehabilitation Act was passed. Under this act, the federal government provides funds and staff to study, construct and operate many small water projects that have made habitable many localities that had been deserted, or never had been occupied, because of the lack of water. This organization has been very helpful in the rehabilitation of many areas in the three prairie provinces and it has gradually expanded until it is now undertaking quite large projects.

The interest and activities of the Engineering Institute have been maintained by the Prairie Water Problems Committee, appointed some years ago to study the various problems and make recommendations. This committee while scattered and difficult to convene, in fact has never held a meeting with all members present, is composed of members of the Institute scattered from Montreal, Que., to Victoria, B.C. Nevertheless, the proposed St. Mary and Milk Rivers development was, after a very careful study, endorsed by the committee. A report dealing fully with the project was prepared and forwarded to the federal and provincial governments with a strong recommendation that the project be undertaken by the two governments.*

The federal government appointed a committee with a member of the Institute, Mr. V. Meek, as chairman, to investigate and report. This committee also recommended that the project should be developed by the Dominion and Alberta governments. It was also pointed out that if this project were not proceeded with, Canada was in danger of forfeiting part of its share of the St. Mary and Milk rivers, both of which head in United States and supply the water for the project. While the Institute committee did not hold regular meetings, the members of the committee individually seized every opportunity to advocate the construction of the project. However, care was taken not to make a political issue of the matter.

Early this year, the Canadian Pacific Railway Company transferred the Alberta Railway and Irrigation Company's irrigation undertaking and works 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. The Alberta government created a crown corporation called the St. Mary and Milk Rivers Development with a manager to maintain and operate the project and as additional works are constructed, the crown corporation will take them over and operate them. The manager will also organize the owners of the additional irrigable lands into irrigation districts to give service to the farmers. The crown corporation will maintain and operate the reservoirs and main canals and wholesale water to the irrigation districts. In this way the government will be responsible for the larger and more costly works and the irrigation districts which are managed by a board of trustees elected by the water users will look after the distribution system and be responsible for the service to the farmers.

The Prairie Farm Rehabilitation organization has started the construction of the Pothole reservoir with funds provided by the Alberta government and the construction of the large dam on the St. Mary river near Spring Coulee with funds provided by the federal government. These two jobs have been started without a formal agreement but it is believed that a formal agreement covering the construction and operation of the whole project will be executed at an early date.

Recently the Lethbridge Board of Trade organized and held a Jubilee to celebrate the twenty-fifth anniversary of the starting of the construction of the Lethbridge Northern Irrigation District works and the recent starting of the construction of the works for the St. Mary and Milk Rivers development. Interested persons from as far east as Montreal and as far west as Vancouver attended. The Right Honourable C. D. Howe represented the Dominion government and Premier E. C. Manning represented the government of the Province of Alberta and gave public addresses. Both are much in favour of the construction of this and other similar projects.

Mr. Howe, in an address packed with informative factual data on irrigation and the St. Mary and Milk Rivers development in particular said in part:

"It is because of the value of irrigation to the state that governments are prepared to contribute largely to the cost of irrigation development. The federal government is in partnership with the provincial government in the building of the most ambitious irrigation undertaking that has been projected thus far. I look forward to the bringing into production of many more green acres in these prairie provinces."

Premier Manning was applauded when in reply he said:

"I was particularly impressed with the reference of Mr. Howe to the 'partnership' in this irrigation enterprise. We are happy to be an active partner with the Dominion in this development."

In expressing the thanks of the gathering to the guest speakers, Senator W A. Buchanan followed up this highlight by saying:

"We have here an example that might well be followed by other leaders in Canada, an example showing that it is possible for provinces to cooperate with the Dominion government."

The ultimate development includes the use of the available waters in the Belly and Waterton rivers as well as the St. Mary and Milk rivers.

It is understood that plans for the Bow River development, which is really an expansion of the Canada Land

* See *Engineering Journal*, May 1941, p. 222.

and Irrigation Company project, are developing and an agreement between the Federal and Alberta governments is likely to be consummated before long.

The Institute Committee is very pleased that its recommendations are being carried out. Seven members of the Committee attended the celebration at Lethbridge.

PITY THE EDITOR

Recently, many comments from members have come to the editor, regarding the "make-up" of the *Journal*. Each issue is getting thinner than the preceding and the amount of reading matter seems to be continually decreasing to the benefit of advertising. No criticisms could have better pleased the editor, because he hopes he may interpret them as expressions of appreciation for the Journal's former composition.

The conditions of which our members complain have been quite patent to the editorial staff, but there seems to be little than can be done about it. The facts are these. There is no shortage of papers to print, but there is a serious shortage of paper on which to print. The situation is worse than it has ever been at any time during the war, and each month it seems to further deteriorate. The fact that the Institute membership keeps increasing further complicates the problem.

It will be recalled that the list of members, which was part of the November issue, appeared on newsprint. It has thus been possible to effect some saving on the regular stock and meet the circulation requirements until the end of the year. The same expedient may have to be resorted to in the next few months unless the supply situation improves.

The principal reason why it is not possible to reduce the amount of advertising in the *Journal* is that the Institute is bound by contracts which usually run on a six months or a yearly basis. However, the pinch of paper has also adversely affected the volume of advertising which constitutes the principal source of revenue for the *Journal*. Incidentally, the printing costs have increased materially in the past year.

Another condition which has aroused criticism is the delay in publication. Here again, the situation is beyond the control of the editors. As in any other business today, delivery on schedule is a thing of the past. Although it may not be an excuse, the editor derives a certain comfort from the fact that this condition is not peculiar to the *Journal*. In fact, it was observed that *Electrical Engineering*, the publication of the American Institute of Electrical Engineers, recently dropped an entire issue in order to adjust its publication date. One of Philadelphia's principal papers recently discontinued for a while the publication of advertisements.

With the readers, the editor looks forward to the time when these conditions will not apply, but in the meantime he hopes the membership will not be too critical.

G. H. DUGGAN'S YACHTING ACTIVITIES

A Correction

In the obituary notice of Dr. G. H. Duggan published in the October number of *The Engineering Journal*, the following revision should be recorded in the description of his yachting activities.

The yacht which he sailed and with which he won the Seawanhaka International Cup against the best professional and amateur designers in the U.S.A. was called *Glencairn*. His success in this competition was an engineering achievement as much as a sporting event, because the yachts which raced were of the lightest weight and called for thorough structural knowledge and an ingenuity which Mr. Duggan possessed to a remarkable degree. The winning and subsequent defence of this trophy for so many years by yachts of his design was the more notable because, at that time, the United States of America yachtsmen were considered unbeatable, and the triumphant results of the races created an unprecedented interest and excitement throughout the country, both in the United States and in Canada.

CORNWALL BECOMES A BRANCH

The 28th branch of the Institute became a reality on November 22nd when at Cornwall, Ontario, the president presented the charter to Donald Ross-Ross, the first chairman. It was an inspiring occasion. One hundred and thirty-eight members were present, fifty-five of them being from cities other than Cornwall, and four of them being vice-presidents. Greetings were presented by representatives from sixteen branches, Regina being the most westerly and Sydney the farthest east. This wide representation was impressive and gave proof of the national character of the Institute's interests and activities.

The meeting was conducted by Chairman Ross-Ross, ably assisted by Drummond Giles, who introduced the president. The president commented on the unique experience he had had in being able to present charters to two branches in one year, the first one being at Trail, B.C., for the Kootenay Branch.

The general secretary spoke of his recent visit to England, and of the work done by the conference of representatives of the Commonwealth Engineering Societies, also of the first meeting held in London for the members of the Institute in the Old Country.

The large attendance of engineers resident in the locality was a definite indication of the need of a branch in that area. Previously, members in Cornwall and surrounding area belonged to the Ottawa Branch, but because of the distance from the branch centre they were not able to participate in the activities. Therefore, Ottawa had a special interest in the new branch, and Councillor Walter Saunders for Ottawa advised the youngest member of the Institute family that the members in Ottawa were delighted with the recent development and sent their heartiest good wishes.

President Hayes presents charter to Chairman Ross-Ross.

A regional meeting of Council was held the following day. There were councillors from eight branches. The president presided, but, following his established custom, handed over the reins in succession to each of the four vice-presidents: C. E. Sisson of Toronto, W. R. Manock of Fort Erie, G. F. Layne of Quebec and J. E. Armstrong of Montreal.

The executive of the new branch are to be congratulated on the excellent arrangements made for the meeting. Their hospitality and their organizing ability were outstanding, and were commented upon, particularly by the out of town members.

PRESIDENT HAYES VISITS QUEBEC AND EASTERN ONTARIO

In a tour which lasted less than two weeks, President Hayes completed last month his visits to the branches outside the Maritimes, inaugurated a branch at Cornwall and a Student Section at Quebec, presided over a regional meeting of Council and met with the largest group of engineering students ever assembled in one faculty, the Ajax Division of the University of Toronto. Throughout the journey, the president was accompanied by Mrs. Hayes, Councillor G. J. Currie of Halifax and Mrs. Currie, and the assistant general secretary. Other officers and past officers of the Institute joined the group for part of the trip to do honour to the president.

The tour started on November 17th at Quebec, where a full programme occupied three days. A detailed account of the proceedings appears in the Branch News Section. G. A. Gaherty, chairman of the Committee on Prairie Water Problems, and R. E. Heartz, chairman of the Committee on Employment Conditions and trustee of the Harry Bennett Educational Fund, both from Montreal, were present at the dinner meeting.

At Trois-Rivières, on November 20th, a dinner meeting was held at the Château de Blois and was well attended by members from all centers in the St. Maurice Valley. Wm. Chester Smith, from the Toronto Branch, and R. E. Heartz from Montreal were among the visitors.

The meeting with the Montreal Branch was held at Headquarters on November 21st and was addressed by the president and Dr. L. Austin Wright, general secretary, who told the audience of his recent visit to England and continental Europe. Before the meeting, the branch executive entertained the president and his party at dinner at the Mount Stephen Club.

A separate account of the Cornwall Branch inauguration appears elsewhere in this issue. On Sunday afternoon, the presidential party proceeded to Kingston where Past Vice-President E. P. Muntz of Hamilton and Montreal, and Councillor J. R. Dunbar of Hamilton, joined the group.

Monday, November 25th, was ladies day for the party. After a morning visit through the Aluminum Company's plant, Mrs. Hayes and Mrs. Currie were each presented with a pressure cooker. This gesture put into the minds of the ladies insidious expectations as they accompanied the group to the Nylon plant of the C.I.L., in the afternoon. The Kingston reputation for hospitality was fully maintained when the ladies were presented with samples of the precious hosiery after the visit. At five o'clock, the president and his entourage were guests at a meeting of the Undergraduate Engineering Society at Queen's. The president presented the Institute prize certificate to R. B. Glass and addressed the students. Councillor Currie and the assistant general secretary also addressed the meeting. The party were then guests of Dean Ellis for a reception at his home, where the branch executive were also present.

The dinner meeting with the branch was held at 6.30 in the Aluminum plant cafeteria. Principal and Vice-Chancellor R. C. Wallace, Hon. M.E.I.C., of Queen's, was present as well as Councillor Dunbar of Hamilton.

On Tuesday, November 26th, the presidential party proceeded to Ottawa where a branch dinner meeting was held at the Chateau Laurier at 7.15. The headtable guests included four past presidents of the Institute: A. J. Grant, Chas. Camsell, C. J. Mackenzie, K. M. Cameron. Among the out-of-town members present were Councillors J. B. Stirling of Montreal and J. R. Dunbar of Hamilton. The meeting was addressed by President Hayes and by Air Vice Marshal E. W. Stedman. A resume of Air Marshal Stedman's address on the Bikini tests appears in the Branch News Section

From Ottawa, the group were driven by Councillor W. L. Saunders to Peterborough, where a successful dinner meeting with the branch was held at the Empress Hotel. E. P. Muntz had joined the party again at this point. Among the guests present at the dinner was Mr. Lucas, assistant chief engineer of the British Thomson Houston Company. After dinner, Past Councillor H. R. Sills entertained for the visitors at his home.

The next morning, the presidential party were shown through the Canadian General Electric plant and entertained at lunch at the Kawartha Country Club.

Visit to Ajax

From there, Past Vice-President R. L. Dobbin drove the party to Ajax where they were greeted by Dean C. R. Young and Professor W. J. T. Wright, director of studies. An inspection indicated that the same standards of mass production to rigid specifications which existed in this former shell-filling plant have been maintained on the make-shift campus where now 3,200 students (first and second years) are undergoing engineering training for the pursuits of peace.

Dean Young was host to the party at dinner in the Faculty quarters, after which a huge meeting was held in the Students' Hall. Over 800 students, mostly returned men, filled the room to capacity. The meeting had been arranged by the Junior Section of the Toronto Branch of the Institute and was conducted by the president of the Undergraduate Engineering Society. Addresses were given by Dean Young, Professor Wright, President Hayes, I. S. Widdifield, chairman of the Junior Section, Councillor W. H. M. Laughlin of Toronto, President M. J. Auliffe of the Undergraduate Society, and the assistant general secretary. The visitors were then driven to Toronto where they entrained for Montreal.

On Friday evening, November 29th, the president accompanied by Councillor and Mrs. J. B. Stirling and Councillor and Mrs. G. J. Currie attended the Annual Dance of the Junior Section of the Montreal Branch at the Ritz-Carlton Hotel.

Thus was completed another presidential tour in the best traditions established by previous presidents.

JOINT ACTION BETWEEN A.S.M.E. AND E.I.C.

On December 5th, at New York City, the joint committee which is established under the cooperative agreement between The American Society of Mechanical Engineers and the Engineering Institute of Canada, met to consider joint activities for 1947. The A.S.M.E. representatives were A. G. Christie, past-president and professor of mechanical engineering at Johns Hopkins University, A. E. White, professor of metallurgical engineering, University of Michigan, and George Stetson, editor of *Mechanical Engineering*. For the Institute, John G. Hall of Combustion Engineering Ltd., Toronto, W. A. Newman of the Department of Research, Canadian Pacific Railway, Montreal and the general secretary, were the representatives. The other representatives of the joint committee who, unfortunately, could not be present were J. W. Parker, president, Detroit Edison Company, Detroit, and Dr. O. W. Ellis, director, Department of Engineering and Metallurgy, Ontario Research Foundation.

Preliminary arrangements were made for joint participation in the work of research and code committees. Also for joint publication of technical papers and joint participation in professional meetings. Prompted by the success of the 1943 meeting, a proposal to hold another joint professional meeting in 1948 is to be submitted to the governing bodies of both organizations.

The next meeting of the joint committee was set tentatively for Toronto in May, 1947, during the course of the annual meeting of the Institute.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Ceramic and Non-metallic Minerals	Chemical Engineering and Chemistry	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
Dalhousie University	1st	94 (62)															94 (62)
	2nd	92 (56)															92 (56)
	3rd	43 (18)															43 (18)
Total		229 (136)															229 (136)
Saint Mary's College, Halifax	1st	19 (3)															19 (3)
	2nd	18 (5)															18 (5)
	3rd	15 (1)															15 (1)
Total		52 (9)															52 (9)
St. Francis Xavier	1st	90 (50)															90 (50)
	2nd	95 (48)															95 (48)
	3rd	80 (12)															80 (12)
Total		265 (110)															265 (110)
N.S. Tech. College	3rd						38 (9)	33 (3)					45 (16)		12 (5)		128 (33)
	4th						16 (2)	21 (1)					27 (5)		4 (1)		*68 (9)
Total							54 (11)	54 (4)					72 (21)		16 (6)		196 (42)
Acadia University	1st	103 (89)															103 (89)
	2nd	62 (47)															62 (47)
	3rd	42 (23)															42 (23)
Total		207 (159)															207 (159)
Mount Allison Univ.	1st	93 (47)															93 (47)
	2nd	67 (48)															67 (48)
	3rd	59 (19)															59 (19)
Total		219 (114)															219 (114)
University of New Brunswick.	1st						79 (62)	103 (94)									182 (156)
	2nd						100 (76)	83 (63)									183 (139)
	3rd						23 (13)	33 (16)									56 (29)
	4th						18 (6)	18 (7)									*36 (13)
Total							220 (157)	237 (180)									457 (337)
Laval University, Quebec.	1st	114 (16)															114 (16)
	2nd					8 (1)	11	13				5		3	5		45 (1)
	3rd					13		13				6		4	6		42
	4th					3		13						1	2		*19
Total		114 (16)				24 (1)	11	39				11		8	13		220 (17)
Ecole Polytechnique	1st	172 (32)															172 (32)
	2nd	82 (4)															82 (4)
	3rd	67 (3)															67 (3)
	4th					4	36 (1)			22					7		69 (1)
	5th					3	21			31					6		*61
Total		321 (39)				7	57 (1)			53					13		451 (40)
McGill	1st	419 (306)															419 (306)
	2nd	261 (187)				81 (53)								16 (11)	19 (19)	23 (19)	400 (289)
	3rd					31 (15)	48 (23)	47 (16)					78 (50)	4 (3)	5 (2)	7 (4)	220 (113)
	4th					26 (6)	38 (17)	34 (12)					44 (13)	9 (6)	5 (4)	7	*163 (58)
Total		680 (493)				138 (74)	86 (40)	81 (28)					122 (63)	29 (20)	29 (25)	37 (23)	1202 (766)
Queen's Univ.	1st	678 (619)															678 (619)
	2nd	504 (416)															504 (416)
	3rd					40 (18)	48 (26)	55 (34)				16 (7)	59 (31)	12 (9)	21 (15)	20 (8)	271 (148)
	4th					32 (6)	31 (16)	24 (7)				6 (2)	37 (11)	7 (5)	18 (10)	13 (1)	*168 (58)
Total		1182 (1035)				72 (24)	79 (42)	79 (41)				22 (9)	96 (42)	19 (14)	39 (25)	33 (9)	1621 (1241)
Toronto	1st		107 (84)		10 (8)	292 (204)	265 (197)	303 (263)				53 (43)	379 (295)	66 (50)	91 (71)	123 (92)	1689 (1307)
	2nd		69 (55)		13 (13)	196 (141)	215 (170)	316 (270)	125 (108)			47 (41)	319 (258)	35 (29)	67 (60)	112 (80)	1514 (1225)
	3rd		25 (13)		7 (2)	84 (40)	83 (50)	91 (48)	38 (33)			3 (1)	120 (72)	18 (16)	13 (10)	48 (19)	530 (304)
	4th		15 (8)		4	66 (23)	42 (23)	49 (20)				5 (3)	65 (29)	12 (7)	7 (6)	23 (5)	*288 (124)
Total			216 (160)		34 (23)	638 (408)	605 (440)	759 (601)	163 (141)			108 (88)	883 (654)	131 (102)	178 (147)	306 (196)	4021 (2960)
Manitoba	1st	470 (314)															470 (314)
	2nd	266 (183)															266 (183)
	3rd						40 (20)	42 (21)									82 (41)
	4th						32 (9)	42 (8)									*74 (17)
Total		736 (497)					72 (29)	84 (29)									892 (555)

*Indicates those graduating in 1947—Total 1,175.

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 and Chemistry	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
Saskatchewan	1st	432 (295)	....	....	....	....	....	....	....	..	..	....	....	....	....	....	432 (295)
	2nd	448 (310)	....	....	....	....	....	....	....	..	..	....	....	....	....	....	448 (310)
	3rd	......	....	21	8	17	37	32	....	..	..	9	44	....	....	6	174
	4th	......	....	7	5	9	21	....	....	..	..	4	40	....	....	14	*100
Total	....	880 (605)	....	28	13	26	58	32	....	..	..	13	84	....	....	20	1154 (605)
Alberta	1st	472 (341)	....	....	....	....	....	....	....	..	..	....	....	....	....	....	472 (341)
	2nd	......	....	....	....	75 (53)	75 (65)	96 (72)	....	..	..	....	....	....	66 (56)	....	312 (246)
	3rd	......	....	....	....	23 (9)	42 (18)	35 (18)	....	..	..	....	....	....	20 (10)	6 (4)	126 (59)
	4th	......	....	....	....	10 (3)	25 (2)	18 (3)	....	..	..	....	....	....	8 (5)	2	*63 (13)
Total	....	472 (341)	....	....	....	108 (65)	142 (85)	149 (93)	....	..	..	....	....	....	94 (71)	8 (4)	973 (659)
British Columbia	1st	1113 (859)	....	....	....	....	....	....	....	..	..	....	....	....	....	....	1113 (859)
	2nd	535 (342)	....	....	....	....	....	....	....	..	..	....	....	....	....	....	535 (342)
	3rd	......	....	1	....	27	30	32	....	..	8	18	42	12	13	10	193 (65)
	4th	......	....	....	....	27	17	37	....	..	6	8	27	6	4	3	*135
Total	....	1648 (1201)	....	1	....	54	47	69	....	..	14	26	69	18	17	13	1976 (1266)
Grand Total	....	7005 (4755)	216 (160)	29	47 (23)	1067	1431	1583	163 (141)	53	14	180	1326	205	399	417	14135 (9016)

*Indicates those graduating in 1947—Total 1,175.

NOTE—The figures shown in brackets indicate, in each case, the number of veterans comprised in the figure immediately preceding.

The accompanying table, showing the enrolment in the various branches of engineering at Canadian colleges for the present session, is the most impressive display of these statistics that the *Journal* has ever published. The figures constitute records in all departments. They convey a better appreciation of the tremendous task undertaken by the teaching staffs at universities, and indicate the responsibility which lies ahead for the profession in seeing that these young men, most of them veterans, get properly established in their calling.

A total registration of 14,135 compares with a figure of 7,061 for last year and 4,197 for 1941-42. It is interesting to note that more than 9,000 of them are veterans. This confirms the forecast made a few years ago based on the survey carried out among the men in the armed services. Although they were not altogether unprepared for it, such an influx has taxed to capacity the resources of our universities and is being met only because of the ingenuity and efforts of the heads and the staffs of the faculties. A striking example of this is the registration figure of over 4,000 at the University of Toronto, 3,200 of whom (first and second year) are located at Ajax. The bold measures taken at the University of British Columbia are another example of the courage and ingenuity of the teaching staff.

The number of students expected to graduate in the spring is 1,175. Considering only the main branches, the graduating class is divided as follows: civil 261; electrical 256; mechanical 240; chemical 176; mining and metallurgical 89. For the first time in several years, the number of graduates in civil engineering exceeds the number of those graduating in each of the other branches.

The tabulation this year includes the registration at the five engineering colleges in the Maritimes where a three-year pre-engineering course is given, starting at the junior matriculation level. The institutions are: Dalhousie University and Saint Mary's College, Halifax; Acadia University, Wolfville, N.S.; St. Francis Xavier University, Antigonish, N.S.; and Mount Allison University, Sackville, N.B. The students graduating from those colleges are admitted in third year engineering at other Canadian universities, so that it is quite proper that their numbers be included in these statistics.

The University of British Columbia, which comes immediately after Toronto in volume of enrolment, has introduced two new courses this year: in agricultural engineering and in engineering physics. It is also interesting to note that a Department of Architecture has been opened, although this has no bearing on the accompanying statistics.

1947 Annual Meeting of the Institute

DIAMOND JUBILEE

TORONTO, MAY 8-9th — ROYAL YORK HOTEL

E.C.P.D. TO MEET IN CANADA

At the November meeting of the executive of the Engineers' Council for Professional Development, at New York, the invitation of the Engineering Institute of Canada to hold the 1947 annual meeting of the Council in Canada was accepted. The 24th and 25th of October were selected for the dates and the meetings will be held in Montreal at the Mount Royal Hotel.

This will be the first time that this international body has met outside of the United States. It will be an important event in the history of engineering development in Canada. It is expected that delegates from the educational field and the industrial world from many parts of both countries will participate. James W. Parker, president of the Detroit Edison Company is chairman.

HIGH SCHOOL STUDENTS ATTEND SYMPOSIUM

"Engineering as a Career" was the topic of discussion at a symposium for high school students, held on the afternoon of Friday, November 22nd, at Institute headquarters, in Montreal.

The meeting was sponsored by the Student Guidance Committee of the Montreal Branch. It was attended by some 150 students, all of whom had expressed an interest in the career of a professional engineer: they were drawn from the upper grades of seven local high schools (Montreal West, Westhill, Westmount, Montreal, Baron Byng, Lachine and Sir George Williams, Claremont Division). Because of the limited capacity of the auditorium it was not possible to accommodate all who wished to attend.

The students were first addressed by two guest speakers. Mr. F. L. Lawton, M.E.I.C., Assistant Chief Engineer, Aluminum Company of Canada, Ltd., spoke on Electrical Engineering as a Career; and Mr. S. R. Banks, M.E.I.C., Aluminium Laboratories Limited, spoke from the civil engineer's point of view. The meeting was then taken over by Professor R. DeL. French, a member of the Committee, who ably dealt with a prolonged question period.

It was evident that the audience were extremely interested in the Symposium—the first of its kind to be held by the E.I.C.—and favourable comments were made by the Student Counsellors, Messrs. H. R. W. Goodwin, L. D. Hamilton, and K. H. Murray, who were present. It is therefore likely that a further meeting on similar lines will take place shortly.

The Student Guidance Committee of the Montreal Branch is to be congratulated on the enthusiastic and realistic manner in which they are tackling their job. Six members of the Committee, including the Joint Chairmen, (L. A. Duchastel, French Section; and G. B. Moxon, English Section) took part in the meeting, which was presided over by Mr. Moxon.

A.S.M.E. STUDENTS VISIT MONTREAL

About twenty-five students from Clarkson College of Technology at Potsdam, N.Y., visited industrial plants in Montreal on December 6th. They are members of the Student Branch of the American Society of Mechanical Engineers at Clarkson.

At the request of the students, the plant visits had been arranged by Headquarters. Accompanied by one of their professors, Mr. Gordon Babcock, the group first inspected the Dominion Engineering Works at Lachine, and, in the afternoon, they were guests of the Steel Company of Canada, at its rolling mill in Montreal.

T. A. Monti and R. J. Griesbach, respectively chairman and vice-chairman of the Junior Section of the Montreal Branch of the Institute, escorted the group throughout the visits.

A STUDENT SECTION AT LAVAL

A Student Section of the Quebec Branch was officially inaugurated at Laval University by President J. B. Hayes in the afternoon of November 19th, on the occasion of his visit to the branch. It was only a few years ago that courses in engineering were established at Laval, and the present enrollment stands at 150. Out of this number, about 80 students belong to the new section of the Institute. Jérôme Lépine, a fourth year electrical engineering student, has been elected president.

Professor René Dupuis, head of the Department of Electrical Engineering, who has been instrumental in the establishment of the Student Section, welcomed the president and expressed the regrets of Dean Adrien Pouliot who could not be present. The annual visit of the president of the Institute at Laval was a great stimulus to both the students and the teaching staff.

On behalf of the students, Mr. Lépine expressed their pleasure at being permitted to become more closely associated with the Institute and thanked both the University authorities and the Quebec Branch for their assistance. He then invited the president to address the students.

President Hayes declared the new Student Section at Laval University officially opened. He then presented to Adrien Morin, a fourth year student, the certificate of the Institute prize "in recognition of his standing in the engineering courses of his year and of his activities in connection with engineering society affairs". In his remarks, the president insisted on the necessity of the engineer's imparting to his work some of his personality, beyond furnishing an honest day's work.

The chairman of the Quebec Branch, Charles Boisvert, thanked the president for his remarks and expressed the satisfaction of the branch at the establishment of a Student Section. He pledged the full support of the senior members of the profession.

The assistant general secretary then supplied the students with information concerning the Institute and the activities which were of particular interest to them.

Several members of the Quebec Branch were present and joined the teaching staff and the visitors for a reception offered by the Faculty.

A.I.E.E. TO MEET IN CANADA

The 1947 Summer Meeting of the American Institute of Electrical Engineers will be held in Montreal on June 9th to 13th, at the Mount Royal Hotel. It is a matter of importance to Canadians that this outstanding engineering society should meet on this side of the boundary. It will afford Canadian engineers unusual opportunities to participate in professional sessions and to cooperate with fellow engineers from another country. The senior officer of the Institute in Canada is Fred L. Lawton, Assistant Chief Engineer, Aluminum Company of Canada, Ltd., Montreal, who is Vice-president.

The Board of the A.I.E.E. has generously invited the members of the Engineering Institute to associate themselves with the Montreal Section A.I.E.E. in extending Canadian hospitality to visiting fellow engineers and to participate in technical and social phases of the programme—an invitation that has been formally accepted by the Council of the Institute. All committees have been made up on a joint basis, and the Institute members are happy to have a part in the arrangements as well as the meeting

As the information becomes available, the E.I.C. members will be advised of the papers and events both through the columns of the *Engineering Journal* and by direct mail.

CORRESPONDENCE

Engineering Costs—Overhead?

Port Arthur, Ont., November 15, 1946.

Editor,
Engineering Journal,
Montreal, P.Q.

Dear Sir:

Under the title, "Can Engineering Survive Being Classed as Overhead" an article by Mr. F. N. Hveem appeared in the July issue of *Civil Engineering*. Mr. Hveem's point is so well taken that I think it should be placed before the members of the Institute.

Briefly, his thesis is this, that our profession suffers as much from attempts to keep down the costs of en-engineering services, as it does from any lack of articulateness in engineers as a group. In addition to our efforts to improve our status in the community by the public speaking classes which are often advocated, we should lay more stress on producing economical designs.

We all can cite instances from our experience where substantial savings of cost could have been achieved through more thorough design. Many of us, however, do not realize quite how large those savings can be. I have sometimes seen a saving of several thousand dollars made possible by a week of extra work, amounting in cost to not more than a couple of hundred dollars, due to refinements in design.

Words often carry implications reaching much farther than their direct meanings. Some words, such as "dark" or "rough", have a bad sound, others, such as "light" or "smooth", have a good sound, and this quite independent of their immediate use and meaning. One of the words that has a bad sound is "overhead". It implies something extra and troublesome, a necessary evil, to be kept within its smallest dimensions. Another such word is "non-productive", often applied to the costs of all office work in a plant.

Now, engineering work, unless it is badly done, is not "non-productive" at all but "productive" in the truest sense, for it is the basis on which the whole business structure rests. It is cruelly false economy to slight our work, or to allow others to do so. But, so long as the cost of our work is considered an evil thing, many of us are forced to do that very thing, to make snap judgments do in place of careful analysis, to make high factors of safety cover up our lack of time for analysis.

The old saying runs that an engineer is one who can do with one dollar what any bungler can do with two after a fashion. What we tend to ignore is that, while it costs maybe twenty-five cents to look after the two dollar job, we must spend fifty cents to turn it into a one dollar job. When engineers come to taking a pride in the height, rather than the lowness, of their office costs, when accountants are trained to consider that height as a good rather than a bad sign, then engineers will fill their proper niche in the world.

A bridge was recently opened, over the Riviere des Milles Isles, near Montreal, that exemplifies this very clearly. In that bridge the girders were welded for full continuity, and integral action between the steel framing and the floor slab was assumed, made use of in design, and accomplished by thorough detailing and construction practices. I venture to suggest that the engineering costs on that bridge, expressed as a percentage of the total costs, were far higher than for any bridge that has been built for many years. That increase in costs was good rational economy, for it resulted in far greater savings in money, improved clearances, better appearance, and, even more important, an advance in the art of bridge design. We owe a debt of gratitude to the engineers in charge.

I have deviated somewhat from Mr. Hveem's paper, which I have before me as I write. He puts the matter more wittily than I can, and I commend his paper to all who can obtain access to it. To summarize the matter, until we make our public realize that we can only serve its real advantage when we are paid enough to do so, so long will poor engineering flourish and needlessly expensive structures be built. With low percentage costs to meet we can only live by consciously or unconsciously padding the jobs.

Yours truly,
Douglas S. Laidlaw, M.E.I.C.

Engineers' Salaries

New York, Dec. 4th, 1946.

To the Editor.

It has been correctly said that if all the past work of engineers and scientists were wiped out today, the world would be back in barbarism tomorrow. It is interesting to ask why in view of this many of these men, who are the brains without which our civilization could not function, receive only financial compensation comparable with the wages of unskilled labor.

One who has studied the subject said that when he found a badly paid engineer invariably it was another engineer higher up who was holding down the subordinate's salary. An executive of a concern employing many engineers, with whom the writer talked on the subject, said that he never interfered in engineers' salaries as they were decided by the manager of engineering who was an engineer with much experience in such matters. And some years ago the directors of the research organizations of two of the most important engineering concerns in the United States stated in addresses before one of the national engineering societies that it was inadvisable to pay high salaries to research engineers as the money tended to distract their attention from their work.

The standard of ethics of the legal and medical professions have been frequently criticized. But we rarely hear of a member of either of these two professions assisting in beating down the fee of another member when such fee is to be paid by a third party. In the recent American Society of Civil Engineers discussion, wherein some of the older members of the Society endeavored to formulate a code of ethics which the junior members should follow, the writer suggested that as he had never known a junior engineer to act except in accord with a high standard of ethics while he had only too often seen older engineers sacrifice their standards, it was perhaps presumptuous for the older engineers to attempt to lecture the juniors on ethics.

If the salaries of engineers and scientists were increased to ten times their present amounts it would be more in accord with the importance of their work; and if this were done the resultant added burden on the national economy would be less than one quarter of that resulting from the increase in the wages of labor since 1939. One of the important obstacles to be overcome before this can be accomplished is the attitude of the older members of the profession.

W. L. Waters, M.E.I.C.,
Consulting Engineer.

Military Engineers Association

Ottawa, 26 Nov., 1946

The Secretary,
The Engineering Institute of Canada,
Montreal, P.Q.

Dear Sir:

The Military Engineers Association of Canada was organized in 1912 for the purpose of furthering the interests of the Non-Permanent, (now Reserve Force) Engineers and of military engineering generally in Canada.

With the outbreak of the second world war in 1939, our Branches, with a few exceptions, ceased to operate as such, as their members engaged in the more serious business at hand. However, we have now reorganized and are putting forth our best efforts to ensure that military engineers receive adequate training and that the qualifications for officers of the Royal Canadian Engineers are maintained at a high professional standard.

In this connection, you may be interested to know that we have already submitted to the Department of National Defence (Army) our recommendations, which are in effect similar to the requirements for corporate membership in the Engineering Institute. One exception has been made and that is in the case of purely administrative officers who will be designated by the letter "A" as follows: R.C.E. (A).

Realizing that many of your members served in the wars of 1914 and 1939, and the great interest taken by the Institute regarding the professional qualifications of officers when the R.C.E.M.E was formed, we are forwarding you this information with the hope that we may receive your co-operation and assistance in furthering the interests of the Corps.

Yours very truly,

E. M. MEDLEN, M.E.I.C., Lt.-Col.
Hon. Secy.
Military Engineers Association of Canada.

MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Cornwallis Hotel, Cornwall, Ont., on Saturday, November 23rd, 1946, convening at ten o'clock a.m.

Present: President J. B. Hayes (Halifax) in the chair; Past-Presidents K. M. Cameron (Ottawa) and A. J. Grant (St. Catharines); Vice-Presidents J. E. Armstrong (Montreal), G. F. Layne (Quebec), W. R. Manock (Fort Erie), and C. E. Sisson (Toronto); Councillors G. J. Currie (Halifax), Boris de Hueck (Cornwall), J. R. Dunbar (Hamilton), R. S. Eadie (Montreal), R. C. Flitton (Montreal), S. R. Frost (Toronto), C. A. Peachey (Montreal), W. L. Saunders (Ottawa), J. B. Stirling (Montreal), J. A. Vance (Woodstock), Paul Vincent (Quebec), Treasurer J. A. Lalonde (Montreal), General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past Vice-President E. P. Muntz (Hamilton); Past Councillor J. G. Hall (Toronto); E. A. Cross, chairman of Toronto Branch; C. H. Boisvert, chairman, Roger Desjardins, secretary-treasurer, and René Dupuis, past-chairman, Quebec Branch; C. A. Robb (Montreal), past-chairman Edmonton Branch; Donald Ross-Ross, chairman, and A. L. Farnsworth, vice-chairman, Cornwall Branch.

In opening the meeting, the president expressed his pleasure at again presiding at a Council meeting in a new branch. He asked everyone present to feel free to express himself on all matters under deliberation.

Conference of Commonwealth Engineering Societies: The president reported very generally on the recently held Conference of Comonwealth Engineering Societies in London, England, and then asked the secretary to report the conference in detail.

The general secretary gave a description of the attendance and the business of the conference and concluded by presenting the resolutions which had been passed unanimously. (A detailed account of the conference appeared in the November *Journal*).

International Technical Congress, Paris (World Engineering Conference): The general secretary reminded Council that the proposal to establish a world federation of engineering societies had been before it many times in the last two years. He reviewed the history of the movement and of the Institute's reaction to it, and then reported that a conference was held in Paris in September at the same time as the Commonwealth Conference was being held in London.

The general secretary gave a very long and detailed account of the conference in Paris and of opinions of officers of several engineering societies both in Europe and in England.

It was agreed that in view of the possible complications this matter should be referred to the Committee on Professional Interests with a request that after further study they should submit a report to Council that would permit prompt action.

General Secretary's Report on Overseas Visit: The general secretary reported that at the conclusion of the Commonwealth Conference he had called on the presidents and secretaries of several other engineering societies such as the Institution of Structural Engineers, the Royal Aeronautical Society, the British Institute of Radio Engineers, the Société des Ingénieurs Civils de France, the Swiss Society of Engineers at Zurich, the Royal Belgian Society of Engineers and Industrialists in Brussels, and the Royal Society of Engineers of Holland at the Hague. In some instances he had been able to meet with the councils of the other organizations and in several instances had gathered information that would be useful to the Institute.

He reported further that he had interviewed several young English engineers who had been in correspondence with the Institute relative to moving to Canada. Through the Professional Engineers' Appointment Bureau, operated by the British institutions, he had been able to arrange for the supply of proper information to all residents in the Old Country who were interested in finding out about engineering conditions in Canada. In this way it was expected a much quicker response could be given to the inquirers than was the case when they had writen direct to the Institute.

He reported further that, through the offices of the three British institutions, the president and he had been able to meet many of the outstanding engineers in the Old Country and that through these contacts he expected the Institute would be able to bring to Canada, from time to time, distinguished speakers who would contribute to the annual meeting programme or to branch meeting programmes. Already, through arrangements made in London with Sir Robert Watson-Watt, that distinguished radar discoverer had spoken to a large group at a Montreal Branch meeting.

At the conclusion of the report of the president and the general secretary, Mr. Cameron moved that Council extend to the president and the general secretary its congratulations, coupled with its thanks, for the splendid work that they had done. This was seconded by Mr. Sisson and carried unanimously.

Community Planning: The general secretary reported that he had had an interview with officers of the Institution of Civil Engineers in London in order to discuss developments in England in the community planning field so that information could be passed on to the Institute's committee.

He was informed that in 1945 the Institution had carried out a series of four lectures which had as their basic purpose the idea of informing the general public of the engineers fundamental interest in the subject. These four lectures were largely attended and were given considerable newspaper publicity. Eventually, they were printed in very neat pamphlet form under the heading "The Position of the Engineer in Relation to Town and Regional Planning". This series was part of the Institution's programme to keep the engineer in the public eye as a town and regional planner.

A further enterprise in this field was an exhibition held in the society's headquarters which was widely advertised to the public and well received by thousands of visitors.

The general secretary also discussed with the officers the possibility of securing as a speaker at the annual meeting one of the leading planning engineers in England. Several names were suggested which would be submitted to the Papers Committee of the Toronto Branch.

Mr. Wright also reported on a meeting of the International Federation of Town Planning which had been held in Hastings while he was in England. He had not attended the conference as advice from the president of the Institution of Civil Engineers indicated that the agenda for the meeting did not offer much valuable material. The papers were given largely by architects and dealt mainly with developments in housing for the last two hundred years in some of the older European cities. Mr. Wright reported, however, that the proceedings of the conference, which had lasted for a whole week, were being forwarded to the Institute. It was thought they might be of interest to the Institute's committee.

Shore Erosion on the Great Lakes: The general secretary reported that while in England he discussed this type of work with the secretary and assistant secretary of the Institution of Civil Engineers. They outlined to him the long time interest that the members of that society had shown in this subject. They also gave the general secretary copies of several papers which had been delivered by their members, all of which it was expected would be helpful to the Institute's committee when formed.

Annual General Meeting 1947: Mr. Cross, chairman of the Toronto Branch, outlined the proposed programme of papers for the anunal professional meeting. These were of a tentative nature but indicated a very interesting programme. They were submitted to Council for discussion, and certain revisions were suggested which Mr. Cross thought would fall in very well with the plans of the Papers Committee.

Mr. Cross also brought to the attention of Council the matter of finances for the meeting. The general secretary explained the usual procedures with regard to these matters and Mr. Cross expressed the satisfaction of the branch at such proposals.

Committee on Medals and Awards: Mr. Muntz reported that he was not yet in a position to present a report with recommendations on all the medals and awards of the Institute. He suggested that a member of each of the previous medal committees be appointed to constitute a general committee, and that each member of the committee be asked to form a sub-committee to report on one specific medal for the 1946 award. The central committee will continue to study the Institute's whole system afterwards.

On the motion of Mr. Stirling, seconded by Mr. Dunbar, it was unanimously agreed that a general committee with sub-committees as suggested by Mr. Muntz be appointed to make recommendations to Council on the medal awards for the year 1946.

Institution of Mechanical Engineers—100th Anniversary: An invitation had been received from the Institution of Mechanical Engineers asking the Institute to appoint two official delegates to represent the Institute at the One Hundredth Anniversary of the Institution which will be celebrated in London in June, 1947. On the motion of Mr. Dunbar, seconded by Mr. Lalonde, it was unanimously agreed that the invitation be accepted and that it be left with the president and the Montreal vice-president to select the two delegates.

On the motion of Mr. Cameron, seconded by Mr. Currie, it was unanimously resolved that a hearty vote of thanks and congratulations be extended to the officers and members of the Cornwall branch for the very capable arrangements which had been made for the inaugural meeting of this new branch, and for the regional meeting of Council.

Mr. Ross-Ross expressed the gratification of the branch at the large number of out of town members who had come to the meeting, which had far exceeded their expectations.

The Council rose at four forty-five p.m.

ELECTIONS AND TRANSFERS

A number of applications were considered and the following elections and transfers were effected:

Members

Bentall, Charles, general mgr., Dominion Construction Co., Ltd., Vancouver, B.C.

Eastwood, George Garnet McDonald, B.A.Sc., Toronto, elect. engr., Courtaulds (Canada) Limited, Cornwall, Ont.

Hurd, Edwin Cecil, B.Sc., (Chem. Engrg.), Sask., Toronto refinery mgr., British American Oil Co., Ltd., Toronto, Ont.

MacKay, William Nelson, B.Aero.Engrg., Univ. of Minnesota, engrg. dept., Trans Canada Airlines, Dorval, Que.

MacLeod, Robert Gordon, B.Sc., (Elect.), Manitoba, 80 St. Clair Ave., W., Toronto, Ont.

Miller, Herbert Beverley, B.Sc., (Chem. Engrg.), Alberta, process engr., production control dept., Polymer Corporation Limited, Sarnia, Ont.

Shupe, Charles Ahrens, B.A.Sc., Toronto, Electric Tamper & Equipment Co. of Canada, Ltd., Toronto, Ont.

Smith, Gerald Edward, B.A.Sc., Toronto, field engr., Canadian Sirocco Co., Ltd., Windsor, Ont.

Wiley, Walter Kenneth, B.Sc., (Elect.), New Brunswick, industrial heating mgr., Northern Electric Co. ,Ltd., Montreal, Que.

Williams, Donald Drysdale, B.Eng., (Mech.), McGill, design engr., steam services, Robt. Rankin & Co., Montreal, Que.

Juniors

Burgess, John Alexander, B.A.Sc., (Mech.), British Columbia, jr. mech. engr., Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C.

Kendall, Evan Wildridge Jackson, The Bell Telephone Co. of Canada, Montreal, Que.

Read, Wallace Foster, B.Sc., (Chem. Engrg.), Queen's, 289 Wychwood Ave., Toronto, Ont.

Webster, Thomas Benjamin, B.Sc., (Mech.), Queen's, engrg. dept., Howard Smith Paper Mills, Cornwall, Ont.

Transferred from the class of Junior to that of Member

Anderson, James Douglas, B.Eng., (Mech.), McGill, service and erection engr., Combustion Engineering Corporation Ltd., Montreal, Que.

Fraser, Frederick Walter, B.Sc., (Civil), Saskatchewan, constrn. foreman, McColl Frontenac Oil Co., Ltd., Calgary, Alta.

Jordan, Jack McLean, B.A.Sc., Toronto, counties engr. and road supt., United Counties of Northumberland & Durham, Cobourg, Ont.

Powell, Robert Montague, Graduate, R.M.C.; B.A.Sc., (Chem.), Toronto, tech. asst., Canadian Industries Limited, Montreal, Que.

Seybold, Hugh G., B.Eng., (Elect.), McGill, mgr., aluminum dept., Drummond McCall & Co., Ltd., Montreal, Que.

Ward, Kenneth Roy, graduate, Royal Military College, 1939, Major, R.C.E.M.E., Staff Officer, Directorate of Mechanical Engrg., N.D.H.Q., Ottawa.

Transferred from the class of Student to that of Member

Meuser, Henry Lloyd, B.Sc., (Civil), Queen's, Colonel, R.C.E., Director of Engineers, N.D.H.Q., Ottawa.

Admitted as Students

Franz, Karl Kurt, B.Sc., (Mech.), Queen's, 45 Michael St., Kitchener, Ont.

Lewis, Robert Arthur, British Columbia, dftsman, Bloedel, Stewart & Welch, Vancouver, B.C.

Morriss, Harry Fayne, B.A.Sc., British Columbia, Northern Electric Co., Ltd., Montreal, Que.

Rochon, Paul-Emile, B.A.Sc., (Metall.), Laval, 122 Pere Marquette St., Quebec, Que.

Students at University of Toronto

Anderson, G. J.	Hill, E. H.	Monteith, H. D.
Beattie, D.	Hill, K. E.	Paulin, A.
Bernick, H.	Kissick, R. F.	Pawling, J. D.
Bourne, K. B.	Langlois, J. W.	Pepper, G. K. F.
Burn, B. D.	LeSueur, R. E.	Pinkus, D.
Chisholm, W. O.	Lusk, C. H.	Quan, B.
Crome, F. E. J.	Mabson, H. J.	Reynolds, D. K.
Cupp, C. R.	MacIsaac, G. E.	Ross, D. G.
Dale, W. E. H.	MacNairn, J. S.	Smith, R. J.
Dudgeon, E. H.	McEachern, D. L.	Temple, W. J.
Ewing, T. A.	McNabb, A. D.	Thomas, G. D.
Field, A. E.	Mann, A. D.	Tucker, G. H.
Harris, D. M.	Mansbacher, P.	Watson, H. A.
Hastings, B. A.	Marcotte, W. C.	Westwood, R. E.
Heaslip, W. T.	Meschino, J. L.	Zarnett, B. H.

Students at McGill University

Bickerdike, C. G.	King, C. G.	Morris, D. R. C.
Earle, A. P.	Lemco, I.	Routledge, B. F.
Elliott, E. W.	Lesperance, P.	Somerville, T. A.
Flaherty, R. N.	McCutcheon, J. O.	Taylor, J. S.
Geller, B.	McLandress, D. H.	Weekes, R. D.
Haley, P. G.	Maclean, W. G.	

Students at Ecole Polytechnique

Bellavance, A.	Couture, L. P.	Fradette, M.
Bilodeau, P. M.	Desbiens, W. F.	Mainguy, R.
Carrier, R. R.	Dorais, M.	Matte, J. P.
Cordeau, J. P.		

Students at University of New Brunswick

Alexander, G. T.	Donald, W. S.	MacDiarmid, R. A.
Busby, J. S.	Fulton, K. R.	Magnusson, E. R.
Donahoe, W. E.	Howard, R. G.	Watson, H. M.

Students at Nova Scotia Technical College

Bell, G. D.	Johnston, C. W.	Payzant, L. J.
Buckingham, R. F.		

Students at University of British Columbia

Butterfield, L. A.	Sissons, W. J.

Student at University of Manitoba

Williams, N. C.

By virtue of the cooperative agreements between the Institute and the associations of professional engineers, the following elections and transfers have become effective.

NOVA SCOTIA

Members

Connolly, Cornelius Joseph, B.Sc., St. Francis Xavier Coll., camp engr., Canadian Veterans Training, Windsor, N.S.

Cooke, William Greig, B.Sc., (Mech.), N.S.T.C., chief engr., National Gypsum (Canada) Ltd., Dingwall, N.S.

Henderson, Edgar Hastings, B.Sc., (Mining), N.S.T.C., plant engr., Halifax Shipyards Ltd., Halifax, N.S.

O'Connor, Victor Frederick, B.Sc., (Mech.), N.S.T.C., Lieut. in Engrg. Branch, R.C.N., Dept. of National Defence, (Naval Services), Halifax, N.S.

Renner, George Lyall, B.Sc., N.S.T.C., mech. supt., i/c of pumping and chlorination plants, Public Service Commission, Halifax, N.S.

Young, Angus Francis, B.Eng., (Mech.), N.S.T.C., operating own sales and service organization, Halifax, N.S.

Junior to Member

Mitchell, Kenneth Roscoe, B.Eng., (Civil), N.S.T.C., intermediate engr., Engineering Service Co., Halifax, N.S.

QUEBEC

Member

Finlayson, Donald William, B.A.Sc., Toronto, structl. engr., Foundation Co. of Canada, Montreal, Que.

Weldon, Harold Stanley, B.A.Sc., Toronto, chief electrical engr., Dominion Textile Co., Ltd., Montreal, Que.

Junior

Wilding, Malcolm Frank, B.A.Sc., (Elect.), British Columbia, power appartus sales engr., Northern Electric Co., Ltd., Montreal, Que.

Junior to Member

Alexander, John Andrew, B.Eng., (Chem.), McGill, asst. supt., McColl Frontenac Oil Co., Ltd., Montreal, Que.

Charland, Roger, B.A.Sc., (Civil), Ecole Poly, engr., tech. division, Public Works Dept., City of Montreal, Que.

Murphy, Daniel Francis, B.Eng., (Civil), McGill, structl. engr., Foundation Co. of Canada, Montreal, Que.

SASKATCHEWAN

Junior to Member

Eull, Leander Frank, B.Sc., (Elect.), Saskatchewan, asst. hydraulic engr., P.F.R.A., Regina, Sask.

Personals

News of the Personal Activities of members of the Institute

Dr. C. J. Mackenzie, M.E.I.C., president of the National Research Council, Ottawa, has been elected a fellow of the Royal Society. For five years of the war, Dr. Mackenzie was a member of the joint technical staff that carried out research in the field of atomic fission which resulted in the development of the atomic bomb. A past-president of the Engineering Institute, and a member of its Prairie Water Problems Committee, he is the former dean of engineering of the University of Saskatchewan.

L. K. Sillcox, M.E.I.C., first vice-president of the New York Air Brake Company, Watertown, N.Y., was presented with a certificate of Honorary Membership in The American Society of Mechanical Engineers at the Annual Banquet on December 4th, in New York City.

Colonel J. A. Macdonald, M.E.I.C., has been re-elected as chairman of the Cape Breton Branch of the Institute for the coming season. He is electrical superintendent of the Dominion Iron and Steel Corporation, Sydney, N.S.

Leo G. Denis, M.E.I.C., district chief engineer for the Province of Quebec, Dominion Water and Power Bureau, Surveys and Engineering Branch of the Department of Mines and Resources, retired on November 25th last following thirty-six years' continuous service with the Dominion Government. He joined the Water and Power Bureau, then part of the Department of the Interior, several years before his appointment in 1922 to the Quebec district, with headquarters in Montreal.

Albert Deschamps, M.E.I.C., Montreal general contractor and engineer, was recently elected by acclamation as alderman of the City of Outremont. He is president of the Canadian Construction Association.

L. L. Bolton, M.E.I.C., has retired from the Mines and Geology Branch of the Department of Mines and Resources, following a period of thirty-one years continuous service with the Dominion Government, during the last ten years of which he was general executive assistant for the Branch. He is a Life Member of both the Canadian Institute of Mining and Metallurgy and the Professional Institute of the Civil Service of Canada, having served the former as councillor, vice-president, and chairman of the Ottawa Branch.

F. C. C. Lynch, M.E.I.C., chief of the Bureau of Geology and Topography of the Department of Mines and Resources, Ottawa, retired in September last, after completing more than forty years of continuous service with the Dominion Government. In 1936, on the formation of the present Department of Mines and Resources, he received his appointment as chief of the Bureau and officer in charge of the National Museum of Canada. He is an honorary member of the Canadian Institute of Mining and Metallurgy and a founder and director of the Canadian Geographical Society. He serves the Society also as chairman of its editorial committee. He was for sixteen years secretary-treasurer of the Ottawa Branch of the Engineering Institute.

Lieutenant-Colonel J. H. Edgar, M.E.I.C., retired from the service of the Canadian National Railways in November last. He has been with the company for many years, located at the Winnipeg Office as inspector of materials. He served overseas in World War I, returning as a major. He has been in command of the 10th District Engineers, R.C.E. Reserve, for several years.

C. E. Garnett, M.E.I.C., has been elected to the presidency of the Edmonton Chamber of Commerce, and to the chairmanship of the Edmonton Industrial Development Board. He has been associated with Gorman's Limited in that city for many years, and is president and manager of the company.

William LeClair, M.E.I.C., of Ottawa, Ont., is the new president of the Canadian Federation of Property Owners' Associations, which includes some 8,000 property owning corporations and individuals. He is the president of the Ottawa Property Owners' Association, and secretary-manager of the Canadian Lumberman's Association and affiliated bureaux.

Donald C. Beam, M.E.I.C., has been appointed chief engineer of the Carter Construction Company Limited, Toronto, Ont. After serving for ten years with the Toronto Department of Buildings, latterly as technical secretary to the joint committee on revision of the Toronto building by-law, Mr. Beam joined Waritme Housing Limited in 1941 as general superintendent of construction. He was appointed manager of the maintenance and construction department three years later. He has been with the Carter Construction Company since 1945.

J. P. Fraser, M.E.I.C., has been appointed assistant chief engineer of the electrical operating division of the B.C. Electric Railway Company. He joined the company in 1940, coming from the Manitoba Power Commission.

G. W. F. Johnston, M.E.I.C., recently became assistant manager of the pricing and distribution divisions of War Assets Corporation, Montreal. A veteran of both world wars, he has been associated with engineering work on the Welland Ship Canal, the Canadian National Railways Montreal Terminal, the Beauharnois power development and other projects. He went overseas in 1939 in command of the First Anti-Tank Regiment, R.C.A., and at the time of his transfer to the reserve in October, 1944, he was colonel in command of artillery training at Petawawa, Ont. He joined War Assets in 1944.

F. J. Hoar, M.E.I.C., vice-president and general manager of the G. D. Jenssen Company, Inc., Watertown, N.Y., has been associated with the pulp and paper industry for many years. He was formerly connected with Stebbins Engineering and Manufacturing Company, Watertown, as middle west representative, and as manager of Canadian Stebbins Engineering and Manufacturing Co. Ltd., Montreal. He returned to Watertown in 1942, joining G. D. Jenssen in 1944.

R. H. Rimmer, M.E.I.C., has been named director of research for Aluminium Laboratories Limited, Kingston, Ont. He was with the Aluminum Company of Canada Ltd., at Montreal, as manager of the technical department, having been transferred there in 1943 from Arvida, Que., where he was in charge of research and development work.

Albert D'Amours, M.E.I.C., has left his position as assistant superintendent at Marine Industries, Sorel, Que., to take care of the administration of D'Amours Limited, building contractors, Montreal, of which firm he is president.

R. W. Emery, M.E.I.C., is resident engineer for the Brompton Pulp and Paper Company Limited, at Red Rock, Ont. He was formerly with the Marathon Paper Mills of Canada Limited, located at Toronto and at Marathon, Ont.

J. S. Green, M.E.I.C., is sales manager of the Ford-Smith Machine Co. Ltd., Hamilton, Ont. He had been associated with the British Air Commission for several years, and was located as resident inspector at the Beech Aircraft Corporation, Wichita, Kansas, and at the Douglas Aircraft Co. Inc., Tulsa, Okla.

M. S. Saunders, M.E.I.C., is in Lima, Peru, employed by the International Petroleum Company. He has been with the Tropical Oil Company at Bogota, Colombia, since 1943.

B. O. Baker, JR.E.I.C., is now in Quebec, with the Canadian Armament Research and Development Establishment of the Department of National Defence. He was previously at Peterborough, Ont., with the Canadian General Electric Co. Ltd.

G. D. Russel, JR.E.I.C., received the degree of master of science from McGill University at the fall convocation, 1946. He is connected with the Dewey and Almy Chemical Company of Canada, Montreal.

H. E. Archibald, JR.E.I.C., presently serving with Proctor, Redfern and Laughlin, consulting engineers, Toronto, Ont., has been appointed engineer of Teck Township, Ont. He was with the R.C.E. from the time of his graduation from the University of Toronto in 1943 until his discharge in 1945 with the rank of captain. He left the Ottawa staff of the Community Planning Branch of the Ontario Department of Planning and Development to assume his new duties on January 1st.

G. H. Galbraith, JR.E.I.C., is enrolled at the University of Toronto where he is taking a course in business administration leading to the degree of Master of Commerce. He is on leave of absence from his position as a mechanical engineer with the Shell Oil Company of Canada Limited, Calgary, Alta.

H. Haakonsen, JR.E.I.C., has established a private consulting practice in Shawinigan Falls, Que. He has been teaching mathematics and electricity at the Shawinigan Technical Institute since his graduation from Queen's University in 1944.

H. W. McFarlane, JR.E.I.C., is assistant professor of civil engineering at the University of New Brunswick, Fredericton. He served with the R.C.E. after his graduation from the same university in 1943 until March 1946, and had been with D. O. Turnbull, M.E.I.C., consulting engineer, Saint John, N.B., until his recent appointment.

R. A. MacKinlay, JR.E.I.C., is with Price Brothers Limited, Jonquiere, Que. He had been with the Navy since 1944 when he graduated with the degree of bachelor of engineering from the Nova Scotia Technical College, Halifax.

W. H. Longworthy, JR.E.I.C., is in Negritos, Peru, with the International Petroleum Company. He has been with the R.C.N.V.R. and was stationed at Esquimalt, B.C., and latterly at Victoria, B.C., with the rank of lieutenant.

Fernand Mailhiot, JR.E.I.C., who has been with the Ministry of Health, Province of Quebec, since his graduation in 1944 from l'Ecole Polytechnique, Montreal, has recently returned from the Graduate School of Engineering, Harvard University, where he received a master degree in sanitary engineering. He was granted a fellowship by the Rockefeller Foundation, New York.

Obituaries

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

F. J. Hancox, M.E.I.C., passed away on September 10th, 1946, at his home in Toronto after a brief illness. He was born in Gloucester, England, in 1885, and studied at the Technical School there, qualifying under the City and Guilds Technical Institute, London, England, as a teacher of milling engineering and technology in technical schools. He spent ten years with J. Reynolds and Company Limited in Gloucester, as plant superintendent and as superintendent of the mill plant and repair shop. Coming to Canada in 1912, he entered the employ of the City of Toronto as a designer of sewage schemes and remained an employee of the city administration for thirty-four years. He served overseas with the Fifth Canadian Division in the first World War.

Mr. Hancox joined the Institute as an Associate Member in 1920, becoming a Member in 1940.

Henry Cron Kennedy, M.E.I.C., Montreal engineer, died suddenly on November 10th, 1946. He was born in Owen Sound, Ont., and was educated at McGill University, Montreal. He was associated with hydro-electric engineering projects in Ontario, B.C. and Alberta, prior to service as a lieutenant from 1915 to 1919 with the 24th Bn. V.R. and with the 3rd Bn. C.E. in France and England. On his return to Canada he spent two years with the Bathurst Lumber Company, as resident engineer on hydro construction and in 1921 he joined William Kennedy & Sons Limited of Owen Sound, Ont., and has been Montreal representative for the company for many years. In 1941 he was appointed inspecting engineer for the controller of steel for the Dominion Government. He was a director of his company and of F. H. Hopkins and Company.

Mr. Kennedy, a nephew of the late Sir John Kennedy and of the late William Kennedy, joined the Institute as a Student in 1904, transferred to Associate Member in 1910, and to Member in 1940.

G. G. Routledge, M.E.I.C., died at his home in Aurora, Ont., on October 23rd, 1946. He was born in Hardhurst, Cumberland, England, in 1870 and attended the Paisley Technical College. He began his engineering career with the British Government, employed on an ordnance survey of Great Britain from 1889 to 1899. In Paisley, Scotland, he was then engaged for some thirteen years on the design and construction of water supply mains. Arriving in Toronto in 1912, he was placed in charge of the survey of water mains and became superintendent of the city water distribution system. He remained with the works department as engineer in charge of the system until his retirement in 1945.

Mr. Routledge held the Hunt Memorial Award of the Canadian Section of the American Water Works Association. He joined the Engineering Institute as an Associate Member in 1921, becoming a member in 1940.

L. T. Rutledge, M.E.I.C., a member of the faculty of Queen's University, died in Kingston, Ont., on September 27th, 1946. He was born in January 1883, at Terra Cotta, Ont. He taught public school in the Brampton area of Ontario for a period of three years prior to entering the University of Toronto in 1906. He graduated with honours in mechanical and electrical engineering in 1910, and became employed by the Vancouver Street Railway as an engineer. Returning to the University of Toronto, he taught drawing in the department of architecture, and lectured at night classes in the Central Technical School of Toronto. From 1916 to 1920 he owned and operated a machine shop in Toronto, after which he joined the staff of the department of mechanical engineering at Queen's University, where he remained for some twenty-six years.

Mr. Rutledge was associate editor of one of McLean's engineering journals for many years, he lectured in mechanical engineering at Royal Military College, Kingston; he practised as a consulting engineer and managed a war plant in Orillia, Ont. Toronto University issued to him the degree of master of engineering in 1939.

He was a member of the Professional Engineers of Ontario, serving as a member of council and on the examining board. He joined the Engineering Institute as a Junior in 1912, transferring to Associate Member in 1914 and to Member in 1921. He was secretary treasurer of the Kingston Branch in 1922 and 1923, vice-chairman in 1926 and chairman in 1927. He was on the council of the Institute in 1928.

Donald Blair, M.E.I.C., of Ottawa, Ont., died on November 23rd, 1946. He was born in Fredericton, N.B., in 1887, studied in Ottawa and Montreal, and worked first in western Canada, for the city engineering department of Moose Jaw, Sask., and later on the Peace River District land survey in British Columbia. In 1917 and 1918 he was field engineer for the Powder Plant at Trenton, Ont., for Fraser Brace and Company, and the following year joined the Department of Public Works at Ottawa. He was office engineer and clerk for the construction department of the Temiskaming and Northern Ontario Railway from 1923 to 1925, and resident engineer for the Rouyn Branch Lines Company of the Canadian National Railways in 1926. Joining the Federal District Commission as an engineer the next year, he transferred in 1933 to the Department of National Defence in Ottawa as a structural design engineer. At the time of his death he was supervising engineer of the chief architects branch of the Public Works Department.

Mr. Blair joined the Institute as an Associate Member in 1934 and became a Member in 1940. He was a member also of the Association of Professional Engineers of Ontario and of the American Concrete Institute.

Ilja Leebosh, M.E.I.C., died in Montreal on November 8th, 1946. He was born in Latvia in 1898, and studied mechanical engineering at Friedrichs Polytechnical Institute, Goethen Anhalt, graduating in 1924. From 1926 to 1932 he was employed by the late Frederick B. Brown, consulting engineer, Montreal, working chiefly in connection with the Beauharnois Power Development. The next year he joined the Beauharnois Light, Heat and Power Co., to do transmission line and right-of-way work. In 1938 he went to the Canadian Bridge Company, Windsor, Ont., and in 1940 returned to the Beauharnois Light, Heat and Power Co., where he was employed on design of control dams, bridges, etc. He transferred in 1945, with the merging of the company, to the Quebec Hydro-Electric Commission, Montreal.

Mr. Leebosh joined the Institute as an Associate Member in 1938, becoming a Member in 1940.

Norman E. Willett, M.E.I.C., of Banff, Alta., passed away on August 23rd, 1946. He was born at Treherne, Man., in 1898, and studied at the University of Manitoba, receiving a B.Sc. in civil engineering in 1927. He immediately joined the Department of Highways of Manitoba as a resident engineer, and in 1937 he transferred to the engineering staff of the P.F.R.A., Department of Natural Resources, located at Regina, Sask. At the beginning of the war he was with the Department of Transport, building airports, and he went later to Revelstoke, B.C., for the Department of Mines and Resources engineering and construction service, transferring to the Banff head office in 1945.

Mr. Willett joined the Institute as an Associate Member in 1939, transferring to Member in 1940.

D. C. Tennant, M.E.I.C., former chief structural engineer of the Dominion Bridge Company, at Toronto, died on November 24th, 1946, in Toronto, Ont., the city in which he was born in 1880. He graduated in 1900 from the University of Toronto with a B.A.Sc. degree and came that year to Montreal to Dominion Bridge. He was first employed in the drawing office and he remained with the company as a designing engineer, with charge of such buildings as the Union Bank, Winnipeg, Macdonald College, St. Annes, Que., and many bridges built by his company. During these thirty-eight years he made his residence in Lachine, and Montreal West, Que. He was transferred in 1938 to Toronto as chief structural engineer for the Ontario Division of the company, and he retired in 1945.

Mr. Tennant joined the Institute in 1906 as an Associate Member, becoming a Member in 1911. He was Councillor representing the Montreal Branch from 1931 to 1933, and at the time of his death he was the Institute's representative on the National Construction Council of Canada.

News of the Branches

Because of the paper supply situation it has been necessary to reduce considerably the amount of space usually devoted to News of the Branches. We beg the indulgence of the branch news editors if they find that we have made liberal use of the blue pencil on their reports.—Editor.

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 general meeting of the Calgary Branch was held in the Palliser Hotel on November 15th. T. D. Stanley introduced the speaker of the evening, Mr. B. A. Monkman, whose subject was **The Water Power Resources of the Yellowknife Area.**

Mr. Monkman reported that the rapid progress being made in the north has made it necessary to develop additional power to meet the rising demand. The Dominion Government had chosen the Snare River as the logical location for a power development following rough reconnaissance surveys of the northern rivers and a study of the limited water records available.

The speaker outlined the history of the development which at this time is being carried out by the Dominion Government on the Snare River. The Montreal Engineering Co. Ltd., consultants on the project, have suggested a five stage development of the river commencing with the construction of a dam on the Snare River at the outlet of Bigspruce Lake, with a power house at the foot of the dam capable of generating 8,000 H.P. but only required to generate 4,500 H.P. in the initial stage. This would entail the construction of an earth fill dam some 65 feet in height and 900 feet long. By diversion of the Emile River and construction of plants at "I" Lake the development would ultimately make 25,000 H.P. available.

A number of questions were asked at the conclusion of the paper and a vote of thanks to the speaker was moved.

F. K. Beach, M.E.I.C., announced that members of the Institute were invited to view a color film presented by the Alberta Petroleum Association showing the search for oil in Alberta.

The annual joint dinner of the Calgary Section, C.I.C., the Calgary district A.P.E.A. and the Calgary Branch of the Institute was held in the Palliser Hotel on November 23rd under the chairmanship of L. C. Stevens.

R. S. Trowsdale introduced the guest speaker, Acting Dean R. M. Hardy of the University of Alberta who spoke on **Engineering Education.**

Professor Hardy gave figures to show the greatly increased number of students now studying engineering and the number of graduates expected in 1949 and 1950. The standard of education of students entering engineering courses is very high due to the large number of applications from which to select, and particularly due to the serious attitude taken by ex-service personnel to the course. The function of a University is not to reduce the numbers in a class by failing, but rather to instruct the students to such an extent that they can graduate. Consequently the proportion of students graduating from the large classes will be about the same as in previous years.

The problem of employment for the large number of graduates is expected to be acute, but it will be offset to some extent by the increasing employment of engineers in positions which are not essentially technical.

Mention was also made of increasing agitation for the expansion of the engineering syllabus. Due to the fact that the subjects now included in the syllabus are fundamental, and cannot be eliminated, consideration must be given to lengthening the course.

H. R. Younger, chairman of the Branch, moved a vote of thanks to the speaker.

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A general meeting of the Calgary Branch was held in the Palliser Hotel on November 28th. Chairman H. R. Younger introduced the guest speaker, Mr. Buchanan, Superintendent of Schools in Calgary.

Mr. Buchanan introduced his subject, **The Need of University Facilities in Calgary,** by outlining the growth of the University of Alberta. He stated that no appropriations had been made for expansion since 1922 at which time the enrolment was around 2,000. At the present time about 4,000 students are attending the University and all buildings are overcrowded.

The speaker remarked that the attendance at the University should not drop below its present level, and, if anything, it should increase in view of the increasing demands for technical knowledge and improvement in social conditions. At the present time the proportion of students by population attending University in Alberta is among the lowest in Canada.

A University branch in Calgary would make it possible for more students in Southern Alberta to take University degrees. Mr. Buchanan said that provision of the necessary money was the greatest obstacle to establishment of the branch. If people generally appreciated the great value of university training in the technical and social development of the Province, the money would be made available.

At the close of the address Mr. Buchanan was assured of the support of the Calgary Branch in the movement to establish a branch of the University in Calgary.

Members were asked to discuss amendments to By-laws 5, 8, and 9 of the Calgary Branch as recommended by the Revision Committee. After minor changes the amendments were adopted on a motion by J. B. De Hart.

CAPE BRETON BRANCH

S. G. Naish, m.e.i.c. - *Secretary-Treasurer*

The first meeting of the season was held on September 23 when Mr. A. G. Dilks, sales engineer of the Canadian National Carbon Company, showed a technicolour film entitled "Manufacture and Use of Carbon and Graphite Electrodes". An interesting discussion followed, as guests included everyone in the district using such material.

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On November 20, D. J. MacNeil, consulting geologist, Antigonish, N.S., gave an address covering his experiences in connection with prospecting for petroleum in the Maritimes. Of particular interest was Professor MacNeil's assertion that geologically Nova Scotia has all the necessary qualifications for oil bearing territory. Although a number of holes have been drilled, so far without success, he pointed out that the average producing well is only obtained after a large number of failures.

Should oil be found in Nova Scotia, it was agreed that it would revolutionize the economy of the province, and bring a number of industries which are very much sought after, to relieve unemployment.

EDMONTON BRANCH

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

At a special joint meeting with the Science Association of the University of Alberta, the Edmonton Branch of the Institute heard Squadron Leader R. Kronfeld, A.F.C. of the National Research Council of Canada, give an illustrated lecture on **Gliding and Soaring,** the Art and Science of Motorless Flight. S/Ldr. Kronfeld who had just completed a study of tailless aircraft in Edmonton, claimed that Canada has ideal climatic conditions for tests that may break the present gliding record held by Russia.

The speaker credited the Wright brothers with starting gliding in 1900. The greatest advance, however, was made in Germany after the first World War, when gliding became a substitute for aviation, which had been prohibited by the peace treaty.

Gliders may be catapulted into the air, or released from a hillside, or towed by a cable attached to a moving automobile, or the car may be held stationary, and the cable wound around a winch which pulls in the cable.

Soaring differs from gliding, in that one loses height while gliding, but not while soaring. To soar, the pilot must get into rising air currents, produced by topography of the ground, growth on the earth, positions of clouds and thermal effects. He must be very observant, to pick suitable conditions, and can learn much from the behaviour of birds.

S/Ldr. Kronfeld then discussed the activities of glider clubs in Britain, France and United States, and hoped Canadians would become more active in forming clubs, particularly at University centres. He reminded his listeners that Germany's fastest fighting plane developed from a glider, and that the use of gliders as freight carriers offers attractive fields of study.

The meeting was held in the University of Alberta Medical Building on May 23rd, and Dr. Winnifred Hughes, president of the University of Alberta Science Association, was in the chair. Acting Dean R. M. Hardy introduced S/Ldr. Kronfeld. A discussion period was in charge of J. E. Cranswick, vice-chairman of the Edmonton Branch who expressed the thanks of the joint organizations to the speaker for his most interesting paper. The attendance was 135.

The prospect that Canada's first tantalum refinery will be built in Edmonton in the near future was revealed by Dr. Daniel Gardner, of the Tantalum Refining and Mining Corporation of America, New York, N.Y., when he addressed a joint meeting of the local organizations of The Canadian Institute of Mining and Metallurgy, and The Chemical Institute of Canada, and the Edmonton Branch of the Institute. Dr. Gardner presented his paper, entitled **Canada's Role in the Tantalum and Columbium Industries,** to an audience of 116, in the MacDonald Hotel, on October 28th.

The speaker reviewed the early research on the little known elements, tantalum and columbium, and told of their occurrence in three belts; one including Siberia, Finland, Norway, Greenland and the North West Territories; the second, including, Colombia, British Guiana, Nigeria, Belgian Congo and Rhodesia; and the third with West Australia, South Africa and Argentina. In 1936, deposits in the North West Territories were discovered east of Yellowknife in the Ross Lake district. Dr. Gardner said, it is estimated that 100 tons of material will be mined daily, concentrated to 2,000 pounds at the mine and sent by plane to the refinery at Edmonton, where about 975 pounds of tantalum, 365 pounds of columbium, 14 pounds of tin and lesser quantities of iron and manganese will be recovered. Dr. Gardner considered there would be enough resources to last several decades. He was also hopeful, judging by experiences in other fields, that beryl and possibly even emeralds might be found.

The unusual properties of tantalum and columbium account for the present interest in them: Tantalum possesses a high melting point and is free from chemical attack. The metals absorb gasses readily and resist corrosion to a high degree. They are non-toxic.

Dr. Gardner concluded his paper with a general description of his refining process.

Among those at the head table were the Chairman, J. W. Porteous; Dr. Gardner and his daughter, Gina Nirova; Mayor Ainley, J. Oberholtzer, chairman of the Edmonton section of the Chemical Institute of Canada, who introduced Dr. Gardner; and E. D. Lilge, vice-chairman of the Canadian Institute of Mining and Metallurgy, who proposed a vote of thanks to Dr. Gardner, a motion which was heartily applauded by the joint membership.

HALIFAX BRANCH

J. D. Kline - - - - - *Secretary-Treasurer*
S. W. Gray - - - - - - *Branch News Editor*

On October 31st, 1946, the first fall monthly meeting of the Halifax Branch was held in the Nova Scotian Hotel. The attendance was 85, including some of the members of the Nova Scotia Technical College, who were guests of the branch.

The guest speaker of the evening was William E. Ross, Canadian manager of the apparatus department of the Canadian General Electric Company. His address covered future power prospects, electric, steam, etc. of Canada, and it was entitled **More Power for Canada.** Mr. Ross's address was accompanied by slides.

At its conclusion a hearty vote of thanks was proposed by Charles H. Wright, seconded by P. A. Lovett, and heartily endorsed by the assembly.

HAMILTON BRANCH

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

The regular monthly meeting of the Hamilton Branch of the Institute was held on Thursday, October 24th, 1946, with over 80 members and guests in attendance. Chairman A. R. Hannaford presided, and called on J. R. Dunbar to introduce the speaker of the evening.

Dr. John T. Wilson, Professor of Geophysics at the University of Toronto, served as deputy director of **Exercise Musk-Ox** while acting as director of operational research for the Canadian Army. This 3,100 mile trip through far Northern Canada, successfully completed last winter, was described by Dr. Wilson.

The expedition was not an isolated venture but the logical growth of secret experiments made during the war. The Canadian snowmobile was designed for possible invasion of Norway or military operations in the Alps, and was used, with the addition of a cab for protection against weather, in the Canadian exercise. The object of the trip was to find out how to live and move in the Arctic, and personnel were chosen for their experience in the far north, or for their technical knowledge.

The speaker outlined some of the conditions investigated by the expedition, including meteorology on the ground and in the air, navigation, signals and magnetic conditions, both on the ground and in the air, aircraft maintenance, air operations, housing, clothing, medical, snow and ice data, photography, flora and fauna, pyrotechnics and the use of small arms. There was no illness during the trip; in fact, the health of the members of the expedition was improved generally at the end of the trip. The trip was completed on schedule with the same vehicles being used continuously. Supplies of gasoline, food and repair parts were flown in by the

R.C.A.F. in twin-engine Dakota planes operated from four bases. These supplies were usually dropped by parachute, although planes landed on the ice at times, and experiments were conducted with gliders. In the speaker's opinion, keeping in touch with the expedition was a wonderful feat of navigation, and he commended the R.C.A.F. for their work. Part of the route covered by the "Exercise" lay over ice out of sight of land, and 1,500 miles had never before been covered by tractors. Parts of the north investigated by the party have never been mapped, and navigation in these regions was very difficult.

The world is too small, concluded Dr. Wilson, for blanks in the Canadian Arctic. Flying, radio, and the weather are all affected by what happens in the North, and Canadians should do more thinking about this little known third of their country. In addition, Canadians should do more for the Eskimos, who are a very fine and intelligent people.

Two films, one in technicolor, were shown during the talk. These films were taken by members of the expedition, and illustrated clearly the conditions and problems encountered in the far North.

After a discussion period, L. C. Sentance tendered a vote of thanks to Dr. Wilson, and expressed the appreciation of the members of the Branch.

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The annual ladies night of the Hamilton Branch of the Institute was held on Thursday, November 14th, 1946, with 110 members and guests in attendance at McMaster University Refectory. At the conclusion of dinner, Chairman A. R. Hannaford called on E. G. Wyckoff to introduce Mr. Frank Alexander, the speaker of the evening.

Mr. Alexander was supervising engineer during the construction of the Iraq pipe line. He spoke of his experiences and of the customs and outlook of the people of Iraq, of the influences at work in that country and their possible effects on the international political situation.

The speaker remarked on the general interest in Palestine and in the immigration difficulties prevailing. He then touched on Russian interest in Arabian oil deposits.

Some of the problems encountered during the laying of the 1,400 mile pipe lines in Iraq were outlined. The line was built through a clay desert with underlying rock that had to be blasted to get the line below the surface. The country between the Tigris and Euphrates Rivers was of limestone, unsuitable for wheeled vehicles, so caterpillar trains had to be used on the job, and it is interesting to note that tires on these vehicles had to be changed every few days because of excessive wear from rocks and lava.

Work on the project started in 1931, and by the time the job was finished in 1934, some 63,000 men were employed, these largely natives.

At the conclusion of the address, the speaker answered questions from the audience, and received a vote of thanks from J. R. Dunbar..

OTTAWA BRANCH

C. G. Biesenthal, Jr.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - - *Branch News Editor*

The president of the Institute, Mr. J. B. Hayes, of Halifax, was present at an informal evening dinner held by the Ottawa Branch at the Chateau Laurier, November 26. Chairman of the Branch, J. H. Irvine, presided and guests at the head table included four past presidents, Mr. A. J. Grant, Dr. Charles Camsell, Dr. C. J. Mackenzie, and Dr. K. M. Cameron, together with Mr. G. J. Currie, councillor from the Halifax Branch, Mr. Louis Trudel, Montreal, assistant general secretary of the Institute, Mr. W. L. Saunders, Ottawa, and the main speaker of the evening, Air Vice Marshal E. W. Stedman, M.E.I.C., of Ottawa.

The president, who was introduced by Dr. Camsell, extended greetings to the Ottawa Branch as part of his tour across the Dominion. He told of the recent engineers' conference in London, England, which he had attended along with the general secretary as representatives of Canada. Four Dominions and India were represented and he had felt it was part of a program to bring the Empire closer together and to encourage a high standard of engineering throughout.

Air Vice Marshal Stedman, who was one of the two official observers for Canada at the scene of the recent atomic bomb tests at Bikini, gave an absorbing account of his experiences and personal observations at these tests. He traced the sequences of the historic experiment pointing out at the outset that there was no secrecy in what he had seen. All he had viewed was seen by a hundred others and there were no restrictions on the dissemination of this information. Eleven countries of the United Nations had been invited to send two observers each. There were also a number of "non-participating" observers from the United States who were present at the Government's expense.

The Air Vice Marshal described the preparations for the first test on July 1st, the precautions taken, and the organization set up for the study of its effects.

The first impression after the flash was of a huge ball, or rather hemisphere, which spread out very quickly, followed by dissipation at the top and bottom leaving a circular cloud which appeared to be moisture. Inside it, the atomic cloud of a sort of salmon colour, with what appeared to be purple shadows, rose up quickly to about 40,000 feet and slowly drifted away.

A view of the target at closer range that afternoon disclosed a black smoke screen over the ships and during the night fires started in the target area. Ships anywhere near the bomb had been singed. They were not blistered, the paint was still solid, but they were black probably as a result of a very high temperature for a very short duration.

Damage to the ships was mostly to the superstructure. The "shadow" effect was very noticeable, as on the Prince Eugen where the front turret was outlined on the bulkhead behind. However, one could not assume from this that he would be safe behind the turret as the heat waves might rebound from neighbouring surfaces.

The second bomb, which was set off by radio signal on July 24, was suspended underwater under a boat between the *Arkansas* and the *Saratoga*. This test was "really a sight". It started with a splash which almost immediately was completely covered by a white hemisphere which soon disappeared. Then a column of water, estimated to be a half mile in diameter rose for about 30 seconds to a height of 5,000 feet and took the same length of time to go down again. However, on its descent, it had increased to about a mile in diameter of radio active water.

The effects of an air shock wave could be seen which very quickly died down and wore itself out when it reached the shore. A water wave about 70 feet high spread toward the beach but was "killed" at the reef. There was also quite a number of other features.

The Air Vice Marshal noted that the Arkansas appeared to be sinking. When the cloud disappeared it was gone. The Saratoga which obviously was in difficulties disappeared 7½ hours later. As the observer ship cruised amongst the target ships, radio activity counts were constantly made and "we went as far as we were allowed". The count would go up when anything floated nearby such as seaweed or an oil slick. The target ships appeared to have everything "pushed out".

On a later flight over the target area from Kwajalein, base point about 200 miles away, a much better view was afforded. The speaker arrived back in San Francisco just two months after he left it.

A motion picture film in colour was shown at the conclusion of the address. This vividly showed the effects of the shock waves on the surface water, the growth and dissipation of the atomic bomb clouds, the nature of damage to the target vessels, and other phenomena.

"History has repeatedly shown that the invention of any one weapon has never been sufficient to prevent war," said Air Vice Marshal Stedman in conclusion, "even although man may know beforehand what to expect. But now we have simply got to remove the causes of war. We have got to work upon the better side of human nature, to tackle man's better qualities if we are to stop war with all its terrifying implications."

BRANCHE DE QUEBEC

Roger Desjardins, M.E.I.C. - - - *Secrétaire-trésorier*
Charles Boisvert, M.E.I.C. - - - *Editeur des nouvelles*

Le 4 novembre, la branche de Québec avait le privilège de recevoir comme conférenciers le Dr P.-E. Gagnon, directeur de l'Ecole de Chimie et doyen de l'Ecole des Gradués de l'Université Laval, et le Dr Roger Potvin, professeur en électrométallurgie et métallographie à l'Université Laval.

Ces deux éminents professeurs présentèrent une étude de l'après-guerre en Allemagne en nous faisant part, dans la mesure permise par la censure, de leurs constatations sur les développements de l'industrie allemande, avant et durant la guerre. Le Dr Gagnon traita des recherches et progrès obtenus par les industries allemandes en produits pharmaceutiques et menus produits chimiques. Le Dr Potvin traita des progrès de l'industrie métallurgique. Un film illustra les constatations du Dr Potvin et nous donna un aperçu émouvant de l'état de démolition dans les centres industriels allemands.

A la demande du ministère de la Reconstruction, un groupe d'experts canadiens recrutés dans l'industrie et le gouvernement, ont passé quelques mois en Allemagne et dans les pays libérés, pendant l'été et l'automne de 1945. Lors de cette tournée d'enquêtes, ils visitèrent des usines, des institutions de recherches, des chantiers maritimes, des régions dévastées et d'autres endroits intéressants en Allemagne, les Pays-Bas, le Luxembourg, la Belgique et la France.

Des experts partirent avant le jour V-J et suivirent de près les troupes d'invasion afin d'obtenir des renseignements qui seraient utiles dans la poursuite de la guerre contre le Japon. Cependant, après le jour V-J, leur voyage prit du soir au lendemain, une tournure plutôt industrielle que militaire.

Les experts reçurent leurs instructions à Ottawa avant de partir pour l'Europe. A leur arrivée en Angleterre, on leur donnait de nouvelles instructions, et le groupe se joignait à d'autres équipes semblables du Royaume-Uni et des Etats-Unis. Tous travaillèrent sans relâche avec leurs collègues des autres pays, chaque expert étudiant avec les experts anglais et américains dans le même domaine. Par exemple, les experts canadiens en textiles se joignirent aux experts du Royaume-Uni et des Etats-Unis pour étudier tout particulièrement l'industrie textile en Allemagne.

C'est pourquoi nos investigateurs se sont trouvés séparés durant leur tournée. Néanmoins, il est intéressant de remarquer qu'il y a quasi unanimité dans leur opinion sur le statut social et économique de l'Allemagne.

En général, ils découvrirent que la technologie et l'industrie canadiennes surpassent celles des Allemands. Seulement en quelques cas exceptionnels, l'outillage en production présentait un développement nouveau inconnu au Canada. Selon leur opinion, la machine industrielle allemande semble s'être élevée à la production en série vers 1935. Apparemment, ceci coincide avec l'établissement du plan économique de quatre ans qui, à ce stage particulier, appuie plus forcement sur la quantité. Il semble que c'est à partir de ce moment-là que l'industrie allemande a pu se prévaloir du maximum d'outillage déjà existant ainsi que de toute la main-d'œuvre disponible. Vers 1939, l'industrie allemande fonctionnait sur un plan qui consacrait au développement industriel le total de la main-d'œuvre, y compris les "ouvriers-esclaves". Cette ligne de conduite ne convenait pas à l'industrie même, mais elle était autorisée par le parti nazi et le parti militaire, puisqu'elle a permis au moins la fabrication des armes et de l'équipement d'une catégorie. Cette situation s'est prolongée durant les premières années et ce n'est pas avant 1942, lors des défaites de Stalingrad et d'El Alamein que les nazis se rendirent compte des défauts apparents d'un tel système économique, et entreprirent des changements radicaux. Dès ce moment, sur les ordres d'Hitler même, on accordait la priorité absolue aux recherches et aux développements scientifiques. On se procura en fait d'outillage de laboratoire tout ce que l'argent pouvait acheter. Heureusement, à notre point de vue, l'Allemagne avait épuisé au delà de toute récupération une force que la richesse ne peut remplacer les cerveaux qui dirigeraient les travaux des laboratoires. La conduite qu'elle avait adoptée pendant les trois années précédentes avait englobé dans les armées plusieurs de ces hommes. Ceci explique pourquoi les Alliés ont découvert de superbes laboratoires de recherches dénués de personnel ou qui ne possédaient qu'une poignée de savants.

Nos deux conférenciers ajoutèrent de nombreux détails intéressants sur la fabrication synthétique de plusieurs produits pharmaceutiques et sur les méthodes particulières utilisées en métallurgie.

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Visite du president J.-B. Hayes

Dans l'après-midi du 17 novembre une douzaine de personnes, épouses et membres du conseil de la branche de Québec de l'Institut se rendaient à Lévis pour rencontrer M. et Mme J.-B. Hayes et M. et Mme G. J. Currie qui arrivaient de Halifax. L'assistant-secrétaire général, Louis Trudel, s'était joint aux membres.

De 5 à 7 heures, le président de la branche de Québec, Charles Boisvert et Mme Boisvert recevaient à un coquetel, à leur résidence, en l'honneur des distingués visiteurs.

A 11 heures 30, le matin du 18 novembre, le président Hayes visitait le maire de Québec et signait le livre d'or en présence des ingénieurs de la cité et des membres du conseil de la branche de Québec de l'Institut et de leurs épouses. Après la cérémonie il y eut réception et déjeuner au Manoir St-Castin, au Lac Beauport.

A 7 heures le soir, M. Hayes était l'hôte d'honneur à un coquetel suivi d'un banquet au Club de la Garnison. Parmi les 75 convives qui assistaient, on remarquait à la table d'honneur, le président de la branche, Charles Boisvert, le président de l'Institut J.-B. Hayes, l'ex-président de l'Institut Dr A.-R. Décary, le vice-président de l'Institut G.-F. Layne, le fiduciaire du fonds Harry Bennett, R.-E. Heartz, l'ex-conseiller Dr P.-E. Gagnon, l'ex-président de la branche René Dupuis, l'ex-vice-président de l'Institut Hector Cimon, le président du "Committee on Prairie Water Problems" G.-A. Gaherty, le représentant de la Corporation des Ingénieurs Professionnels de Québec Ernest Lavigne, le vice-président de la branche de Québec P.-A. Dupuis, l'ex-président de la branche Alex. Larivière, le conseiller de l'Institut G.-J. Currie, l'ex-président de la branche J.-O. Martineau, le conseiller de la branche J. O'Halloran, le conseiller de l'Institut Paul Vincent, le président de la section des Etudiants Jérôme Lépine, l'ex-président de la branche E.-D. Gray-Donald, l'assistant-secrétaire général Louis Trudel et le secrétaire de la branche Roger Desjardins. Le président de la branche, Charles Boisvert, présenta le président général, J.-B. Hayes, et invita le Dr A.-R. Décary à lui offrir un souvenir de son passage à Québec. Dans des termes appropriés, le Dr Décary présenta à M. Hayes une pipe et un paquet de tabac "Alouette".

M. Hayes remercia chaleureusement les membres de la branche de Québec et se dit touché de la délicate pensée qu'ils avaient eue en installant devant lui le drapeau distinctif de la Nouvelle-Ecosse. Il fit mention particulière du doyen Adrien Pouliot, du Dr A.-R. Décary et de Hector Cimon. Dans son discours aux membres M. Hayes référa aux conditions ouvrières actuelles et mentionna que

The head table at the dinner.

les ingénieurs avaient la responsabilité de ré-apprendre au monde à travailler et que leur travail devait être empreint de leur personnalité. Parlant de son voyage en Angleterre, où il représenta l'Institut à la conférence des ingénieurs du Commonwealth, le président s'est dit émerveillé de l'énergie déployée par les Anglais pour sortir de leurs ruines. M. Hayes s'est avéré l'apôtre de l'unité nationale en montrant comment nos deux grandes races doivent coopérer pour le progrès du Canada. Le président général Hayes a adressé quelques mots bien sentis en français à son auditoire. M. J. O'Halloran s'est fait l'interprète des membres de la branche de Québec et a présenté en français et en anglais les remerciements d'usage. Ont également adressé la parole: M. Gaherty, M. Heartz sur le fonds Bennett, M. G.-J. Currie pour apporter le message de la branche de Halifax, M. Louis Trudel sur les initiatives du bureau central.

Pendant ce temps, les épouses des membres du conseil de la branche de Québec recevaient à dîner, au Cercle Universitaire, en l'honneur de Mme J.-B. Hayes et Mme G.-J. Currie. Le 19 novembre, de 4 à 6 heures au Cercle Universitaire, un thé réunissait une soixantaine d'épouses des membres de la branche de Québec de l'Institut. Les invitées d'honneur étaient mesdames Hayes et Currie.

Le 19 novembre à 3 heures de l'après-midi, le président Hayes, accompagné de René Dupuis, directeur de l'école de Génie Electrique de l'Université Laval, Charles Boisvert, président de la branche de Québec, G.-J. Currie, Louis Trudel, Roger Desjardins et René Rioux se rendaient à l'Université Laval rencontrer le recteur Mgr F. Vandry. Après une entrevue très intéressante, le président Hayes visita l'université. De là, le groupe se transporta à la Faculté des Sciences, Boulevard de l'Entente, pour l'inauguration d'une section des étudiants. Le directeur René Dupuis souhaita la bienvenue au Président Hayes, au nom de l'Université, le présenta à l'assistance et demanda à M. Jérôme Lépine, en sa qualité de président de la section des étudiants, de prendre charge de la réunion. M. Lépine se dit heureux d'accueillir le président et lui demanda d'ouvrir officiellement la section des étudiants qui comprend près de 80 adhérents.

M. Hayes adressa quelques mots de remerciements et inaugura officiellement la section des étudiants. Il présenta à M. Adrien Morin un diplôme attestant que ce dernier a gagné le prix de $25 accordé par l'Engineering Institute à l'élève le plus méritant de Laval en 3ème année de Sciences. Le président prononça ensuite une courte allocution en français et en anglais et invita les étudiants à mettre dans leur travail le meilleur d'eux-mêmes et de développer leur personnalité. Le président de la branche de Québec, Charles Boisvert, se fit le porte-parole de M. Hayes et remercia les autorités de l'Université Laval, le directeur René Dupuis et les étudiants de leur magnifique accueil: Il fit appel à ces derniers pour les inciter à s'enrôler de suite dans les sociétés professionnelles afin de se préparer au rôle qu'ils seront plus tard appelés à y jouer. Il signala les avantages qu'offrent ces sociétés et invita l'assistant-secrétaire général, Louis Trudel, à dire quelques mots de l'Institut. Ce dernier exposa aux étudiants ce qu'est l'Institut et ce qu'il est en mesure de faire pour eux. Après le cérémonie, il y a eu réception au salon des professeurs de la faculté des sciences où un grand nombre d'entre eux s'étaient réunis.

Le 20 novembre, un bon groupe de membres de la branche de Québec, accompagnés de leurs épouses, se rendaient à la gare du Palais pour souhaiter bon voyage aux distingués visiteurs qui s'embarquaient pour Trois-Rivières.

SAGUENAY BRANCH

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

Yacht Racing was the topic of an interesting address given by Professor D. M. Jemmett to the Saguenay Branch of the Institute on November 5th.

Professor Jemmett is professor of electrical engineering at Queen's University, and since 1922 has been connected with the

Kingston Yacht Club. In that year he was instrumental in obtaining for the club, 15 cat-rigged dinghies, each carrying 140 square feet of sail. The purpose of having many identical boats was to make a specialty of racing competition. Professor Jemmett stressed the point that sailing need not be a rich man's sport since small boats could provide a great deal of pleasure.

Professor Jemmett then discussed the rules of yacht racing as well as the finer points of handling a boat. In team racing, where several boats are entered for each competitor, it would often prove to be better strategy to "block an opponent's wind" and let a team-mate forge ahead rather than try to outdistance the competitor. Worrying an opponent is considered good sailing providing all tactics come within those prescribed by the racing rules.

Professor Jemmett then went into the technical aspects of sail construction. It was during the last world war that the slotted airplane wing was developed. Later it was realized that this was the principle involved in using a mainsail and jib. It had been known for a long time that a mainsail and jib gave better efficiency than a single mainsail of the same area but the reason behind it was not fully understood.

In connection with future construction of boats, Professor Jemmett believes that plywood will come to the fore, especially in the case of small craft. This type of boat will become fairly cheap when built on a mass production basis. The durability and seaworthy properties of the plywood boat had already been demonstrated. The present quality of lumber available is not suited to building boats since well seasoned wood is unavailable. Professor Jemmett advised using mahogany in place of any home grown type of lumber if boat building is contemplated at the present time.

T. A. Carter 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 general meeting of the Saint John Branch of the Engineering Institute of Canada was held Thursday evening, Nov. 21 in the Admiral Beatty Hotel with the Chairman L. O. Cass presiding. There was a record number of engineers present. The guest speaker for the evening was Mr. R. M. Doull, General Manager of the Canada Gunite Co., Montreal.

Mr. Doull spoke on the reconstruction of the Halifax water reservoir, a concrete structure of four million gallons capacity. He described in detail the prestressed gunite roof, which roof is at present the largest dome in the world, being 164 feet in diameter. He told also of the condition of the reservoir before reconstruction, and of the methods of removing the old concrete from the roof and walls and of the condition of the walls and reforcing steel after removal of the old concrete.

The lecture was illustrated by a color film, showing details of all stages of construction, and at its conclusion Mr. Doull answered questions on various aspects of the work.

A vote of thanks was extended to Mr. Doull by L. G. Lilley and seconded by R. M. Richardson.

SARNIA BRANCH

F. F. Dyer, m.e.i.c. - - - - *Secretary-Treasurer*
S. V. Antenbring, jr.e.i.c. - *Branch News Editor*

The Sarnia Branch held a dinner meeting at the Polymer Cafeteria on Thursday, Nov. 21st, 1946. Dr. M. K. Inman, professor of economics at the University of Western Ontario, was the guest speaker, and discussed the **Gold Standard and the International Monetary Fund.**

Dr. Inman went into the history of the gold standard and described how it was established internationally about 1880 as a means of fixing rates of exchange between nations so as to promote trade and as an international guarantee against inflation.

The proper working of the gold standard required that nations with unfavorable trade balances would make up the difference by shipping gold. By so reducing the quantity of gold in the country, the banks would have to lower their credit and the resulting deflation would bring about a drop in price levels in the country, which would tend to restore favorable trade balances in the competitive world market.

The system, however, required dropping of wages and costs at home until such time as trade balances were restored, and often unemployment resulted during these periods.

During the 1920's the gold standard broke down because various countries concerned did not have this flexibility. Tariff walls tended to offset the balancing effect of the standard, and labor unions prevented wage cuts and decreased costs of goods. Unbalanced budgets and gold flowing for political rather than for economic reasons were further factors.

Dr. Inman feels that we should not return to the gold standard as the break down would be repeated, and he went on to describe the International Monetary Fund now being set up which, it is hoped, will be a means of tiding nations over short periods of unfavorable exchange without the bad features of the old gold standard.

A hearty vote of thanks was proposed by Bill Harrison.

LETHBRIDGE BRANCH

H. T. Miard, m.e.i.c. - - *Secretary-Treasurer*
E. A. Lawrence, s.e.i.c. - *Branch News Editor*

A well attended Ladies Night was held by the Lethbridge Branch of the Institute on Saturday, November 16th in the Marquis Hotel, commencing with a dinner at 6:30 p.m.

Dinner music by George Brown's Instrumental Trio was enjoyed.

Following an address of welcome to the ladies by the Chairman, R. S. Lawrence, community singing was led by Mr. Morton Brown and excellent vocal solos were rendered by Mrs. Chas. Lloyd and Mr. Edgar Rannard. Accompanists were Mrs. R. S. Lawrence and Mrs. George Brown.

A hearty vote of thanks was tendered the orchestra and artists for their contributions, following which a Northern Electric Sound film entitled "Wings of Wire" was viewed with interest. It depicted the contribution that wire has made to man's comfort and safety by bringing under his control, at the flick of a switch, the immense power of electricity. The various processes of drawing wire and preparing it for its multiple uses were demonstrated.

At the conclusion of the film shown by Mr. Smith of the Lethbridge J.C.'s, P. E. Kirkpatrick introduced the speaker of the evening, Mr. J. D. Sutcliffe of London, England.

Mr. Sutcliffe, taking for his subject the **Wavy Navy Ashore and Afloat,** wove a very interesting and humorous address around his experiences while training with the Royal Navy in the British Isles and during subsequent operational duty with the Fleet Air Arm as a radar radio officer.

A hearty vote of thanks was tendered the speaker by J. Davidson and heartily endorsed by all present.

SASKATCHEWAN BRANCH

D. W. Houston, m.e.i.c. - *Secretary-Treasurer*
L. A. Dokken, m.e.i.c. - *Branch News Editor*

The regular monthly meeting of the Saskatchewan Branch was held in the Kitchener Hotel, Regina, on Friday, November 15th, 1946. Since our Council held their business meeting during the afternoon, Vice-President E. K. Phillips ,presiding, took pleasure in welcoming out of town councillors to our dinner meeting.

Mr. G. E. Kent, assistant sup't. of Imperial Oils Regina Refinery, gave a very interesting talk on the search for oil in Western Canada. Maps, prepared by the speaker, were distributed so that the members could actually note the areas in which oil was discovered or in which some promise of a producing field was shown by preliminary tests. During his review of the areas in Western Canada the speaker made mention of the tremendous cost of exploration and drilling operations, as well as the risk involved even when very favourable geological conditions were noted. He stressed the point that despite the difficulties encountered, our crude oil situation is such that the search must go on in order to locate producing fields that can replace existing areas, which are experiencing rapidly diminishing reserves.

An Imperial Oil technicolor film entitled "Search Unending", was shown, which reviewed the entire field of oil production from the theory of sedimentary deposits up to and including the actual drilling operations. Emphasis in the film was placed upon the scientific methods employed in the actual search such as gravimetric and geological surveys, seismograph recordings, core analysis, and aerial photography, all of which interlock to minimize the margin of error in determining the location of a "test" well.

During the discussion period, Mr. Kent obliged with a brief on actual drilling operations, in the course of which he gave figures on the amount of material used in the drilling of a well, the life and cost of the "bits", the mud circulation system, and obliged with actual accounts of some of the difficulties encountered by production engineers. The informal discussion period was especially interesting, since it connected up so well with the address and films to give a complete overall picture of this phase of the Oil Industry from the preliminary survey to bringing in a producer. This feature was brought to the attention of the members by H. S. Carpenter, who, in thanking the speaker, made reference to the fact that the field of oil production is new to most of our members, and such a complete account was both informative and interesting.

Before closing Stewart Young paid tribute to Councillor H. L. Roblin, who will shortly be transferred by his firm. Mr. Roblin has served the branch well and has always been keenly interested in the development. Mr. Roblin, in replying, recalled many incidents of the past, and expressed his regret at leaving the branch, which is associated with many pleasant memories.

TORONTO BRANCH

E. G. Tallman, m.e.i.c. - - - - *Secretary-Treasurer*
E. R. Graydon, m.e.i.c. - - - - *Branch News Editor*

The November technical meeting of the Toronto Branch of the Institute was held on November 28th, at the University of Toronto.

Members and their guests, members of the Ontario Section of the American Society of Mechanical Engineers and of the Institute of Power Engineers filled the Botany Lecture Room to overflowing. Wide interest in the paper presented was evident by the presence of representatives of interested bodies, among whom was Toronto's mayor, Mr. Saunders.

Professor A. E. Allcut of the University of Toronto, was the speaker and his paper was entitled **Toronto's Smoke Problem.** E. A. Cross, branch chairman, presided at the meeting and recalled several humorous anecdotes of the days when Professor Allcut and he were students at the University of Manchester. Slides showing smoke pouring out of chimneys of two buildings in the Queen's Park area, one a government building, the other a University of Toronto building, set the stage for Professor Allcut's presentation.

Space limitations here prevent proper reporting of a technical paper that deserves complete publication. Professor Allcut discussed the problem in general terms as he considers that Toronto's smoke problem is typical of any large city. The divisions of the paper were headed by the questions—what, whence, how, why, what results, how much, and remedy? Smoke was described as dirt forming, harmful, and issuing from a chimney. Carbon particles combined with tar and ash in varying proportions and of great variation in size are present in smoke, and hence analysis of smoke helps to identify the source. Dilution is a great factor in the problem as air under 2,300 feet has been known to travel 1,000 miles per day, thus making it important to stop smoke at the source.

The cause of smoke is generally improper combustion which can be attributed to improper firing or improper fuel. The effect of smoke in the air we breathe can be judged by the fact that an average human being takes in about four to seven times as much air as food per day.

The cost of smoke has been estimated at five to twenty dollars per person per year. Various gauges and charts are available to measure smoke, and Professor Allcut illustrated these and other parts of his paper with slides. Various remedies were discussed. It was pointed out that filtering removes only the coarse particles. Central heating, cyclones, wet baffles and electrostatic precipitation were also discussed. An ineresting point mentioned by Professor Allcut was that smoke forecasts are now possible. In conclusion Professor Allcut stated that in his opinion the remedy for the problem lay in "education supplemented by legislation applied with discrimination."

TORONTO BRANCH

Junior Section

B. R. Murphy, Jr.E.I.C. - - - - *Secretary-Treasurer*

The 1946-47 season opened in a flourish with an overflowing crowd of 225 in the Debates room of Hart House on October 8th. Mr. Winnett Boyd, chief engineer, Gas Turbine Division, A. V. Roe, Aircraft Co., gave a splendid talk on **Jet Propulsion Engines.** Members learned such interesting facts as the point that jet planes for speeds below 500 m.p.h. develop greater efficiencies with the energy being transferred to a propeller shaft; for speeds above 500 m.p.h. the hot gases are blown out the back in a stream.

Two sound films, "The Bell Telephone Hour" and "The Dawn of Better Living" were well received.

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A successful dinner meeting was held at the Winchester Hotel on Nov. 12 with 110 in attendance. Mr. H. R. Hilliard, speaking on **Frequency Modulotion,** in the light of his supervision of the construction of the new C.B.C. station VE9EV, outlined the improvements in reception with F-M broadcasts but stated that sets for domesic use are expensive at present. Mr. K. R. Stehling, chemical engineering student, gave an absorbing talk on **Development in Atomic Energy,** and members were loathe to let him go. He stated the engineering problem of harnessing the heat released in an atomic pile. If water is used to carry away the heat, it becomes dangerously radio-active. In time, this water loses its radioactivity. Due to the difficulty of separating U-235 from U-238, plutonium was used, by preference, in the bombs. Mr. R. H. Self, a construction engineer with the H.E.P.C., unfolded the gigantic task of planning a job such as the H.E.P.C. Stewartville Development, which will supply 54,000 K.W. Mr. Gordon Keith gave the results of the Jr. Section annual salary survey, which indicated progress for the last place electrical branch and showed that civil servants or government employees were the lowest paid of all engineers; many salaries are still too low for the well-being of the profession. Two interesting films, "Rail Roading" and "Communications, News and Views", were shown.

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A plant visit on Nov. 21 to Consumers' Gas Co., the largest public utility of its kind in Canada, producing 27,000,000 cubic ft. per day, using 200 tons of coke, 900 tons of coal and 1,000,000 gals. of water, drew an enthusiastic gathering of 80. We are very much indebted to the Consumers' Gas Co. Limited for their gracious reception.

Library Notes

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

BOOK REVIEW

THE ENGINEER IN SOCIETY

J. Mills. New York, Van Nostrand, 1946
196 pp., 8½ x 5¼ in., cloth, $2.50

Reviewed by E. P. MUNTZ, M.E.I.C.*

This very readable book should be studied by every engineer and scientist, as well as by many others.

The author, "recently retired Director of Publications at the Bell Telephone Laboratories, is a Fellow of the American Physical Society, the American Institute Electrical Engineers and the Institute of Radio Engineers. The inventor of several methods for wire and radio telephony, he conceived and supervised the design of the Bell Telephone Exhibits at the World's Fairs in Chicago, 1933; San Diego, 1935; Dallas, 1936; San Francisco, 1939-40, and New York, 1939-40. For three decades a top-line expositor of electrical science, Mr. Mills is the author of over a dozen volumes including the pioneering text on radio, written during World War I and widely used in the Signal Corps. He is also the author of *Within the Atom, Signals and Speech,* and *A Fugue in Cycles and Bels.*"

Mr. Mills was a scout for research workers and subsequently Personnel Director for Bell Laboratories, and is peculiarly well qualified to write about the Engineer in Society.

The preface to the book begins, "It should not have required the development of an atomic bomb to direct attention to the political importance of science and engineering. Nor to emphasize for scientists and engineers their relationship to the world society of which they are a part. Those recognitions are by-products which may prove to be more influential than the bomb itself."

The introduction begins, "Engineers as a class are too modest," and ends, "All that totals to an appalling task for the engineer and scientist. They must apply the objective method of science to the things that directly affect their lives and material surroundings, and do so without regard to inbred or subjective attitudes. They must do that also without regard to well established vested interests and pressure groups. Unshrinking they must seek the truth. And as they learn, they must persuasively present it to their fellowmen. More than they can do? Perhaps, but I hope not, because I believe the application of the method of science is the last hope of our civilization. And I know no class that can apply it better than the scientists and engineers, who have already learned how in studying the physical relationships of our universe."

In vivid colloquial style the engineer and scientist and their jobs are analysed. This takes the first three general divisions of the five in the book.

"A Course for Action" is the title of the fourth division, the chapter headings of which are "Scientific Men of Good Will," "The Lady or the Tiger," and "Organizing for Evolution."

"Exposition for Engineers" is the title of the fifth general division of the book. It contains chapters on "The Art of Thought," "The Curve of Growth," "Persuasive Exposition," "Forms of Anonymity," "Euclid and King James," "Reader Consciousness."

The first three divisions lay the groundwork leading to "A Course for Action" in the fourth; the six chapters of the fifth division are included evidently to make more effective the engineer's thinking, writing and speaking—a necessary corollary to any action.

The climax comes in Chapter 12, "Organizing for Evolution." "The immediate problem before engineers and scientists in industry is an engineering study of their class relationship to society. The first aspect of that problem is the scheme under which they receive their rewards, in other words, their pay. That is the subject which I propose for their scientific investigation. Like most research projects, as the investigation progresses, it will disclose new problems. I shall miss my guess, on the basis of other projects observed, if it does not very soon indicate a broad series of studies which will bring the engineer and scientist into fruitful contact with the major problems of our time. If the project is attacked in the objective manner of the scientific method it should lead to socially important results." The

*Consulting Engineer, Montreal, Que., and Hamilton, Ont.

chapter ends with "Like all problems of research and development that of organizing must be answered by evolution. Neither the successful method of attack nor the final conclusions can be predicted. The solution is in the lap of the gods, as one might say, but the gods are those of the scientific method and are co-operative with the forces of evolution. The time has come when all scientific men of good will must join in an intelligent attack upon the social and economic and even political problems of the day. And that attack must be an evolutionary application of the methods of science."

Mr. Mills finds the chief voluntary and licensing bodies too conservative and therefore unsuitable. He demands an organization which "must not produce any John L. Lewis or lesser imitation thereof." "They (the Engineers and Scientists) must even avoid letting any organization which they form present another opportunity for the executive-minded or the exploiter." He even suggests excluding those in minor executive positions.

In a convincing manner, Mr. Mills leads the reader to the necessity for a new form of organization. This he surrounds with many limitations in chapter 12, and then leaves the whole matter to evolution without giving a definite suggestion for the final structure. He laments the loss of research workers to executive positions and almost in the same breath states that "the end result of licensing, except as it protects those who direct construction and installation, would seem to be to tax all technical school graduates initially twenty-five dollars and annually a dollar."

Anyone with an open mind will acknowledge the contribution Mr. Mills has made in this book and can derive benefit from and agree wholeheartedly with most of it. However, any successful organization must have competent leaders with executive ability, who are executive minded. If even those in minor executive positions are excluded, the leaders will have little experience, and the evolution will be painfully slow. Mr. Mills' objective seems to be an executive composed of research workers for research workers. Presuming individuals with executive ability offer themselves, they must carefully eschew any other form of executive work. This is idealistic surely. The only way it could work out would be in another form of totalitarian cell within our so called democracy.

A man of Mr. Mills' wisdom and experience undoubtedly has a preferred starting point and it would be interesting to have some further indication from him regarding probable initial form and early steps of the type of organization he envisages.

The text is made vivid by pertinent illustrations from the author's 45 years of experience, by some anecdotes and by the happy phraseology. These coupled with a subject of so great current interest induce a non-stop first reading. A second reading then follows as a matter of course to digest all the valuable information and the fine points of the philosophy so ably presented.

ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS, ETC.

Airports; Design, Construction and Management:
H. K. Glidden, H. F. Law, and J. E. Cowles. N.Y., McGraw-Hill, 1946. 583 pp., illus., cloth.

Currents in Aerials and High Frequency Networks:
F. B. Pidduck. Oxford, Clarendon Pr., 1946. 97 pp., illus., cloth.

Elastomeric Engineering:
Describing the Scientific Process of Manufacturing Rubber Units for the Requirements of the Engineering and Shipbuilding Industries. Andre Rubber Co. Ltd., Tolworth, Surrey, Andre Rubber Co. Ltd., 1945. 165 pp., illus., cloth.

Engineering and Society with Special Reference to Canada:
Part 1 by C. R. Young; Part II by H. A. Innis and J. H. Dales. Toronto, University of Toronto Press, 1946. 429 pp., paper.

Factual Analysis of the Tennessee Valley Authority:
Huet Massue. N.Y., Edison Electric Institute, 1946. 184 pp., illus., cardboard. (A Presentation at the Annual Meeting of the Institute, New York, June 3-5, 1946.)

Heat Treatment of Carbon Steels:
F. Johnson, Brooklyn, Chemical Pub., 1946. 204 pp., illus., cloth.

New Cities for Old; City Building in Terms of Space, Time, and Money:
Louis Justement. N.Y., McGraw-Hill, 1946. 232 pp., illus., cloth.

Radio Tube Vade-Mecum; 6th ed. 1946:
P. H. Brans. Anvers (Borgerhout), Editions Techniques P. H. Brans, 1946. 232 pp., illus., paper.

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Willard Kelso Dennis. Wichita, Kansas, Beech Aircraft Corp., 1946. 387 pp., paper.

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Eugene L. Grant. N.Y., McGraw-Hill, 1946. 563 pp., illus., cloth.

Steam Power Plant Auxiliaries and Accessories; 2d ed.:
Edited by T. Croft, revised by D. J. Duffin. N.Y., McGraw-Hill, 1946. 583 pp., illus., cloth.

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Proceedings of the 56th Annual Meeting, 1946.

Connecticut Society of Civil Engineers:
62nd Annual Report, 1946.

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Proceedings of the Radiolocation Convention, March-May, 1946. (Issued as Vol. 93, Part IIIA, No. 1 of I.E.E. Jl.)

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Report of the General Manager on the Administration of the Railways and Harbours, 1945.

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Twenty-Ninth Annual Report, 1945-46.

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Report of Council, 1945-46.
. . . Presidential Address, H. B. Robin Rowell, 1946.

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B-1367—Some Numerical Methods for Locating Roots of Polynomials, Thornton C. Fry.
. . . B-1368—Visible Patterns of Sound, Ralph K. Potter.
. . . B1369—Dynamics of Package Cushioning, R. D. Mindlin.

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Canada. Bureau of Mines:
Catalogue and Index of Bureau of Mines Reports, (No. 818).

Codes of Practice Committee. British Standard Code of Practice:
CP(B) 607—Painting and Distempering Wall and Ceiling Boards and Slabs.
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Edison Electric Institute:
Specifications for Indicating Thermal Watt Demand Meters, Approved by Committee on Metering and Service Methods, Association of Edison Illuminating Companies and Meter and Service Committee, Edison Electric Institute. (MS-5, 1946.)

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90-14—Electric Power Conversion at the Trail Plants of the Consolidated Mining & Smelting Company of Canada, Limited, A. G. Dickinson.—90-15—Properties of Polytetrafluoroethylene of Interest to the Electric Industries, E. B. Yelton.—90-16—An Aluminum Coulometer, Martin Tosterud and Ralph B. Mason.—90-17—Low Temperature Dry Cells, Earl Otto, C. K. Morehouse, and George W. Vinal. —90-18—Introduction to Silicone Chemistry, E. G. Rochow.—90-20 —Characteristics of the Silver Oxide-Zinc Alkali Primary Cell, J. C. White, R. T. Pierce, and T. P. Dirkse.—90-21—Lead Dioxide Cell Containing Various Electrolytes, J. P. Schrodt, W. J. Otting, J. O. Scholgler, and D. N. Craig.—90-22—Electrical Conductivity Measurements of Carbon Blacks, G. Benson, J. Gluck, and C. Karfmann.— 90-23—Dry Cell Design to Operate at −40° C Containing Lithium Chloride in the Electrolyte, Milton E. Wilke.—90-24—Styrene Copolymer Solvent Reacting Varnishes—"Fosterite", N. C. Foster.—90-25 —Corrosion Resistance of Magnesium and Certain of its Alloys under Various Accelerated Atmospheric Conditions, R. R. Rogers, D. A. Tetu and H. Livingstone.—90-26—Characteristics of a Silver-Peroxide-Zinc Primary Cell, I. A. Denison.

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Utilization of Sewage Sludge as Fertilizer, Prepared under direction of the Committee on Sewage Works Practice by the Sub-Committee on Sludge Utilization for Fertilizers, 1946. (Manual of Practice No. 2.)

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No. 12—Soil-Bituminous Roads.

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Electrical Distribution Bus-Bars. (Vol. 4 n 2, May, 1946.)

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Feed Distribution and Hunting in Marine Water-Tube Boilers, H. Hillier.
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No. 8—Infra-Red Apparatus Detects Faulty Joints on Power Lines.

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Standard Cargo Liners, W. T. Butterwick and W. MacArthur Morison.

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No. 12—Union-Management Cooperation in Production.

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No. 59—Proceedings of the Personnel and Industrial Relations Conference, May 13-14, 1946.

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Preliminary Report on Lanaudiere River Map-Area, East Part of Duparquet Township, Abitibi West County, R. Bruce Graham. (P.R. No. 193.)
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Refrigeration Abstracts:

Published by American Society of Refrigerating Engineers, v 1 n 2, April 1946.

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No. 1—Design of Stacks to Minimize Smoke Nuisance, Robert W. Nolan.—No. 2—German Wartime Technical Developments, Henry A. Schade.—No. 3—Development of Ice-Breaking Vessels for the U.S. Coast Guard, Harvey F. Johnson.—No. 4—Turning and Course-Keeping Qualities, Kenneth S. M. Davidson and Leonard M. Schiff.—No. 5—Alternating Current for Auxiliary Plants of Merchant Vessels, Benjamin Fox and Harry C. Coleman.—No.6—Development of Steam Turbines for Main Propulsion of High-Powered Combatant Ships, G. B. Warren.—No. 7—Aspects of Large Passenger Liner Design, James L. Bates and Ivan J. Wanless.—No. 8—Pattern for Research in Naval Architecture, E. A. Wright.
... General Information Book, edition of 1946.

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No. 5—Byggnadsmaterialens Transporter; Studier av Metoder och Kostnader, Mejse Jacobsson.

U.S. Navy Dept., Research and Standards Branch. Research Memorandum:

No. 6-44—Gas Turbine Gas Charts.

University of Minnesota. Engineering Experiment Station. Bulletin:

No. 25—Vapor Resistant Coatings for Structural Insulating Board, F. B. Rowley, M. H. Lajoy, E. T. Erickson.

PAMPHLETS, ETC.

Aesthetic Aspect of Civil Engineering Design; a Record of Six Lectures delivered at the Institution:

Institution of Civil Engineers, London, 1945. 120 pp., illus.

Alpaste; the Aluminum Paint Pigment:

Aluminum Co. of Canada, Ltd., Montreal, c1946. 87 pp., illus.

Arterial Plan for New Orleans:

Robert Moses. Louisiana, Dept. of Highways, Baton Rouge, 1946. 35 pp., illus.

Century of Turbines: Water Turbines, Steam Turbines, Aerodynamic Turbines:

Escher Wyss Engineering Works, Ltd., Zurich. (Escher Wyss News, Vol. 15-16, 1942-43.) 213 pp., illus.

Dominion Safety Manual:

Dominion Engineering Works, Montreal, 1946. 24 pp., illus. (French and English).

Educational and Vocational Guidance Materials; a Canadian Bibliography:

E. F. Sheffield and N. M. Sheffield. Ottawa, Canadian Council of Education for Citizenship, 1946. 49 pp.

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Institute of Industrial Administration, London, 1946. (Proceedings of Conference, Oct. 11 and 12, 1946. 40 pp.

Planning for Montreal; Master Plan—Preliminary Report:

Montreal, Dept. of City Planning, 1944. 60 pp., illus.

Position of the Engineer in Relation to Town and Regional Planning; a Record of Four Lectures delivered at the Institution:

Institution of Civil Engineers, London, 1945. 96 pp., illus.

Profit Control; Through use of Budgets, Standards, and Standard Costs:

Sweetser, Frank L., Montreal, Engineering Institute of Canada, 1946.

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American Wheelabrator & Equipment Corp. (formerly American Foundry Equipment Co.), Mishawaka, c1946. 128 pp., illus.

Story of AVIMO:

Avimo Ltd., Taunton, 1946. 104 pp., illus.

Traffic Survey (of Montreal), Summer 1945:

Montreal, City Planning Dept., 1946. 41 pp., illus.

Traffic Survey of New Orleans Metropolitan Area, 1944-1945:

Louisiana Dept. of Highways, in cooperation with the Public Roads Administration and the City of New Orleans. Baton Rouge, 1946. 91 pp., illus.

Use of Research by Professional Associations in Determining Program and Policy:

Esther Lucile Brown. N.Y., Russell Sage Foundation, 1946. 39 pp.

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.

AIRCRAFT PRODUCTION DESIGN:

J. L. Thompson, Aviation Press, 1590 El Camino Real, San Carlos, California, 1945. 238 pp., plus index, illus., diagrs., charts, tables, 9¼ x 7½ in., stiff paper, ring binder, $5.00.

Design procedure is considered with respect to production methods, the serviceability and accessibility of parts, machineability, and the factors of repair and lubrication. The various operations which enter into the manufacture of airplane parts are described with discussion of their adaptations and limitations. Separate chapters are devoted to materials for airplane construction and to standardized parts.

BEAMS ON ELASTIC FOUNDATION:

M. Hetényi. The University of Michigan Press, Ann Arbor, Mich.; Geoffrey Cumberlege, Oxford University Press, London, 1946. 255 pp., diagrs., charts, tables, 10¼ x 6¾ in., cloth, $4.50.

This book deals with the analysis of elastically supported beams. Chiefly theoretical in nature, the book discusses as well the applications to a variety of technical problems. Beginning with the general solution of the elastic line, the several chapters treat of beams of finite and unlimited length, beams of variable rigidity and modules of foundation, bars under various loadings, the torsion and elastic stability of bars, circular arches, and continuity in the foundation. Although mainly in the field of statics, the solutions developed may also be employed in such fields as vibration and acoustics.

CURRENTS IN AERIALS AND HIGH-FREQUENCY NETWORKS:

F. B. Pidduck. Clarendon Press, Oxford, Eng; Oxford University Press, Toronto, New York, 1946. 97 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $2.50.

This book is an account of previously unpublished investigations on currents in aerials, based on a little-known paper of Pocklington. Fundamental formulae are deduced and extended to soldered networks. The theory of transmission lines is established as that of a system of two aerials, the untuned Y-feeder is considered in detail, and a theory of aerials parallel to the earth is worked out. The necessary tables or calculations are included.

ELASTOMERIC ENGINEERING, describing the scientific process of manufacturing rubber units for the requirements of the Engineering and Shipbuilding Industries:

Andre Rubber Company Limited, Hook Rise, Tolworth, Surrey, England. 2 ed., 1945. 168 pp., illus., diagrs., charts, tables, 10 x 7½ in., cloth (one guinea).

The first four chapters are devoted to the properties, preparation, compounding, manufacture and processing of natural and synthetic rubbers. The succeeding chapters describe the production of rubber-metal bonded units for various engineering applications. The properties of the rubber-metal bond are discussed, manufacturing processes and testing methods are described, and design procedure and calculations are given.

LES ESSAIS DES TRANSFORMATEURS INDUSTRIELS:

M. Lapine. Dunod, Paris, 1946. 139 pp., diagrs., charts, tables, 10 x 6½ in., paper, 330 frs.

This practical book describes a variety of tests for industrial transformers. Among the topics covered are windings, losses in vacuo, short circuits, insulation, overheating, coils, connections, and defects resulting from accidents. The final chapter discusses the operation of transformers in parallel. Instrument transformers are not considered.

GAS TURBINE GAS CHARTS (Research Memorandum No. 6-44):

Research and Standards Branch, Bureau of Ships, Navy Department, Washington, D.C., 1945. 48 pp., diagrs., charts, tables, 8¼ x 10¾ in., paper, apply.

This report was prepared to provide a means for rapidly and accurately calculating gas turbine performance. Along with the charts is a brief description of their use, and an appendix explains the method of calculation with actual examples of gas turbines plant performance. A bibliography lists the original sources of the data from which the charts were prepared and the method of preservation was derived.

PLASTICS FOR ELECTRICAL AND RADIO ENGINEERS:

W. J. Tucker and R. S. Roberts. Technical Press Ltd., Gloucester Road, Kingston Hill, Surrey, England, 1946. 148 pp., illus., diagrs., charts, tables, 9 x 5¼ in., cloth, 12s.

This handbook provides the electronic engineer with essential data relating to the application of plastics in the electrical and radio industry. Molding and manufacturing procedure and the advantages and limitations of plastic materials are discussed in a full and practical manner. Insulation and testing problems are dealt with in detail, and tables giving physical properties are presented in a manner useful to the electronic industry.

POST-WAR DEVELOPMENT OF ROAD MOTOR TRANSPORT:

H. E. Aldington, E. G. Beaumont and J. S. Nicholl. Institution of Automobile Engineers, 12 Hobart Place, London, S.W.1. 1945. pp. 179-210. illus., tables, 8½ x 5½ in., paper, 2/6.

This small pamphlet presents three papers read at a joint meeting of eight British Technical Societies and covers the following topics: roads (highway design and traffic development); progress of motor vehicle design and construction; traffic (analysis and planning).

RECENT AERONAUTICAL LITERATURE, a Selective Subject Index for 1945:

Compiled and edited by W. K. Dennis. Beech Aircraft Corp., Wichita 1, Kansas. 1946. 387 pp., 11 x 8½ in., paper, $5.00.

Over 12,000 title entries from some sixty aeronautical periodicals (American, Canadian and English) are included in this volume. They are arranged alphabetically by title under a large number of selected subject headings. Many of the periodicals indexed (including a large number of company publications) are not covered by the commercial indexing services. A supplementary monthly publication is also available.

SOILS, CONCRETE & BITUMINOUS MATERIALS, a record of a course dealing with Airfield Construction:

Given at the Road Research Laboratory, Dept. of Scientific and Industrial Research, July-August, 1943, London, His Majesty's Stationery Office, 1946. 288 pp., illus., diagrs., charts, tables, 9½ x 7¼ in., paper, 10s. net (obtainable from British Information Services, 30 Rockefeller Plaza, New York, $2.75).

In this volume are collected a series of lectures by some 35 specialists for the training of engineers in the construction of airfields from certain materials. Part I, on soils, covers geology and soil formations, the properties of soils, stabilization, construction methods, airfield design, and the theory of soil testing. Parts II and III deal with the properties, manufacture and use of cement, concrete, and bituminous surfacings. Recommended testing procedures for various phases of the work with these materials are given in Part IV. A comprehensive and detailed index increases its use for reference purposes.

STEAM POWER PLANT AUXILIARIES AND ACCESSORIES:

T. Croft, editor, revised by D. J. Duffin, 2 ed. McGraw-Hill Book Company, New York and London; Embassy, Toronto, 1946. 583 pp., illus., diagrs., charts, tables, 8¼ x 5½ in., cloth, $5.00.

A practical manual for the operating engineer, this book has been revised to conform with the changes that have taken place in the 24 years since it was originally published. Topics on which considerable new material has been added include reciprocating and centrifugal pumps, methods of boiler feeding, foodwater heaters, economizers and air preheaters, condensers, steam piping of power plants, and steam traps. As before, there are review questions and problems, and a technical data section has been added.

THERMODYNAMICS:

G. A. Hawkins. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 436 pp., diagrs., charts, tables, 8¾ x 5½ in., cloth, $4.50.

This book is intended as a text for a two-semester undergraduate course. Fundamental concepts, the basic laws, and the theoretical considerations of ideal gases, energy, and entropy are discussed in the first half of the book. Succeeding chapters deal with the practical aspects of nozzles and orifices, internal combustion engines, air compressors, gas turbines and jet propulsion, vapor cycles and refrigeration. There is also a final chapter dealing with the fundamentals of heat transfer.

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.

ELECTRICAL PROTECTIVE EQUIPMENT AND POWER-FACTOR CORRECTION, Fire Protection and Fire Fighting Equipment:

By E. S. Lincoln. Essential Books, 270 Madison Ave., New York. 1945. 242 pp., illus., diagrs., charts, tables, 8¼ x 5¼ in., cloth, $3.00,

This book presents the fundamentals of electric circuit protection by means of fuses and circuit breakers against overloads, reverse currents, under and over voltage. The equipment is described in detail, including fire protection and fire fighting equipment. The material is based on the provisions of the National Electric Code and the NEMA definitions applying to protection and protective relays. A special chapter is devoted to power factor correction.

ELECTRONIC EQUIPMENT AND ACCESSORIES:

By R. C. Walker. Chemical Publishing Co., Brooklyn, N.Y., 1945. 393 pp., illus., diagrs., charts, tables, 8¾ x 5¼ in., cloth, $6.00.

Specific information is given on the various applications of electronic devices, with many illustrative examples outside the field of telecommunication. The book constitutes a simple introduction of the main sections of the subject of electronics to practical engineers, mechanics, etc. Since electronic devices so often act as a control link in connection with small mechanisms, a large part of the book is devoted to such apparatus with its accessory equipment.

ELEMENTARY APPLIED AERODYNAMICS:

By P. E. Hemke. Prentice-Hall, New York, 1946. 231 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $3.25.

The opening chapters discuss the physical properties of air and the flow of an ideal fluid. Following directly from these come the chapters on airfoil theory, including the compressibility effect. Propellers receive separate treatment, and the performance of a conventional airplane is discussed. A brief chapter on rotors and helicopters is included. The presentation has been kept as simple as possible, but some preliminary training in mathematics, physics and mechanics is expected.

ELEMENTARY WAVE MECHANICS.

W. Heitler. The Clarendon Press, Oxford, England; Oxford University Press, New York, 1945. 136 pp., diagrs., tables, 7½ x 5 in., cloth, $2.25.

Beginning with chapters on the experimental basis of quantum mechanics and the derivation of the wave equation, the author proceeds to discuss the hydrogen atom, angular momentum and spin, the problem of two electrons, pertubation theory, and the periodic system of elements. The past two chapters provide an introduction to the theory of chemical bond.

METALLURGY of STEEL CASTINGS.

C. W. Briggs. McGraw-Hill Book Co., New York and London, 1946. 633 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $6.50.

The object of this book is to provide a reference work for the technical control of manufacturing operations for the production of steel castings. It correlates the problem of the casting of steel with the methods of steel manufacture, and considers in addition the following related topics: gases, deoxidation, and inclusions; tapping and pouring; gates and risers; properties of liquid cast steel; solidification; hot-tear formation; molding sands and cores; and the welding of steel castings.

THEORY and PRACTICE of FILTRATION. (Modern Library of Chemical Engineering).

G. D. Dickey and C. L. Bryden. Reinhold Publishing Corp., New York, 1946. 346 pp., illus., diagrs., charts, tables, 9¼ x 6 in., cloth, $6.00.

The general concept of filtration as considered in this book is limited to the separation of solids from liquids and gases by the use of porous media, with by far the most space devoted to liquid filtration. History, theory, and filtration principles are first discussed, followed by description of the types and uses of filters and their auxiliary apparatus. Three special applications are dealt with separately: oil filters, extractors and expellers; water filtration; sewage clarification and sludge dewatering. Surface and interfacial separation of immiscible fluids are discussed in an appendix.

WATER BACTERIOLOGY, with special reference to Sanitary Water Analysis.

S. C. Prescott, C.E.A. Winslow and M. H. McCrady. 6th ed. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 368 pp., charts, tables, 8½ x 5½ in., cloth, $4.50.

Intended both as a textbook for the student and as a reference manual for the laboratory worker, this book covers the public health phases of the subject. It discusses the distribution, behavior and sanitary significance of bacteria introduced into water from extraneous sources. It describes the development of methods currectly employed in sanitary water bacteriology, with official standards, paying special attention to the details of recognized tests and reactions. Separate chapters are devoted to sewage bacteriology and shellfish examination.

WORKSHOP TECHNOLOGY, 2 Parts:

W. A. J. Chapman. Edward Arnold & Co., London; Longmans, Green & Co., New York, Toronto, 1945. Illus., diagrs., charts, tables, 8¾ x 5½ in., cloth. Part 1, 303 pp., $1.50; Part 2, 328 pp., $2.50

The full range of workshop operations is covered in these two volumes. The majority of the text deals with machine-tool work on the standard machines: lathes, shapers, milling machines, etc., covering the tools, speeds and feeds, indexing, and numerous detailed descriptions of actual jobs. The materials, ferrous and non-ferrous, are described with their properties and heat treatment. The hot working of metals is considered, bench jobs are described, power devices and safety are discussed, and the elements of measurement and gauging are given full coverage.

PRELIMINARY NOTICE

of Applications for Admission and for Transfer

December 9th, 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 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 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 circumstance 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

ANDERSON—BURNETT LYMAN, of Chippenham, Bucks,. Eng. Born at Toronto, Ont., May 21st, 1912. Educ.: B.A.Sc. (Mech.), Toronto, 1934; Small arms tech. course, Military Coll. of Science, England; 1934-35, shopwork, Bradbury Steel Co., Toronto; 1935-36, time and motion study, Ward St. Works, Canadian General Electric, Toronto; 1936-37, time study, cost analysis, distribution of overhead expense dept., Dominion Rubber Co., Montreal; 1937-38, asst. to plant supt., development of prod. control methods, Cockshutt Plow Co., Brantford, Ont.; 1938-39, prod. engr. with Govt. staff at John Inglis plant (Bren Guns), Dept. National Defence; 1940-46, R.C.O.C. and R.C.E.M.E., Canada and England, at the end of war on Tech. Staff at Canadian Military H.Q., i/c Small Arms, etc., England; at present, managing-dir., Keith Tool & Production Co., Ltd., mfrs. press tools, jigs, fixtures, gauges, etc., Chippenham, Bucks., England.

References: E. A. Allcut, C. R. Young, L. S. Lauchland.

BACON—CHARLES IVES, of Cornwall, Ont. Born at West Lake, Idaho, June 24th, 1908. Educ.: B.Sc. (Elect. Engrg.), Nova Scotia Tech., 1934; R.P.E., Ontario; during vacations and for two years after graduation, all phases of constrn. and operation of small electric system, North Tryon Electric Co., Ltd., Tryon, P.E.I.; 1936-38, engr. i/c of elect. plant, large addition made to plant, entire switchboard moved, additions made, new diesel engine installed, dist. system revised, etc., Town of Summerside, P.E.I.; with Stormont Electric Light & Power Co., Ltd., and Cornwall Street Rly. & Power Co., Ltd., Cornwall, as follows: 1942 (5 mos.), asst. mgr. supvr. of constrn., mtce.. all phases of engrg., 1942 to date, mgr.

References: E. A. Ryan, H. Meadd, D. Ross-Ross, D. Giles, J. B. Hayes.

BARWICK—WILLIAM STANLEY of Vancouver, B.C. Born at Barrie, Ont., Feb. 13th, 1879; R.P.E., B.C.; 1902-04, dftsman., Vancouver Engrg. Works; 1904-06, dftsman., N. Thompson & Co.; 1906-07, dftsman., City of Vancouver; 1907-21, designing engr., Vancouver Engrg. Works; 1921-23, sales engr., Engineering Corp.; 1923-26, designer and constrn. engr., various engrg. projects for B.C. Cement Co., amounting to over $200,000.; 1926-28, asst. engr., C. C. Moore; 1928-31, mgr., Wallace Foundry Co.; (1930-36, examiner for the Professional Engrs.); 1931-34, private engrg. practice; 1934-36, mgr., Wallace Foundry Co.; 1936-38, foundry supt., Vancouver Engrg. Works; 1938-39, mgr., Nelson Iron Works, 1940-41, designer, Reed Prentice Co.; 1941-44, chief dftsman., Reliance Gear Works; 1944 to date, consultg. metall. and mech. engr., Westland Iron & Steel Foundries Ltd., designing sawmill, logging, electrical handling equipt., specialized foundry machinery and elect. furnaces, also, has genl. mech. consultg. practice.

References: G. A. Walkem, D. O. Lewis, H. P. Archibald, C. E. Cooper, W. O. C. Scott, G. W. Allan.

BLUETH—JOHN HANS, of 4030 Vendome Ave., Montreal, Que. Born at Nurenburg, Germany, April 21st, 1903. Educ.: Mech. Engr., Higher Technical State Coll., Nurenburg, 1925; (formerly member VDI, Assn. German Engineers, Berlin); naturalized Canadian; 1919-21, practical trainee, MAN-Maschinenfabrik, Augsburg, Nurenburg; 1921-22, trainee, drawing off., Ardie Motor Works, Nurenburg; 1925-26, mech. engr., Bing Werke A.G., Nurenburg; 1926-27, engr., Schwarzenberger & Co., Nurenburg; 1927-31, designer, NSU Vereinigte Fahrzeugwerke, A.G. (United Car & Motorcycle Works A.G.); 1931-38, supvr., H. Uhlfelder, G.M.B.H., Munich; 1940, chief engr., Swan Mill Paper Co., Ltd., London, Eng.; 1941, designer, Sorel Industries Ltd.; 1941-42, designer, Machinery Service Ltd., Ville La Salle, Que.; 1942-43, sr. dftsman., Citadel Merchandising Co., Ltd., Montreal; 1943-44, section leader, Federal Aircraft Ltd., Montreal; 1944-46, chief dftsman., Canadian Armature Works, Montreal; and at present, power plant design engr., Canadair, Cartierville, Que.

References: H. Jasen, M. Nathanson, H. Scheunert, N. L. Hartmann, B. H. Margo.

BROCKINGTON—HUGH, 424 N. Ingleton Ave., Vancouver, B.C. Born at Cardiff, Wales, Oct. 7th, 1897. Educ.: B.Sc. (Mech.), Univ. of Wales, Cardiff, 1922; R.P.E., B.C.; 1913-14, engr. pupil, Hills Dry Docks, Cardiff; 1914-19, Royal Engineers; 1919-22, student engr., South Wales Electric Power Co.; with Imperial Oil Limited, as follows: 1923-24, dftsman., Sarnia, 1924-32, asst. mech. supt., IOCO, B.C., 1932-39, supt. of constrn., IOCO; 1939-41, inspector of constrn., Dept. of National Defence, Esquimalt, B.C.; with Carter-Halls-Aldinger, as follows: 1941-42, mech. supt., Pickering, Ont., 1942-43, asst. to genl. supt., Prince George and Terrace divn.; 1943-45, tech. adviser, Unemployment Insurance Commission, B.C. Region; 1946 to date, consultg. engr. to Home Oil Co., Halse-Martin Construction Co., Bottled Gas Co., etc.

References: A. D. Creer, W. G. Swan, N. D. Lambert, R. C. Pybus, M. S. MacGillivray.

CARRUTHERS—HARVEY, of Vancouver, B.C. Born at Spokane, Wash., Dec. 25th, 1913. Educ.: B.A.Sc. (Mech.), Univ. of B.C., 1940; 1936, asst. to engr., B.C. Cement Co.; 1938, asst. to surveyor, Pioneer Timber Co.; with Dominion Rubber Co., as follows: 1940-41, sales engr., Winnipeg, 1941-43, development engr., Montreal; 1943-46, with R.C.N., as follows: Junior Engr. Officer, Engr. Officer I/C of Machinery, Staff Officer I/C of Engrg. Appointments, demobilized with rank of Lieut. Commander (Engrg.); and at present, dist. mgr., Bingham Pump Co., Ltd. Vancouver, B.C.

References: H. J. MacLeod, A. Peebles, P. N. Bland, W. N. Kelly, G. W. Allan.

DAVIDSON—HARRY DRANEY, of Vancouver, B.C. Born at Vancouver, B.C., Oct. 11th, 1910. Educ.: Night school—2 yrs., mech. drawing; 3 yrs., maths.; 1 yr., mining; 1928-38, with Vancouver Engrg. Works, as follows: 22 mos., pattern making, 18 mos., foundry, 3 yrs., machine shop, 2 yrs., mech. drawing, 2 yrs., asst. to plant supt.; 1938 to date, chief dftsman. and engr. i/c drawing office, sales, for R&M Bearings Canada Ltd. and asst. B.C. mgr., Renold-Coventry Ltd. (associated companies).

References: G. W. Allan, T. W. Lazenby, G. H. Bancroft, W. T. Fraser, R. C. Pybus.

DENHAM—HARRY FREDERICK, of Toronto, Ont. Born at Preston, Ont., Dec. 15th, 1923. Educ.: B.A.Sc. (Mech.), Toronto, 1946; 1945 and 1946 (summers), asst. to asst. engr., Grand River Railway; 1946 to date, asst. to elect. engr., mech. and elect. work in connection with motive and stationary power plants, etc., Canadian Pacific Railway, eastern lines, Toronto.

References: R. H. Self, I. S. Widdifield, R. F. Legget, T. R. Loudon, F. H. Midgley.

GOLDBERG—IRWIN, of 28 Kent St., Hamilton, Ont. Born at Hamilton, Ont., June 27th, 1918. Educ.: B.Sc. (Business and Engrg. Administration), Mass. Inst. Tech. (accredited E.C.P.D.), 1941-42, prod. engr., J. Bertram & Sons, Dundas, Ont.; with R.C.A.F., as follows: 1942, develpg. work on gas turbines at Metropolitan Vickers Co., Barton Works, Eccles, Lancs., Eng., 1942-45, Aero. Engr. Officer, engaged on mtce. and repair of aircraft and engines at Command Hdqts., i/c repair squadron at service flying stn., Rockcliffe, Ont.

References: R. A. Low, A. Jackson, L. T. Rutledge.

HUDA—A. F. M. MIRZA SHAMSUL, of Toronto, Ont. Born at Tangail, Bengal, India, Jan. 1st, 1917. Educ.: B.Eng. (Civil), Univ. of Calcutta, 1940; 1940-41, completed one year's practical training under civil engr., constrn. of roads, screw-pile bridges with abutments, works, open foundations, R.C. State culverts, bldg. constrn.; 1941-42, asst. engr., communications and works dept., Govt. of Bengal, i/c improvement work on Mymensingh-Tangail road; 1942-44, asst. engr. (Gazetted rank), Public Health Engrg. Dept., Govt. of Bengal, i/c of a sub-divn., prepared and executed scheme of water supply by means of tube wells in areas of Calcutta, responsible for sinking and resinking of deep tube wells by diff. methods incl. casing system, i/c mtce. Calcutta A.R.P. tube wells; 1944-46, insptr. works, Bengal-Assam State Rly., Govt. of India, worked in Paksey and Chittagong district, engaged in constrn. of station yds., goods sheds, roads, bldgs., bridges, rly. embankments, mtce. works, during period was employed in military works for constrn. of marshalling yds., bldgs., drains, roads, water supply by means of pipe lines and huge earth work in Chittagong and Serajgunj; 1946 to date, engaged in graduate studies in dept. of civil engrg., Univ. of Toronto, Toronto, Ont.

References: C. R. Young, T. R Loudon, C. F. Morrison, M. W. Huggins, R. F. Legget.

JOHNSTON—DAVID H., 29 Bellwood Ave., Ottawa, Ont. Born at Ottawa, April 2nd, 1915. Educ.: B.Sc. (Elect.), Queen's, 1941; R.P.E., Ontario; 1941-43, inspetng. officer of Radar Inspectorate of Inspection Board of U.K. and Canada at Research Enterprises Ltd., Leaside, Ont.; 1943-45, Active Service as an Air Radio Officer with Fleet Air Arm of Royal Navy (on loan from R.C.N.V.R.); 1945 to date, exploration dept., Imperial Oil Limited. Sangudo, Alta., first as an operator trainee and latterly as asst. operator of seismograph field party.

References: N. B. MacRostie, D. S. Ellis, D. M. Jemmett, A. Jackson, W. H. G Flay.

LIBBY—HUGH T., of Vancouver, B.C. Born at Herne Bay, Kent, Eng., Oct. 10th, 1905. Educ.: private study; R.P.E., British Columbia (by exam.); 1935-45, with British Columbia Electric as supvr. of gas troublemen and appliance designer; later, responsible for study and planning of elimination of trouble in gas distribution system, gas divn., and at present, supt. of gas dist., gas dept., Vancouver, B.C.

References: A. D. Creer, P. B. Stroyan, H. P. Archibald, G. W. Allan, W. T. Fraser.

McKILLOP—DOUGLAS BRUCE, of Norwood Grove, Man. Born at Carnduff, Sask., April 4th, 1903. Educ.: B.Sc. (Civil), Queen's, 1929; R.P.E., Manitoba; 1924 and 1925 (summers), inspector, Regina City, engr.'s dept.; foreman, Carter-Halls-Aldinger; with Canadian National Railways, as follows: 1929-33, resident engr., 1938-41, res. engr., 1941 to date, asst. engr., bridge engr.'s dept., Winnipeg Man.

References: W. Walkden, J. L. Charles, J. W. Porter, W. Hurst, R. W. Ross, E. S. Kent.

MORTON—STANLEY, of Vancouver, B.C. Born at Coventry, Eng., July 29th, 1902. Educ.: Birmingham Tech. School, 1920-24; M., A.S.M.E.; A.M., Inst. M.E., London (by exam.); 1927-35, asst. engr., R&M Bearings Canada, Ltd., Montreal; 1935 to date, B.C. mgr. i/c engrg. for western Canada, R&M Bearings Canada Ltd., and Renold-Coventry Ltd., Vancouver, B.C.

References: G. W. Allan, E. M. Stiles, J. G. Daoust, R. C. Pybus, G. H. Bancroft.

NEILSON—MAURICE O., of Toronto, Ont. Born at Attmar, Norland, Sweden, July 27th, 1886. Educ.: Civil Engr., Royal Swedish Tech. Inst. (Univ. of Stockholm), 1911; R.P.E., Ontario; 1911-12, Swedish Institute of Testing Materials; 1913-30, Belgo Canadian Pulp & Paper Co. (and successors), Shawinigan Falls, Que.; 1931-37, F. R. Booth Limited, Ottawa; 1937-39, engrg. design on own inventions; 1939-42, Don Valley Paper Co., Toronto; 1942-45, Alliance Paper Mills Ltd., Merriton, Ont.; 1945, consultg. engr., Toronto, Ont.

References: J. C. Day, J. Stadler, W. H. Wharton, D. C. Tennant.

NOYES—RICHARD ROE, of Montreal, Que. Born at Canton, China, Mar. 17th, 1915. Educ.: B.A.Sc. (Mech.), Toronto, 1936; with Canadian General Electric, as follows: 1935 (summer), time study engr., 1936, asst. plant engr.; Canadian Sirocco Co., Ltd., as follows: 1936-37, jr. engr., research dept., testing and development of new heating, ventilating, air-conditioning and power plant equipt., 1937-43, application engr., design of systems using heating, ventilating and air-cond. power plant mech. draft, variable speed hydraulic couplings, drying, vapour removal and dust collector equipt.; 1943-46, Naval Officer, Aero. Engrg. design, United States Navy; 1946 to date, application engrg. with Canadian Sirocco Co., Ltd., asst. dist. mgr., Montreal office.

References: H. M. Esdaile, G. L. Wiggs, A. E. Allcut, E. B. Jubien.

PERCIVAL—EDWARD ABEE, of Lang Bay, B.C. Born at Trinidad, B.W.I., April 10th, 1920. Educ.: B.A.Sc. (Civil), Toronto, 1942; 1942 (summer), dftsman., General Engrg. Co., Toronto; 1942 (5 mos.), jr. engr., H.E.P.C., Ontario; 1942-44, Lieut., R.C.E.; 1946 to date, field engr., British Columbia Bridge & Dredging Co., Stillwater, B.C.

References: W. H. Blake, A. G. Grant, R. R. Willis, H. E. Maple, D. Blair.

PHELPS—THOMAS HENRY, of Cornwall, Ont. Born at Bristol, England, Sept. 21st, 1901. Educ.: Univ. of Michigan (accredited E.C.P.D.) part time, 1925-27; 1915-20, app. elect., Canadian Vickers Ltd., Montreal; 1920-21, i/c elect. mtce., Canadian Government M.M., Montreal; 1922-25, power house and elect. constrn. foreman, Ford Motor Co. of Can., Windsor; 1925-27, power house and sub-stn. constrn., Detroit Edison Co., Michigan; 1928-38, elect. instructor, Fort William Vocational School; with Cornwall Collegiate and Vocational School, 1938-43, elect. instructor; (summer, 1943, foremanship training, setting up apprent'ship training programme, Canadian Vickers Ltd., Montreal); 1944, director, Collegiate and Vocational School, Cornwall, Ont.

References: D. Ross-Ross, B. T. Yates, H. E. Meadd, A. L. Farnsworth., D. Giles

RITCHIE—FRANK ALBERT, 1154 Dougall Ave., Windsor, Ont. Born at Windsor, Ont., Dec. 21st, 1918. Educ.: B.Sc. (Mech.), Queen's, 1942; R.P.E., Ontario; with the Ford Motor Co. of Canada, as follows: 1942-43, engrg. dept. layout and design of engine and hull components of Universal carriers, 1943-45, experimental test engr., engrg. dept., testing of proposed designs for Universal and Windsor carriers, i/c 5 Pilot Models, 1945 to date, process and purchase engr., operation layout, machine tool design, specifications and purchase for various automotive parts with particular attention to cylinder block machining equipt., Windsor, Ont.

References: J. B. Dowler, H. D. Harris, J. E. Daubney, G. W. Lusby, J. F. G. Blowey.

SUTHERLAND—ANDREW THOMSON, of Cornwall, Ont. Born at Edinburgh, Scotland, Dec. 1st, 1895. Educ.: Heriot Watt Tech. Coll., Edinburgh, 1912-14 and 1918-20 (World War I interfered with studies, migrated to Canada before graduating); 1911-20, app'tice dftsman, improver, jr. dftsman., Bertrams Ltd., Edinburgh; 1920-27, dftsman., checker, squad boss, i/c mech. dftsmen., Dominion Engineering Co., Lachine; 1927-29, sr. designer, Paper & Textile Machinery Co., Sandusky, Ohio; 1929-36, chief dftsman. and asst. plant engr., Consolidated Paper Corp., Grand'Mere, Que.; 1937-46, chief designer and representative, Bertrams Limited., Edinburgh; at present, machinery designer, pulp and paper-making machinery, responsible for changes to existing equipt. and planning, arranging and designing new machinery for instaln., Howard Smith Paper Mills Ltd., Cornwall, Ont.

References: W. H Wharton, E. B. Wardle, V. Jepsen, A. L. Farnsworth, D. Ross-Ross, H. E. Meadd, W. P. Nesbitt.

THOMSON—JOHN MORTON, of Weston, Ont. Born at Couva, Trinidad, B.W.I., June 3rd, 1898. Educ.: B.A.Sc., M.A.Sc., Ph.D., Toronto, 1923, 1933, 1937, respectively; R.P.E., Ontario; M., A.I.E.E.; 1924-25, test course, General Electric Co., Schenectady; 1925-26, transformer engr., English Electric Co., St. Catharines; with Ferranti Electric Ltd., Toronto, as follows: 1926-28, radio engr., 1928, radio engr. and i/c transformer developt. and research work; 1930, designing engr., i/c all designing and developt. work carried out by transformer dept., 1931, research work at Hollinwood works, Ferranti, England; 1933, Univ. of Toronto for M.A.Sc., 1937, Univ. of Toronto for Ph.D. degree; with Ferranti Electric Ltd., as follows: 1937, chief designing engr., Mount Dennis, 1942-46, chief engr., and at present, asst. genl. mgr., Toronto.

References: A. B. Cooper, M. J. McHenry, D. G. Geiger, W. J. W. Reid, S. O. Shields, C. E. Sisson, O. W. Titus.

TREMAYNE—WILLIAM MAURICE, 383 Windermere Rd., Windsor, Ont. Born at Toronto, June 17th, 1924. Educ.: B.Sc. (Civil), New Brunswick, 1945; R.P.E., Ontario; 1944 (summer), N.B., Dept. Public Works, instru'man.; 1945 to date, structl engr., Canadian Bridge Co., Windsor, Ont.

References: C. S. Neilson, F. Steven, A. H. MacQuarrie, J. T. Turnbull, J. E. Tremayne.

VON STEENBURGH—WILLIAM ELGIN, Colonel, of Ottawa, Ont. Born at Havelock, Ont., Dec 24th, . Educ.: M.A., Ph.D., Toronto, 1925 and 1930, respectively; special courses physics, maths. and biology, Queen's, 1924; 1920-27, mining constrn., development of new mining properties, shafts, slopes, timbering, entries and concrete linings, foundations, etc., finally mining supt., R. G. Johnson Co., Washington, Pa.; 1927-39, research scientist, science service divn., Dept. of Agriculture; with R.C.A., as follows: 1939-41, O.C., 3/47 Fld. Bty., 1941, C.O. 7th Fld. Regt., 1942, Chief Instructor A1 CATC, 1943, Commandant A1 CATC., 1944-1945, Director of Artillery, N.D.H.Q., 1945 to date, Director of Armament Development, N.D.H.Q., Ottawa, Ont.

References: C. A. Manson, R. E. Jamieson, C. J. Mackenzie, J. B. Hayes, L. G. Eon, G. M. Carrie, L. A. Wright.

WALKER—WILLIAM DEANS, of Riverside, Ont. Born at Galt, Ont., June 25th, 1909. Educ.: B.Sc. (Mech.), Queen's, 1931; with Ford Motor Co. of Canada, Ltd., Windsor, Ont., as follows: 1931-36, tool designing, 1936-44, machine tool engr., 1946 to date, asst. supt., machine shop, i/c tool design, machine tool engrg.

References: J. B. Dowler, G. W. Lusby, A. D. Harris, J. F. G. Blowey.

WILSON—RALPH FREDERICK, of Hamilton, Ont. Born at Winnipeg, Man., April 28th, 1912. Educ.: B.A.Sc. (Civil), Toronto, 1934; R.P.E., Ontario; 1938-41, plant supt., responsible for prod., mtce.; 1941 to date, genl. supt. and personnel mgr., responsible for production, plant and product engrg. and personnel administration, Donald Ropes & Wire Cloth Ltd., Hamilton, Ont.

References: H. J. A. Chambers, E. G. Wyckoff, L. C. Sentance, H. A. Cooch, C. R. Young, C. C. Parker.

FOR TRANSFER FROM JUNIOR

ACKHURST—WILLIAM HALL, of Toronto, Ont. Born at Halifax, N.S., Feb. 21st, 1915. Educ.: B.Sc. (Elect.), N.S.T.C., 1939; R.P.E., Ontario; with Canadian Gen. Elect. Co., as follows: 1939-40, test course; 1940-41, engrg. dept.; 1941-42, application engr. sales, Toronto; 1942-44, rank of army Capt., Artillery; 1944-45, Capt., R.C.E.M.E.; 1945 to date, application engr., Canadian Gen. Elect. Co., Toronto, Ont. (St. 1939. Jr. 1946.)

References: W. T. Holgate, F. A. Becker, W. E. Ross, G. R. Langley, W. T. Fanjoy, A. L. Malby, C. D. Martin, P. A. Lovett, J. R. Kaye, F. H. Sexton.

BETHEL—VINCENT WALTER, of Kingston, Ont. Born at Winnipeg, Man., May 8th, 1916. Educ.: B.Sc. (Elec.), Toronto, 1939; R.P.E., Ontario; 1937-38 (summers), rodman for P.F.R.A. in Sask.; 1939-41, demonstrator in elect. measurements laboratory, Univ. of Toronto; 1943-44, Adjutant and Instr. in Sound Ranging, 2nd Survey Regiment, R.C.A.; 1943-45, O/C Radar Wing, i/c instruction of radar techniques to technicians for the Can. Army; 1945-46, chief instr. responsible for forming and implementing training policies for the training of telecommunications, mechanics and radar technicians; 1946, senior instr. Tels. and Elect. Section, R.C.E.M.E. school for the Can. Army, Kingston, Ont. (St. 1939. Jr. 1946.)

References: M. B. Watson, K. H. McKibbon, E. P. Fetherstonhaugh, D. C. MacMillan, L. F. Grant.

BLACKETT—ROBERT LESLIE, of Barranca Bermeja, S.A. Born at Moncton, N.B., Nov. 5th, 1921. Educ.: B.Sc. (Chem.), Queen's, 1943; 1943 (1¾ mos.), senior instru'mn., Dept. of National Defence, Naval Service; 1943-44, rank of Pilot Officer, R.C.A.F.; 1944-45, Navigation Officer, rank of Flying Officer; 1945-46, engr. i/c of draughting room, engrg. office, design of pressure vessels and minor process equipt., Barranca Refinery, Tropical Oil Co., Barranca Bermeja, S.A. (St. 1939. Jr. 1944.)

References: G. L. Colpitts, C. Scrymgeour, L. E. Mitchell, A. Jackson, H. J. Crudge, R. L. Dunsmore, K. W. Edmiston.

BRIDGE—DAVID E., of Hamilton, Ont. Born at Kincardine, Ont., June 23rd, 1904. Educ.: B.A.Sc., Toronto, 1930; with Canadian Westinghouse Co., Hamilton, as follows: 1929 (5 mos.), mech. design and drawing, 1930 (May to 1931 (Sept.), apprent'ship test course, engrg. dept. on transformers, various kinds and designs, 1932-46, Hamilton Tech. Institute, head of maths. dept., director i/c Co-operative Apprent'ship. Training. During war organized shop maths. and shop practice classes; (1943, 4 mos., H. G. Acres, worked on the Shipshaw development; and during period lectured at Ontario Training Coll. to Air Force men and rehabilitation instructors); at present, director of all academic training, Hamilton Tech. Institute, Hamilton, Ont. (St. 1930. Jr. 1937.)

References: W. E. Brown, H. Hannaford, R. W. Callender, A. Love, L. C. Sentance, E. G. Wyckoff.

De MAIO—ALEXANDER, of Schreiber, Ont. Born at Toronto, Ont., April 9th, 1910. Educ.: B.A.Sc. (Mech.), Toronto, 1937; R.P.E., Ontario; 1932-36, engr. in training, Gutta Percha & Rubber Co., Toronto; 1937-40, mech. engr., design and development, layout and routing of plant equipt. in mfg. wire and cable products (rubber covered), investigating and reporting on methods and processes in General Electric plants in U.S.A. on prod. of wire and cable, etc.; 1940-46, R.C.E.M.E., Lieut., later Capt. and finally Lt. Col. and Commander; at present, supt. of constrn. of main dam, Aguasabou, Hydro Electric Power Commission of Ontario, Schreiber Ont. (St. 1937. Jr. 1946.)

References: E. A. Allcut, I. F. McRae, J. W. Bishop, H. R. Sills, W. Crombie. W. F. McMullen.

LANGLEY—JOHN GORDON, of Toronto, Ont. Born at Peterboro, Ont., Oct. 5th, 1915. Educ.: B. Eng. (Elec.), McGill, 1939; 1937 and 1938 (summers), dftsmn., Can. Gen. Elec. Co., Lynn, Mass.; with Beauharnois Light, Heat and Power Co., doing instaln. and mtce. work on volt. regs. relays and control; 1939-40, student test course, Can. Gen. Elect., Peterboro; 1940 (9 mos.), 10th Search light Battery R.C.A.; with 1st Cdn. Radio Location Establishment, R.C.A., as follows: 1942-43, Instaln. Engr. siting of army radar equipt. in Canada; 1944, Capt. Tech. Staff Officer; 1945, Major, Radar Staff Officer in Atlantic and Pacific command, i/c army radar personnel; at present, sales engr., Can. Gen. Elect. Co. Ltd., Toronto. (St. 1939. Jr. 1946.)

References: C. E. Sisson, C. A. Manson, T. R. Durley, B. K. Boulton, W. E. Ross, J. D. Duncan.

RATTENBURY—DAVID JAMES, of Vancouver, B.C. Born at Kelowna, B.C., Mar. 5th, 1918. Educ.: B.A.Sc. (Mech.), B.C., 1941; R.P.E. of B.C.; 1941-44, aircraft inspector at Boeing Plants and finally at C.P. airlines, repair plant at New Westminster, B.C.; 1944-45, dftsman., Canadian Sumner Iron Works, Vancouver, B.C.; 1945 to date, chief dftsman. with same company. (Jr. 1946.)

References: J. N. Finlayson, H. J. MacLeod, G. W. Allan, P. N. Bland, A. Peebles, H. N. MacPherson.

FOR TRANSFER FROM STUDENT

CHURCH—JAMES WALTER, of Toronto, Ont. Born at Ottawa, Ont., Mar. 17th, 1916. Educ.: B.Sc. (Mech.), Queen's, 1946; R.P.E. of Ont.; with Ottawa Car & Aircraft Ltd., as follows: 1939-40, chief tool designer for mfr. of parts for Hampden and Hurricane, A/C Div.; also two months' study of aircraft tooling at Short Bros. in Kent, England; 1940, shop supt. i/c mfr. of tooling of aircraft components; 1941, chief engr., gun divn. i/c devlpt. of equipt. processes of tools; 1942-43, works mgr. i/c complete gun plant; 1943-44, designing and checking special artillery for Dom. Govt., Armstrong Wood & Co.; 1944-45, tech. asst., trouble shooting on tooling and prodn., Victory Aircraft Ltd., Malton; 1946, mech. engr., Armstrong & Anderson & Co., Toronto, Ont. (St. 1945.)

References: E. G. Patterson, D. Boyd, R. V. Anderson, J. D. Lee, S. D. Lash.

OTT—HELMUTH GEORGE, of Montreal, Que. Born at Berlin, Germany, Dec. 19th, 1923. Educ.: B. Eng. (Civil), McGill, 1945; summer jobs as follows: 1941, chainman, Quebec Highways Dept.; 1942, machine shop student, Algoma Steel Corp.; 1943, lev'man, Alaska Highway Proj. Whitehorse; 1944-45, res. asst. and chief of party, Dept. of Mines; 1945 to date, engr., Gunite & Waterproofing Ltd., Montreal, Que. (St. 1946.)

References: A. R. Chadwick, J. R. Mills, G. J. Dodd, H. R. Montgomery.

Rehabilitation and Employment Service

THE ENGINEERING INSTITUTE OF CANADA
2050 MANSFIELD STREET, MONTREAL 2, QUE.

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

JUNIOR CHEMICAL ENGINEER required for control work by a paper company in Western Ontario. Salary open. Apply to File No. 3717-V.

CIVIL

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 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).

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 required by a contractor in Montreal as field engineer and layout man on a construction job. Salary open. Apply to File No. 3694-V.

ELECTRICAL

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, 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 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 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 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 shopwork 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.

MISCELLANEOUS

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

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 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 emmission 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.

MECHANICAL OR ELECTRICAL ENGINEER with about five years' experience required by a Montreal firm for material control and sales engineering. Salary open. Apply to File No. 3711-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.

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

CHEMICAL

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 ENGINEERS, age 22-35, recent graduates up, are required by a Montreal firm for development work, maintenance, design and construction in explosives field. Sales and technical service representation to paper and textile industries. Salaries according to qualifications. Apply to File No. 3588-V.

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 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.

CIVIL

TWO CIVIL ENGINEERS, one experienced man to be in charge, the other to act as assistant, mostly for office work, are required for a building programme in Ontario, in connection with roads, trails, lookout towers, telephone line, buildings, etc. Preference to veterans. Salary up to $3,000 per year for senior and $2,000 per year for junior position. Apply to File No. 3394-V.

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 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 3 or more years' experience on design of industrial buildings, equipment, supports and foundation work, is required by a Montreal firm for structural design work in steel, timber and reinforced concrete. Salary $200 up. Apply to File No. 3588-V.

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

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 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 practica 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 DRAUGHTSMEN, preferably with pulp and paper experience, required by a paper company in Montreal. Salary open. Apply to File No. 3610-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 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 east 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.

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 ENGINEERS from recent graduates up required by a structural steel company in the Montreal area. Salary according to qualifications. Apply to File No. 3485-V.

MECHANICAL ENGINEER, recent graduate, for junior position in the design department of a firm in Central Ontario making special heavy duty mobile equipment. Apply to File No. 3572-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.

MECHANICAL ENGINEER with five to ten years industrial experience and familiar with the layout and construction of chemical plants, required by a manufacturer in the Montreal area for plant design and construction. Salary from $300. Apply to File No. 3605-V.

MECHANICAL ENGINEER with at least five years' experience of aluminum processing, plant design and operation, etc., required for Aluminum production organization in Australia. Limited contract. Salary open. Apply to File No. 3620-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.

MECHANICAL DRAUGHTSMAN with experience in power house layouts required by an engineering firm in Toronto. Salary open. Apply to File No. 3630-V.

MECHANICAL ENGINEER, bilingual, with shop or automotive experience, required for equipment maintenance by a manufacturer in the Montreal area. Salary open. Apply to File No. 3631-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 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 DRAUGHTSMEN, graduates preferred, with experience in shop and field erection, required for design of coal and oil fired heating and steam systems by an industrial firm in Montreal. Salary open. Apply to File No. 3647-V.

MECHANICAL ENGINEER with knowledge of machine tools, age about 35, required in Montreal for work in connection with purchase, design, re-conversion and sale of machinery. Salary $300-$400. Apply to File No. 3648-V.

JUNIOR MECHANICAL ENGINEER to be trained as plant engineer and assistant to plant manager in an industrial plant in central Quebec. Must be bilingual. Salary from $225. Apply to File No. 3658-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.

METALLURGICAL

METALLURGIST, age 25-30, veteran, experience in Metallurgical Laboratory or Mine Assay office and Mining Mill practice decided advantage, required by a Montreal firm to be trained for Sales Representative. Salary depending on experience. Apply to File No. 3588-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

TWO INDUSTRIAL ENGINEERS, preferably with engineering background in mechanical, electrical or chemical engineering, age 35 up, bilingual, with some practical experience, is required by a company in Montreal engaged in industrial engineering, consulting work, plant layout, controls, inventories, production and admin. controls. 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 under 35, with at least 5 years practical experience, is required for a responsible position in the engineering department of an industrial firm in Toronto. Apply to File No. 3472-V.

STRUCTURAL STEEL DESIGNERS AND DETAILERS required by a construction company in Montreal. Salary open. Apply to File No. 3482-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.

PLANT ENGINEER with pulp and paper experience for development, construction and maintenance work with a paper mill in the Lake St. John area. Salary open. House available. Apply to File No. 3507-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, lahour and costs. Salary according to qualificatons. Apply to File No. 3524-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.

MECHANICAL AND ELECTRICAL DRAUGHTSMEN required by a Montreal firm. Must have working knowledge of equipment layout, architectural, piping and design. Salary from $200 up. Apply to File No. 3588-V.

MECHANICAL AND ELECTRICAL ENGINEERS, from recent graduates up, are required for mechanical and electrical maintenance, also design phases of project engineering work, by a Montreal firm. Salaries according to qualifications. Apply to File No. 3588-V.

GRADUATE ENGINEERS required as Development Engineer and Assistant to Sales Manager by a Montreal firm. Industrial, also sales and administrative experience necessary. Salary $200 up according to experience. Apply to File No. 3588-V.

INDUSTRIAL ENGINEER, 5 years' experience industrial manufacturing or process work, required by a Montreal firm for study and co-ordination of plant work. Salary $295 up according to qualifications. Apply to File No. 3588-V.

CHIEF DRAUGHTSMAN, under 35, 5-12 years' experience in drawing office, Including year or more as squad boss, required by a Montreal firm. Salary $225 up. 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 DRAUGHTSMAN with experience in design and controlling a design staff required for both structural and equipment work by a steel fabricating plant in Western Canada. Salary open. Apply to File No. 3616-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.

GRADUATE ENGINEER, bilingual, required for senior position on the Montreal sales staff of a firm manufacturing and installing mechanical equipment in buildings of all types. Veteran preferred. Salary open. Apply to File No. 3622-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.

INDUSTRIAL ENGINEER with at least ten years experience required by a manufacturer in Montreal. Salary open. Apply to File No. 3662-V.

JUNIOR MECHANICAL OR ELECTRICAL ENGINEERS for training as production engineers with an industrial firm in Montreal. Salary from $175. 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.

WANTED

Graduate Mechanical or Civil Engineer

Required for permanent employment in Newfoundland for development and general engineering work for woods operations, involving an annual cut of 600,000 cords of pulpwood. Good salary and opportunity for qualified engineer. Applications should be sent to Bowater's Newfoundland Pulp and Paper Mills, Limited, Corner Brook, Newfoundland.

ASSISTANT PLANT ENGINEER

Graduate Engineer with pulp and paper mill experience preferred but not essential. Structural design experience necessary. Immediate Employment. Position permanent. Mill manufactures newsprint and sulphite pulp and is located in city on north shore of Lake Superior. Salary from $250—$325. Apply to File No. 3657-V.

Mechanical Engineers

Are required on armament research and development at the Canadian Armament Research and Development Establishment, Valcartier, Quebec. Experienced in design or recent graduates. Salary at various grades from $2,280. per year up, depending on training and experience. Applications should be forwarded to Director General of Defence Research, New Army Building, Ottawa, Ontario.

RESEARCH CHEMIST
OR
CHEMICAL ENGINEER

To conduct fundamental research on combustion and fuels in gas turbines, jet engines and propulsive ducts. Qualifications, graduation from a recognized University, majoring in physical chemistry, post-graduate research or research experience. Thorough grounding in chemical thermodynamics essential. Salary $3,000 to $4,000 per annum, depending upon qualifications and experience. Address reply to Director, Mechanical Engineering Division, National Research Council, Ottawa, Ontario.

RESEARCH CHEMIST
OR
CHEMICAL ENGINEER

To conduct research on lubricating oils and lubricating greases. Qualifications, graduation from a recognized University, post-graduate research or acceptable research experience. Thorough general grounding in physical chemistry essential. Salary $2,880-$3,600, depending upon qualifications and experience. Address reply to Director, Mechanical Engineering Division, National Research Council, Ottawa, Ontario.

CIVIL OR MECHANICAL ENGINEERS

EXPERIENCED in design and field supervision of construction of industrial buildings, piping, pumping and mechanical equipment, for products distribution. Ten years experience required.

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RECENT GRADUATES for work in engineering department on design of buildings and miscellaneous equipment for handling petroleum product.

Required by major oil company. Salaries open. Please reply to File No. 3685-V.

SALES ENGINEER

Wanted by an old established Company operating a completely equipped machine shop for Contract Engineering. The Engineer we want will assume executive directive of all engineering activities and will be the main point of contact with large clientele. An opportunity exists here for a resourceful individual to establish himself with a going concern and develop his own ideas.

Reply stating age, experience and present occupation. Interview will be arranged.

Please reply to File No. 3698-V

WANTED
Utility Rate and Appraisal Engineer

Large public utility on West coast requires an experienced engineer to make rate studies on gas and electricity, prepare reports and to make property appraisal and evaluation.

Reply fully stating experience, education, age, marital status, etc.

Please reply to File No. 3718-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.

SAFETY ENGINEER, preferably with considerable industrial experience, required by a brewing company with headquarters in Montreal. Salary from $375. Apply to File No. 3670-V.

CIVIL OR MECHANICAL ENGINEERS with some industrial experience required as plant engineers by a brewing company with headquarters in Montreal. Salary from $350. Apply to File No. 3670-V.

JUNIOR ENGINEERS, under 30, preferably with shop or industrial experience, required by an Ontario paper company for training as designers. Salary $200 plus board and lodging while under training. Preference to veterans. Apply to File No. 3676-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.

CIVIL OR MECHANICAL ENGINEER, age 28-35, with at least five years industrial or construction experience, required by a Montreal firm for training as branch manager for the Toronto area. Salary open. Apply to File No. 3681-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.

Situations Wanted

MECHANICAL ENGINEER, S.E.I.C., married, age 35, wants more suitable work. Experienced in Mechanical, Aeronautical, Civil and Forestry engineering, with over 7 years in responsible positions involving organization, getting along with people and fast control of new problems. Speaks several languages; has experience as Draughtsman, Foreman, Inspector, Plant Engineer, Assistant to Plant Superintendent and Designer; also in hydraulics, thermodynamics and stress analysis. Will accept responsible position anywhere with assured family accomodation near work. Prefers Airlines, Paper Industry, Mining or any expanding enterprise where technical ability in organising would be welcome. Desired salary $300 a month. Apply to File No. 140-W.

CHEMICAL ENGINEER, graduate in 1939, Jr.E.I.C., veteran, considerable experience in development and process control and quality control as well as some experience in production work, desires change. Employment since graduation, except for time in the services, has been with a large chemical manufacturing company. Montreal or Toronto areas preferred. Apply to File No. 798-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.

COMMUNICATIONS ENGINEER. Engineering Physics (Hons.), Jr.E.I.C., Assoc. I.R.E., R.P.E. Ont., F.B.I.S., age 26. Summer employment with telephone manufacturer, Ontario Hydro, and as radio instructor. Three years with the Royal Navy as Radar Officer in complete charge of maintenance, installation and operation of radar equipment on board. One year field engineering with commercial FM radio equipment. Seeks position with opportunity for original work in electronic and allied fields. Available beginning 1947. Apply to File No 2779-W.

CIVIL ENGINEER, age 39, M.E.I.C., R.P.E., etc., used to responsibility and control in Consultative, Public Authority and Governmental fields, seeks worthwhile professional or commercial opportunity in Southern Ontario. Apply to File No. 2790-W.

MECHANICAL ENGINEER, Sask., '46, with summer experience in highway surveying, time checking, a steel rolling mill, ship wiring, job planning and cost estimating, desires work, preferably in Vancouver area. Would prefer work including time and motion studies, cost control and estimating, and job evaluation. Available on short notice. Apply to File No. 2795-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

THE

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AUTHOR — TITLE

SUBJECT